

STEM education and young people's aspirations for development in "luar bandar": A Malaysian case study

Aizuddin Mohamed Anuar

New College

Department of Education, University of Oxford

Supervised by

Dr. Maia Chankseliani & Professor Sibel Erduran

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> "An adequate approach of development cannot really be so centred only on those in power. The reach has to be broader, and the need for popular participation is not just sanctimonious rubbish. Indeed, the idea of development cannot be dissociated from it."
>
> Amartya Sen

Abstract

Tracing the economic promise that dominates the development discourse, Drori's (1998) model of "science for development" highlights the putative link between science education at all levels, the expansion of scientific labour force, and subsequently national economic development. Across the global South, this model has been negotiated and internalised through a national focus on science—and recently Science, Technology, Engineering and Mathematics (STEM)—education as a means of national development. Using a postcolonial lens and Malaysia as the site, this study aims to explore the idea of development through the prism of rural young people's aspirations in the periphery, in their encounter with STEM education as the state's intermediary for national development.

Through a comparative case study design, the aspirations of eight young people (16 year olds) in one secondary school in *luar bandar* (rural, literally meaning "outside the city") are contrasted against the national discourse emphasising STEM through the centralised education system. I pay careful attention to the translation of the science for development model into STEM education policy and implementation, as well as young people's day-to-day experiences in the luar bandar. Perspectives of young people are contextualised with that of nine teachers in their school, six experts and policy makers, as well as development discourses gleaned through relevant documents. Whilst navigating the STEM pathway and their lives in the luar bandar, young people describe aspirations for development characterised by a desire for infrastructure and technology advancement, a balance of global desires and national distinction, commitment to family as well as affinity and mobility in/out of the local environment. Such aspirations are circumscribed by material conditions shaped by national forces. As a form of exposure to novel experiences, participatory informal STEM education attuned to their local development realities points to the embodied and affective sense of *rasa* (feel, intuition, sense) that augments their "capacity to aspire" (Appadurai, 2004).

In this study's emphasis on the vertical dimension of the comparative case study—placing development as a dialogue between the state and young people in the luar bandar—I provide new empirical material that expands and nuances perspectives on rural young people's aspirations and foreground the interplay of scale and context in comparative studies of rural education. Attentive to *Bahasa Melayu* (Malay language) as a source of conceptualising and analysing, I also offer methodological and conceptual contributions for education and rural studies. The findings of this study suggest the need to honour young people's aspirations as resources for the epistemic and material project of development, and offers a tangible example of an informal STEM education project rooted in young people's development concerns in a specific place.

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Pada keluasanmu	In your vast expanse
aku menemui nisbah wujudku:	I meet the scale of my existence:
kecil, terlontar pada	miniscule, flung unto
cakerawala yang bisu	the heavens muted
dan tak menjelaskan,	and unfathomable,
pada kewujudanmu	in your existence
aku mencari maknaku.	I search for my meaning.

Excerpt from *Lautan* // The Sea
by Muhammad Haji Salleh

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List of Abbreviations

Listed below are abbreviations that are used frequently in this thesis in both English and Bahasa Melayu. In the case of the latter, the translation into English is also provided.

ASM	*Akademi Sains Malaysia* // Academy of Sciences Malaysia
CCS	Comparative Case Study
CIE	Comparative and International Education
CUREC	The Central University Research Ethics Committee
FELCRA	Federal Land Consolidation and Rehabilitation Authority
FELDA	Federal Land Development Authority
FIDS	Feel, Imagine, Do, Share (a framework for design learning)
GKT	*Grafik Komunikasi Teknikal* // Technical Graphic Communication
JPN	*Jabatan Pendidikan Negeri* // State Education Department
KL	Kuala Lumpur (the largest city of Malaysia)
KSSM	*Kurikulum Standard Sekolah Menengah* // Secondary School Standard Curriculum
MARA	*Majlis Amanah Rakyat* // Council of People's Trust for Indigenous People
MOE	Ministry of Education Malaysia
MPV	*Mata Pelajaran Vokasional* // Vocational Subjects
MRQ	Main Research Question
NEP	New Economic Policy
OECD	Organisation for Economic Co-operation and Development
PA	*Prinsip Akaun* // Accounting Principles
PET	Polyethylene Terephthalate
PPD	*Pejabat Pendidikan Daerah* // District Education Office

PT3	*Pentaksiran Tingkatan Tiga* // Form Three Assessment
STEM	Science, Technology, Engineering and Mathematics
SPM	*Sijil Pelajaran Malaysia* // Malaysian Certificate of Education
STPM	*Sijil Tinggi Pelajaran Malaysia* // Malaysian Higher Certificate of Education
S&T	Science and Technology
TA	Thematic Analysis
UMT	Universiti Malaysia Terengganu
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Science and Cultural Organization
UPSR	*Ujian Penilaian Sekolah Rendah* // Primary School Evaluation Test
YPAR	Youth Participatory Action Research

List of Terms in Bahasa Melayu

Listed below are terms from Bahasa Melayu (the Malay Language) that are used frequently in this thesis. The definitions are referenced from *Dewan Bahasa dan Pustaka* (DBP, Institute of Language and Literature) (2017), which is Malaysia's government body of authority on Bahasa Melayu. Where necessary, I have also included additional contextual details pertinent to this study. The first time each of these terms are mentioned in the thesis it is *italicised*, and subsequently integrated into the text alongside English. The reader is encouraged to consult this list to aid in navigating this thesis.

Term in Bahasa Melayu	**Translation into English**
bandar	city
Bumiputera	native population -literal translation: sons of the soil (see Section 3.2 for elaboration)
cikgu	teacher -this is often used as prefix when addressing or referring to one's teacher (e.g. Cikgu Aizuddin)
Dasar Pandang Ke Timur	Look East Policy
Dasar Pembangunan Luar Bandar	Rural Development Policy
gotong-royong	mutual aid, communal work
hulu	upstream -this also refers to a remote, interior location
kampung	village (see Section 3.3 for elaboration)
kandang kuda	horse stable -this is the name given fondly by the young people in this study to an agriculture shed in their school

Term in Bahasa Melayu	**Translation into English**
kebetulan	chance, coincidence -the root word *betul* means true, real, right (see Section 4.7.2 for elaboration)
luar bandar	rural, countryside -literal translation: outside of the city (see Section 1.3.5 for elaboration)
maju	prosper, flourish, move forward -*negara maju* means "developed country"
orang putih	people of European ancestry -literal translation: white people
pembangunan	development -the root word *bangun* means rise, awake
rasa	feel, intuition, sense, taste (see Section 2.5 for elaboration) -*perasaan* means feeling, emotion
Rukun Negara	National Principles
Sekolah Luar Bandar	Rural School -pseudonym for the school in this study
turun kelas	"Going down" to a class deemed of lower status in the school (STEM to non-STEM) (see Section 5.3.3 for elaboration)
Wawasan 2020	Vision 2020

CHAPTER 1: Introduction

1.1 Setting the Scene

"Development" and the set of logics undergirding it have been accepted as a normative aspiration across the world. In contemporary times, development is largely shaped by priorities for economic growth and accumulation of capital to eradicate poverty, the pursuit of modernity, industrialisation and urbanisation, as well as the expertise of science and technology to produce knowledge on "what works" (Corbett, 2016; Escobar, 2012; Esteva, 1999; Goldin, 2016). The ushering of the contemporary global development project and the international aid industry is often attributed to U.S. President Harry Truman, reflected by his inaugural address in 1949:

> We must embark on a bold new program for making the benefits of our scientific advances and industrial progress available for the improvement of underdeveloped areas. More than half the people of the world are living in conditions approaching misery. Their food is inadequate. They are victims of disease. Their economic life is primitive and stagnant. Their poverty is a handicap and threat both to them and to more prosperous areas…(J. Smith, 2009, pp. 4-5)

I make three observations in relation to the above excerpt. First, a postcolonial reading of the concept of development highlights the creation of both "underdevelopment" and "developing countries" as categories (Esteva, 1999). Such a reading must be placed in the context of development that has served as a vehicle for the racialised, civilising mission that preceded Harry Truman's benevolent speech quoted above (Moore, 1999). The West thus became the benchmark and knowledge custodian on development for the rest, and rural life must make way for its urban counterpart, propelled by the spirit of modernity and capitalism (Javed, 2018; McEwan, 2019).

Next, science plays a significant role in the development project; the two are deeply connected in that one relies on, but also propels the other, in pursuit of economic gains (Alvares, 1999; J. Smith, 2009). Finally, the logics of such development based on science flows from the West and are negotiated, appropriated and internalised by countries deemed "developing" so as to influence national policies. The following observations from the (post)colonial world demonstrate this claim:

> Reviewing the relationship between science and the state in colonial and postcolonial Africa in the period between 1930 and 1970, Bonneuil (2001) concluded "…the colonialists of the 1930s viewed themselves as experimenters. Colonizing then meant completing conquest through modernization, and the transformation of African societies and environments with the assistance of the 'experimental method.' By 1900, the dominant metaphor of development was that of a continuous process (growth from childhood to adulthood) that would be guided by knowledge of laws, presented as scientific. By contrast, after the 1930s, development came to be seen as an experiment, and Africa as a laboratory. This shift from 'governing, thanks to the light of science' to 'governing as an experimental activity' is an essential feature of the emergence of a development regime in Africa." (p. 280)
>
> At the turn of India's independence, the first Prime Minister Jawaharlal Nehru adopted a science policy in 1958, insisting that "it was science and science alone that could solve problems of hunger and poverty, of insanitation and illiteracy, of superstition and deadening custom and tradition…" (Alvares, 1999, p. 225)
>
> In 1991, as part of his national agenda for development known as *Wawasan 2020* (Vision 2020), Malaysia's fourth Prime Minister Dr. Mahathir Mohamad reflected that "[t]here can be no fully developed Malaysia until we have finally overcome the nine central strategic challenges that have confronted us from the moment of our birth as an independent nation…The sixth is the challenge of establishing a scientific and progressive society, a society that is innovative and forward-looking, one that is not only a consumer of technology but also a contributor to the scientific and technological civilisation of the future." (Mohamad, 1991, p. 3)

The emphasis on science and experimentation in service of development, progress and modernisation by those in power rests on a universalising assumption and aspiration. Development is a project that travels, hinted by the words of Truman earlier—its direction is

from the West to the rest. Science is its vessel. Drori (1998) observes that science education plays an integral role in the global project of development, suggesting that our opinion of its value for progress is so naturalised that we seldom question it. Through the "science for development" model, she argues, "science—the national commitment to science education, policy, and investment—is a ritual of modern nation-statehood and is dependent on the world polity, its organizational structure and the global discourse" (Drori, 1998, p. 50). At first glance, the various quotes presented above certainly gesture towards this observation. The universal status of science education and development creates a sense of ambivalence for all that aspire at this intersection. I am therefore reminded of a postcolonial quandary highlighted by Tsing (2005) regarding universalised aspirations:

> Here a specific valence for the universal has been produced; the universal is what, as Gayatri Spivak has put it, we cannot not want, even as it so often excludes us…Whether we place ourselves inside or outside the West, we are stuck with universals created in cultural dialogue. (p. 1)

As a Malaysian, the discourse of (national) development—and the integral role of science education—is one that I am intimately attuned to both personally and professionally. My mother, hailing from a rural part of Malaysia is a product and agent of development—she attended a technical school in the state capital, migrated to the city for higher education, and was subsequently employed in a regional development programme in her home state of Pahang. Growing up shuttling between the city and my mother's ancestral village, I witnessed the latter undergo successive periods of modernisation—paved roads, telephone signal, brick houses, a concrete bridge across the river, internet connection, progressively murky rivers, more frequent monsoon floods. I too have been socialised into the national development project. I attended a specialised science school, earned an engineering degree, worked for the national oil company PETRONAS in the eponymous twin towers that stand

as Malaysia's beacon of modernity, and delivered education projects across the country as part of the company's philanthropy efforts. Prior to undertaking this DPhil, I conducted research into the growth of informal science, technology, engineering and mathematics (STEM) education in Malaysia (Anuar & Chankseliani, 2021).

This study embraces my embodied experiences described above as resource for research, in concert with the collected empirical data. Aligned with Vavrus's (2021) recent work in Comparative and International Education (CIE), I imbue this study with an ethnographic sensibility, recognising that I do not stand outside of, and detached from, the line of inquiry. I consider my situatedness as described above and throughout this thesis as "intellectually productive" when placed in dialogue with the empirical data, and as is the case here, one's "intersubjective experience as subject and witness is part of the larger story, and it would be a less trustworthy account if I omitted my own intimate, embodied knowledge" (Vavrus, 2021, p. 13).

It is therefore at the "muddy confluence"[1] of these personal and scholarly observations that I situate this study. By closely considering the rise of STEM education in my home country, Malaysia, the project of national development and the local notion of rurality, the research agenda thus begins to take shape. Building on my existing work on postcolonial theory in CIE (Anuar et al., 2021), I adopt this lens to interrogate the question of development in Malaysia, and the role accorded to STEM education. To do this, I concur with McEwan (2019) that development should be

[1] I borrow this term from the literal translation of Kuala Lumpur (KL), the commercial capital city of Malaysia, its beacon of development.

> properly opened to the presence and significance of voices, knowledge and agency in the South…It also means acknowledging the already postcolonial world of development in which contemporary re-workings of development theory and practice, such as decolonial thinking, grassroots and participatory development, indigenous knowledge and global resistance movements, inform postcolonial theory. (pp. 41-42)

As such, rather than merely treating young people as the beneficiaries of development programming through education, what can they offer in return to the epistemic and material project of development? Foregrounding young people and rurality is pertinent in the Malaysian context where rural life is increasingly marginalised and effaced. The World Bank (2015) refers to Malaysia as "among the more urbanized countries of East Asia, and its urban population continues to increase rapidly" (p. 99). Nevertheless, marginality can be a location from which to imagine otherwise (hooks, 1990). In encountering the forces of development—translated through STEM education by the state—what can rural young people teach us about development beyond the prevailing discourse? Additionally, what role can STEM education play in young people's enactment of their aspirations about development?

1.2 Aim and Focus of the Study

Grounded in the spirit of participation, this study aims to explore the idea of development in Malaysia through rural young people's aspirations from the grassroots in their encounter with STEM education—the state's intermediary for national development. In Malaysia and many rapidly urbanising contexts, the notion of the rural is also transforming, thus blurring the urban/rural dichotomy (The Desakota Study Team, 2008; Thompson, 2004). Therefore, I am interested in how young people's aspirations are also rooted in, and coloured by, the

particularity of their day-to-day lives in a shifting rural place. The Main Research Question (MRQ) for this study is as follows:

> **How do young people in the Malaysian luar bandar describe and enact their aspirations for development in relation to STEM education and their day-to-day experiences?**

Attending to this research question, I adopt a Comparative Case Study (CCS) design developed by Bartlett & Vavrus (2017, 2018), focusing on Malaysia as the site of analysis. This design is comparative in the sense that I am interested to trace the translation of aspiration for development from national policy and discourses associated with STEM education and rural development into a particular rural site, foregrounding young people's own aspirations in response. I take on this work of comparison to interrupt the assumption that the development interests of the state and that of the intended beneficiaries—rural communities—are one and the same. Here, rural takes on the local categorisation of *luar bandar*, which in *Bahasa Melayu* (Malay Language) literally means "outside of the city". As part of this study, I engage in interviews with six experts and policymakers, followed by prolonged, ethnographic engagement in one school I call *Sekolah Luar Bandar* (Rural School). At the school, I "follow" eight young people via observations, interviews and a series of participatory activities, including a collaborative project on informal STEM education. I also interview nine of their teachers at the school. I complement these methods with document analysis of relevant policies, circulars, reports, media articles, pamphlets, textbooks and artefacts collected at Sekolah Luar Bandar and within the broader Malaysian context. Throughout the process of data collection over 11 months from October 2019 to August 2020, I also recorded extensive fieldnotes.

Adopting a postcolonial perspective on development, throughout this study I pay attention to language—Bahasa Melayu—as a resource for concepts and analysis. Overall, this study provides rich empirical material on the translation of STEM education and rural development discourses into a particular site in the Malaysian luar bandar, coupled with wide-ranging aspirations for development articulated by the young people. Our collaborative engagement on the informal STEM education project also yielded insights into the enactment and strengthening of young people's aspirational capacity.

This research was in no small way ruptured by the arrival of the COVID-19 pandemic. Such rupture, which alters the design of this study, is foregrounded in this thesis not as an object of inquiry, but rather as a crucible for reflecting deeply on the ethics of doing research in a world so altered by this exceptional, ongoing occurrence.

1.3 Key Terminologies and Scope

In this section, I provide the definition for key terms used in this study, which include STEM education, young people, development, aspirations and luar bandar. Aside from clarifying the definitions, where applicable, the relevant terminologies presented here also establish the boundaries and scope of this study.

1.3.1 STEM Education

The definition of STEM education is not singular and can refer to various dimensions and concerns, such as the increasing specialisation by level of education, combination of disparate fields and a holistic approach (Xie et al., 2015). As an educational approach, STEM education points to "the disciplines of science, technology, engineering and mathematics

taught and applied either in a traditional and discipline specific manner, or through a multidisciplinary, interconnected and integrative approach…with a strong emphasis on critical and creative-thinking skills." (Siekmann, 2016, p. 3). In their literature review of the definition of STEM education, Martín-Páez et al. (2019) highlight problem-solving skills and addressing real world scenarios as characteristic of the integration of disciplines in STEM. I further discuss STEM education as part of the literature review in Chapter 2.

In the Malaysian context, STEM education is delineated along three dimensions, which are STEM fields, STEM stream and STEM approach (Mohd Shahali et al., 2017). In Chapter 3, I provide a brief overview of these dimensions. For the purpose of this study, STEM education largely refers to the STEM stream, which is a specialist track in upper secondary education that students can pursue, associated with the 60:40 policy that I will explore in greater depth in Chapter 5. STEM education is also manifested as an approach in the informal education project developed with young people, which I describe in Chapter 7.

1.3.2 Young People

The United Nations Educational, Scientific and Cultural Organization (UNESCO, 2002) uses the phrase "young people" to denote those aged between 15 to 24 years. I focus specifically on rural young people who are students in Form 4 (16 year olds) of one rural secondary school (Sekolah Luar Bandar) who were initially tracked into a class related to the STEM stream described in the previous section. Geographically, I situate this study among young people in the interior of the east coast of Peninsular Malaysia in the state of Terengganu, which is predominantly populated by rural Malay-Muslims (Abdul Hamid, 2018). I provide more demographic information on Malaysia in Chapter 3.

1.3.3 Development

This study concerns development, in essence the pursuit of a meaningful life described by Amartya Sen (1999) as the kind that people have reason and freedoms to value. I take on Sen's (1999) conception of human development as the core of this study, quoting him at length from *Development as Freedom*:

> Development can be seen…as a process of expanding real freedoms that people enjoy. Focusing on human freedoms contrasts with the narrower views of development, such as identifying development with the growth of gross national product, or with the rise in personal incomes, or with industrialization, or with technological advance, or with social modernization…Viewing development in terms of expanding substantive freedoms directs attention to the ends that make development important, rather than merely to some of the means that, inter alia, play a prominent part in the process. (p. 3)

Development as discussed in this thesis, is multiscalar and purposefully open-ended to enable its exploration and articulation among young people. I am less interested here in technocratic solutions and approaches of development professionals and organisations that have dominated discussions in this "industry" (Lewis, 2019; McEwan, 2019; Ziai, 2016). While young people may indeed gesture to the narrower views of development as highlighted by Sen (1999) above, they are also free to diverge on their own terms—I follow them where they take me. In articulating their aspirations, young people may refer to their own personal development, that of their family, community or nation. The question of what makes life valuable for them and others around them underpins my inquiry into the amorphous idea of development.

1.3.4 Aspirations

Given the extensive literature on aspirations, various definitions exist depending on the discipline within which it is studied. I adopt a broad definition of aspirations as being constitutive of "wants, preferences, choices, and calculations...[which] are never simply individual…They are always formed in interaction and in the thick of social life" (Appadurai, 2004, p. 67). Aspiration includes the element of desire, a sense of commitment and an exercise of one's voice (Baillergeau & Duyvendak, 2017). I thus position young people's aspirations for development in relation to social actors such as teachers who engage them in STEM education as well as their day-to-day life in a particular rural place. Also, their aspirations are positioned in relation to national discourses and policies that they negotiate through education and their lives in the luar bandar. Therefore, aspirations are not simply characterised by individual goals and plans to achieve such goals in the instrumental sense. Rather, the view I take on here considers the sociality and structural dimensions which bear upon the formation, and realisation of aspirations (Naafs & Skelton, 2018; B. White, 2021). As such, attention to young people's contextual, material realities is central to this study. I further elaborate on development and aspirations in the literature review in Chapter 2.

1.3.5 Luar Bandar

In this study's Malaysian context, rural is translated into luar bandar in Bahasa Melayu. This formal term in Bahasa Melayu literally means "outside of the city". According to the Ministry of Rural Development Malaysia (2019), luar bandar is defined as areas in the country other than the *bandar* (city) with low population density, which includes the countryside, small settlements, as well as agricultural estates and sites. There are also districts in Malaysia that

are categorised as interior districts, which is defined as areas far from the city or coast, with very low population density and less access to the network of roads and transportations (Ministry of Rural Development Malaysia, 2019). Sekolah Luar Bandar, as the principal site for this study, is situated in one of these interior districts in the luar bandar. More geographical details framing Sekolah Luar Bandar are presented in Chapters 3, 4 and 6.

1.4 Structure of the Thesis

Below, I present the structure of this thesis by summarising the content of each upcoming chapter.

Taking an interdisciplinary approach, Chapter 2 entails a survey of relevant studies in the fields of CIE, science education, development studies, youth studies, human geography, anthropology and rural sociology, among others. First, I survey the postcolonial perspective on development, coupled with postdevelopment as a means of decentring the dominant development discourse. I then explore the intersection between science, development and education, distilled by Drori's (1998) model of science for development that traces the putative link between science education, the development of technical labour force and national economic development. I highlight the continuation of this model's explanatory potential through contemporary discourses around STEM education. I then review literature on rural science/STEM education, followed by informal STEM education. Subsequently, I focus on aspirations and development, particularly from the perspective of rural young people. The final topic of the literature review is associated with local and situated resources for development thinking, where I focus on language, Bahasa Melayu, as an asset for conceptualisation and analysis in this study. Finally, I synthesise a position in the literature

for this particular study—yet to be explored—at the confluence of the aforementioned topics.

Chapter 3 is dedicated to a deeper exploration into the Malaysian context. I present this chapter as a means of rendering a clear picture for how this study is enmeshed in both the universal, particular and *personal* dimensions of Malaysia's story. I start by highlighting the centrality of context in inquiry within CIE. Then I provide an introduction to the reader on Malaysia as a postcolonial nation state, followed by its charateristics and manoeuvres as a developmental state. I close this chapter with a macro overview of Malaysia's education system, paying close attention to its centralised administrative structure, the education pathways across young people's lives and STEM education. Throughout the chapter, I weave personal history and biography to suggest how I as a researcher am a product of this area of inquiry, thus influencing the questions underpinning this study.

In Chapter 4, I elaborate on the research methodology. I begin by outlining the main and sub-research questions, linking the formation with pertinent dimensions from Chapters 2 and 3. I then describe the adoption of the CCS design as a strategy to address the research questions. The CCS design enables the tracing of aspiration for development as the phenomenon of interest across sites (metropole to periphery) and scale (national to local). I include in this design a postcolonial critique of development coupled with a participatory spirit. Subsequently, my positionality as a researcher coupled with an ethnographic sensibility influences the selection of the research site, the qualitative research methods (semi-structured interview, participant observation, participatory research and collection of documents) and approach to data collection. This chapter—and thesis—is then interrupted by an Interlude that highlights disruption to fieldwork due to the COVID-19 pandemic

looming over the data collection period. Following this, the Malay notion of *kebetulan* (chance, coincidence) is included as an approach to data collection and among considerations of rigour. As the analytical procedure, I present the use of reflexive thematic analysis by demonstrating how this approach is applied to the corpus of data. Following this, I reflect on ethical considerations tied to issues of (non)participation and representation, among others. This chapter is concluded by describing how the themes that were constructed during analysis are structured in the subsequent findings chapters, in order to address the research questions.

Chapter 5 presents the findings associated with RQ1: "How does the science for development model translate in the Malaysian context and what are young people's related aspirations for development in the luar bandar?" In this chapter, I first present the characteristics of the science for development model as indigenised in Malaysia in order to set the scene for comparative work with young people's aspirations for development at the grassroots. I find that science is embedded in the national imaginary through targets such as Wawasan 2020 and subsequently translated into education via the 60:40 policy emphasising STEM in upper secondary enrolment. I then present an instance where the science for development model permeates the principal site of my study, Sekolah Luar Bandar. Here, the 60:40 policy drives the tracking of young people into a class I call 4-STEM. Against this backdrop, the young people describe aspirations for development related to the concept of *maju* (march forward), characterised by the desire for day-to-day convenience driven by technological advancement. Additionally, they conceive of development as a balance between globalised desires and carving out a distinct identity for Malaysia. While young people's aspirations for development cohere with the state's in relation to positive attitudes

towards modernisation and technology, they do not necessarily connect such aspirations with the role that the state expects them to fulfil by enrolling in class 4-STEM—to contribute to the realisation of the 60:40 policy and join the pipeline of STEM talent for the nation.

I present the findings associated with RQ2 in Chapter 6: "How does the national development discourse translate to the luar bandar and what are young people's related aspirations for development based on their day-to-day experiences?" This chapter starts with the elucidation of the national-level discourse of luar bandar as largely deficient and the necessity to undertake the project of development in such places. Subsequently, I provide a fine-grained description of Sekolah Luar Bandar and its surrounding community in dialogue with the national level translations of development that play out in the luar bandar. Within this context, young people describe their aspirations for development grounded in their day-to-day life. First, young people describe their commitment and contribution to family, and their family in turn influences their thinking about aspirations. Secondly, they highlight an aspiration associated with affinity and mobility in relation to their local environment, characterised by a kind of ambivalence. Such aspirations, when contrasted against national development discourse of the luar bandar that seek to protect them from the ills of globalisation, reflect how young people are able to aspire to both family-related and globalised values, thus resisting essentialisation. Also, the effects of macro-patterns of outmigration are evident on young people's future prospects locally, thus circumscribing their aspirations and potential futures.

Chapter 7 attends to the findings of RQ3: "How can young people enact their aspirations for development in relation to STEM education and their day-to-day lives in the luar bandar?"

Here, I first describe a participatory informal STEM education project with the young people, as they prepared to represent Sekolah Luar Bandar in a competition held at a local university in the state capital. Using elements of youth participatory action research, the participants brainstormed problems around their school that can be addressed through the application of STEM education. They voted to conduct a project to recycle plastic waste and also noted the absence of seating and shade for students waiting for after-school transportation. Involvement in the project provided the space for young people to enact their aspiration for development, in relation to a problem located in their school community. Using the Malay concept of *rasa* (feeling, intuition), I dialogue with Sellar & Gale's (2011) conception of a new structure of feeling regarding equity in education. I find that young people were able to practice the rasa of aspiring and embodied mixed emotions in the face of a novel experience. This is coupled with the experience of physically traveling outside of their familiar environment as part of embodying an informal, participatory mode of education. I argue that this mode of STEM education rooted in the day-to-day experiences of young people and applied to their immediate problems signals an instance of capacity to aspire in action. Preliminary findings from this chapter were previously published in the *Proceedings of the Yidan Prize Doctoral Conference* (Anuar, 2021).

Finally, Chapter 8 brings together the findings presented in the three preceding chapters in a discussion to address the MRQ for this study. I discuss the findings in light of the existing literature, highlighting young people's aspirations in relation to postcolonial concepts of mimicry, hybridity and ambivalence, followed by an attention to material conditions as well as aspirational equality. I then discuss the various dimensions of young people's rasa when engaging in the informal STEM education project. Subsequently I carve out my own

contributions to research as well as practice borne out of this study. Additionally, I also include a critical reflection on the limitations associated with this study in terms of choices and circumstances, coupled with associated openings that accompany such limitations. I conclude the thesis by suggesting future pathways for research.

CHAPTER 2: Literature Review

2.1 Introduction

In order to carve out a space for this study in the academic literature, in this chapter I undertake an interdisciplinary review of the relevant literature in fields such as CIE, science education, development studies, youth studies, human geography, anthropology and rural sociology. First, I survey the postcolonial approach to development as a critical lens, coupled with postdevelopment as a means of decentring the dominant development discourse. I then explore the intersection between science, development and education, distilled by Drori's (1998) model of science for development. I highlight the continuation of this model's explanatory potential through contemporary discourses around STEM education. Subsequently, I survey literature associated with rural science and STEM education, as well as informal STEM education. This is followed by an attention to aspirations and development, particularly from the perspective of rural young people. I close with a consideration of language, specifically Bahasa Melayu in the Malaysian context, as a resource for thinking about development and the associated dimensions pertinent for this study. Bringing together these sub-topics, I synthesise a position for this particular study—heretofore unexplored—at their confluence.

In this study, I follow McEwan's (2019) use of the categories of global North/South, recognising other terms that have been utilised such as developed/developing countries, minority/majority world, First/Third world. The term global South refers to geographies which are generally considered "developing countries", but beyond the framing of "underdevelopment", it underscores power relations by representing "an entire history of

colonialism, neo-imperialism, and differential economic and social change through which large inequalities in living standards, life expectancy, and access to resources are maintained" (Dados & Connell, 2012, p. 13). Nevertheless, although countries are taken as the primary unit of analysis in this survey, I acknowledge the huge diversity within national boundaries—there are "Norths" within "Souths" and vice versa. Additionally, where the word "West" is used in this study, it refers to "ideologies, cultures and systems of thought, originally centred in Europe and exported through colonialism to the Americas, Australia and New Zealand" (McEwan, 2019, p. 20). Ultimately, there is always a danger in taking these terms as hard boundaries and binaries. Any set of terms employed for comparison bring with them ambivalence, contradiction and some form of compromise. I am therefore mindful of the need to embrace nuance, hybridity, particularity and contingency throughout this review and thesis.

2.2 The "Post" Lens of Development: Postcolonialism & Postdevelopment

This section begins by articulating the components of a postcolonial perspective on development, before highlighting the adjacent concept of postdevelopment. The postcolonial perspective then infuses the subsequent sections of the review.

2.2.1 Postcolonial Perspectives on Development

Critical attention to development in contemporary times examines how the concept itself—tied to notions of progress, modernity and urbanisation—cannot be separated from its historical roots in Western imperialism. Javed (2018) argues that scrutinising "development as a discourse allows us to understand how the power imbalance of the 'developed' and the

'underdeveloped' can be treated and actually function as a mechanism of contemporary imperialism" (p. 160). Here, I review some key conceptual dimensions of postcolonial thinking on development, weaved with empirical examples. Within the rich body of postcolonialism as a theory there exist multiple movement and "turns" that reflect evolving concerns and influences in relation to colonialism throughout history. Kamat (2004) highlights the work of anti-colonial thinkers such as Frantz Fanon and Mahatma Gandhi as part of postcolonial thought prior to the formalisation of this body of theory, whilst also acknowledging contemporary scholars such as Gayatri Spivak and Homi Bhabha who were influenced by the post-structuralist tradition.

To begin, Gordon (2004) in his commentary on Fanon and the question of development, highlights how Fanon has cautioned about the phenomena of neocolonialism creeping into newly independent nations when there is scant consideration to both epistemic and material dimensions of decolonisation. In *The Wretched of the Earth*, Fanon also foregrounds public participation in the project of national development:

> Public business ought to be the business of the public. So the necessity of creating a large number of well-informed nuclei at the bottom crops up again. Too often, in fact, we are content to establish national organizations at the top and always in the capital…The citizens should be able to speak, to express themselves, and to put forward new ideas. (Fanon, 1961/1963, pp. 194-195)

Fanon's concerns above point to a number of important dimensions in postcolonial critiques of development, which includes historicising the epistemic basis of development thinking, paying attention to material inequalities in the aftermath of colonisation, coupled with prioritising collective participation in the process of development. I explore these and other dimensions of postcolonial perspectives on development below.

Critiquing the epistemic basis of development follows from Edward Said's landmark work *Orientalism*. Said (2003) closely analysed the imbrication of power and knowledge with reference to imperial actors and their imagination, description and construction of the "Orient", which subsequently justifies imperial conquest. McEwan (2019) refers to Said and other postcolonial scholars such as Spivak to suggest that this body of theory provides the basis for problematising representations of peoples in the global South in service of the development "industry" and in response, call for valorising the knowledge of the subaltern. Historicising the epistemic basis of development thinking reminds me of the work of Malaysian intellectual Syed Hussein Alatas (1977), *The Myth of the Lazy Native*. In this text, S. H. Alatas (1977) illuminated the colonial representation of natives in South East Asia—the Malays, Filipinos and Javanese in the 16th to 20th century—as lazy and indolent because they resisted participation in the colonial capitalist economy. This work presents an important counter-narrative to the inherited perception of Malay laziness, especially towards the poor and rural populace, which permeate contemporary Malaysian discourse of development and politics (Maaruf, 2014).

Additionally, a postcolonial critique of development also attends to various notions such as agency, subjectivity, hybridity, mimicry and ambivalence. M. Power (2003) refers to subjectivity as "the range of subject positions or identities that an individual human being as agent or subject actually mobilises or embodies", suggesting that postcolonial theory illuminates "the notion of agency, to deepen our understanding of subjectivity by looking at its multiple forms, influences and meanings and opening up the spaces where development's subjects are constructed" (p. 126). Working through notions of subjectivity and agency, attention to the multiple categories of identity, language and culture become pertinent in

considering questions of development. In various sites of the global South, where development is targeted through foreign aid and international organisations, the everyday experience of modernity also leads to hybridity of practices, outcomes and aspirations that also in turn, shape development scholarship and practice (McEwan, 2019). For instance, the work of Sánchez Rodríguez (2021) in Lao People's Democratic Republic highlights the power imbalance and hierarchy between international aid organisations and local implementing partners in an effort to realise disability-inclusive development, such that the agency of the local partners is constrained. In the absence of proper contextualisation and recognition of differing subjectivities, disability-inclusive development remains a "foreign" ideal superficially implemented in the Laotian context (Sánchez Rodríguez, 2021).

Meanwhile, the concepts of mimicry and ambivalence in postcolonial perspectives of development are credited to the work of Homi Bhabha (himself influenced by Fanon), through his critique of modernity and nationalism (Bhambra, 2014; Kapoor, 2008). In considering the interplay of agency and the mimicry of colonial tropes or manoeuvres, Kapoor (2008) highights Bhabha's point that "the politician, and the cultural critic alike can neither extricate themselves from their position in post-colonial history, nor resort to a language uncontaminated by Orientalism or imperialism" (p. 122). This is to say that operating within the existing hegemonic discourses (postcolonially) always involves a kind of negotiation, "a degree of mutuality and complicity between the agent and the hegemon, even if each may want to deny it" (Kapoor, 2008, p. 124).

The above negotiation that entails mutuality and complicity therefore invokes a kind of ambivalence, a mixed feeling that—in the words of Homi Bhabha (1994)—involves both

"desire and derision" (p. 96). As an example, Sylvester (2006) explores this interplay of mimicry and ambivalence in the context of postcolonial governments employing inherited manoeuvres of biopolitics in Uganda and Zimbabwe. In recapping the exchange between the President Yoweri Museveni of Uganda and Agnes van Ardenne, the Dutch Development Minister, Sylvester (2006) observes:

> The confrontation is typical: sinned against by the imperial apparatus of uneven development, Museveni implies that a postcolonial head of state cannot be a sinner. For her part, van Ardenne tries to ward off Museveni's anticipated sins without implicating her own state's colonial-development sins of the past and present. (p. 69)

Subsequently, another pertinent component of postcolonial perspectives on development is the risk of neocolonialism. In the context of development, neocolonialism is related to the endurance of the colonial capitalist economic system. This entails the integration of (post)colonies into systems of dependency as well as flow of material and labour between metropoles and peripheries across different scales—the overall logic is seen to persist notwithstanding formal processes of decolonisation (M. Power, 2003). Postcolonial theory that mainly focuses on discourse, semiotics and representations—as academic exercises—has been critiqued for neglecting this materialist, capitalist dimension that is so central to the modern project of development. Kapoor (2008), for instance, provides an extensive survey of this critique, which is also extended by McEwan (2019). Therefore, attention to representation and discourse must be coupled with recognition of material inequalities reflected in people's encounters with development, structured by overarching global neocolonialism and capitalism.

Overall, adopting a postcolonial critique of development entails confronting the power relations in the material and epistemic project of development, problematising dominant

knowledge claims of development and modernity, and devoting attention to the agency and dignity of the subaltern populations as they navigate the tides of development (Kapoor, 2008; M. P. Kumar, 2011; McEwan, 2019). Within contemporary times, the revival of decolonial theory in mainstream academia in the global North (Moosavi, 2020) suggests the need to understand the potential points of convergence of post- and decolonial[2] thinking in studying development (Bhambra, 2014; de Sousa Santos, 2021; McEwan, 2019). In fact, Moosavi (2020) presents S. H. Alatas (1977) who I had mentioned earlier as a decolonial rather than postcolonial theorist, given his commitment to intellectual decolonisation that seeks emancipation from Eurocentric paradigms and concepts. Although it is important to identify the distinct historical tradition and geographical focus of both postcolonial and decolonial theories, here I am much more interested in their converging emancipatory potentials, with respect to their mutual confrontation of colonialism and its enduring afterlives. In this study, I make reference primarily to the term "postcolonial"[3] to represent the critical stance I adopt in researching development. Meanwhile, de Sousa Santos (2021) highlights points of convergence and departure of postcolonial and decolonial thought with his call for the epistemologies of the South, which I present in the next section. I continue this dialogue of cognate intellectual traditions by turning to postdevelopment.

2.2.2 Postdevelopment as Alternative to Development?

In tandem with postcolonialism, postdevelopment also aims to disrupt the dominant discourse and framing of development. Beginning with Escobar's (2012) influential text

[2] Bhambra (2014) highlights that post- and decolonial theories sit "within the broader politics of knowledge production and both emerge out of political developments contesting the colonial world order established by European empires", though they diverge in terms of the historical scope of colonisation and geographic focus (p. 119). She provides a clear description of their convergence and divergence, which I will not rehearse here.

[3] Spivak (2014) refers to the decolonial scholar Walter Mignolo as part of "Latin American Postcolonial Theory" in her survey of "the range, roots and ramifications of postcolonial studies". (p. 185).

Encountering development: the making and unmaking of the Third World initially published in 1995, postdevelopment has since then "move[d] beyond critique to the envisioning of alternatives or successors (in the literal meaning of the term) to conventional development" (Simon, 2006, p. 11). By moving away from development as the primary means of thinking and representing the material conditions of peoples labelled as "underdeveloped", postdevelopment is concerned with other potential realities of flourishing as worthwhile projects (Escobar, 2015).

Attempts to depart from the framing of development have given birth to theorisations and social movements such as *Buen Vivir* (Gudynas, 2011) and *tecnologia social* (Pozzebon & Fontenelle, 2018) in Latin America, *Ubuntu* in Africa (Murithi, 2009), the Sufficiency Economy Philosophy in Thailand (Schaffar, 2018), Gross National Happiness in Bhutan (Wangyal, 2006) as well as the commitment to pastoral nomadism in Mongolia (Ranta & Schaffar, 2018). Escobar (2015) frames such paradigms as alternatives to development, displacing hegemonic visions of development that follow colonialism by soliciting grassroots perspectives and practices from various corners of the global South. This follows McGregor's (2009) observation that postdevelopment thinking is moving towards "sourcing alternative imaginaries and using them as means to chart pathways into the future…represent[ing] a significant shift…to tones of hope and possibility." (p. 1696). Attention to hope and possibility suggests that a focus on aspirations in relation to (post)development from the grassroots—my area of interest for this study—is an important direction for research.

Such alternatives to development are also tied to the production, appreciation and legitimisation of alternative knowledges, echoing de Sousa Santos' (2014) call for epistemologies of the South based on the following tenets:

> First, the understanding of the world by far exceeds the Western understanding of the world. Second, there is no global social justice without global cognitive justice. Third, the emancipatory transformations in the world may follow grammars and scripts other than those developed by Western-centric critical theory, and such diversity should be valorized. (p. viii)

Nevertheless, it is crucial to avoid the temptation of romanticising grassroots, local alternatives to development as pure counterpoints to what can easily be perceived as the monolithic wave of Western development (Schaffar, 2018). Escobar (2012) posits that in the encounter with dominant forces of development, local communities exert their cultural resources to create "local models [that] exist not in a pure state but in complex hybridizations with dominant models" (p. 96). Such a perspective is consistent with a postcolonial critique of development where binary divisions such as "West/rest" are problematised, suggesting instead moments of intermingling and mutual (re)constitution (McEwan, 2019). In this light, Ziai (2017) observes that in the field of development studies, postdevelopment is increasingly gaining traction, often discussed alongside postcolonial and postmodern critiques.

In the subsequent sections of this literature review, I infuse elements from postcolonial perspectives of development to consider its intersection with education as well as young people's aspirations. Generating new knowledge and new realities by focusing on rural young people is in line with the adoption of a postcolonial critique of development that emphasises representation and participation, especially from communities that are marginalised. This has

become salient particularly within the framework of the United Nations Convention on the Rights of the Child that came into effect in 1990, which included an explicit pillar on "participation" on top of the preceding focus on protection and provision (Ansell, 2005; Mayo, 2001; Skelton, 2007). Nevertheless, recognising the critiques around participatory development associated with power, tokenism as well as the complex interplay of structure and agency (D. A. Clark et al., 2019; Cooke & Kothari, 2001; McEwan, 2019; M. Power, 2003), I must maintain a reflexive stance on the potential pitfalls of an uncritical call for more participation.

2.3 Education and Development

The study of education and development has been a crucial dimension of the field of CIE (Colclough, 2010; Little, 2000; McGrath, 2010; Tikly, 2020). McGrath (2010) observes that economics has long held the prime position as the custodian of knowledge on development, thus relegating education towards the fulfilment of instrumental aims for the economy. However, despite the dominance of economics, research at the intersection of education and international development have also been informed by rich insights from disciplines ranging from peace and conflict studies to anthropology and political science, subsequently forming a significant and vibrant knowledge base for the field of CIE (K. Kumar et al., 2017; McGrath & Gu, 2016; Sivaramakrishnan & Agrawal, 2003; Verger et al., 2018). Importantly, McGrath (2010) goes on to pose the following questions, which I reflect on in the course of identifying the space to contribute through this study:

> Do we need to make the case for education's contribution to economic development more forcefully? Should we turn our attention more systematically to human development alternatives? Or, should we resist the lure of big claims for education,

> preferring to focus on how education makes differences (both positive and negative) to people's lives without any real concern for bigger questions of development? (p. 250)

These set of questions refer to what kind of development should education be marshalled for, as well as the scale of education's contribution, suggesting the interplay between the universal and the particular, the global and the local. In this regard, the adoption of a postcolonial perspective in analysing education's role for development is not something new in the field of CIE. Alongside colleagues, I have written about the utility of postcolonialism within CIE (Anuar et al., 2021), acknowledging the scholars whose works we learn from, such as Andreotti (2010), Crossley & Tikly (2004), Hickling-Hudson (2003), L. T. Smith (1999) as well as Takayama et al. (2017), to name a few. In attending to the intersection of education and development, the legacy of colonialism, power relations in the production of knowledge, questions of language and self-reflexivity are important takeaways to incorporate into this research.

2.3.1 From 'Science for Development' to 'STEM for Development'?

This research is interested in Drori's (1998) identified link between science, development and human capital, which is tied to a model termed as "science for development". This model suggests the belief that

> national economic growth depends on the scientific and technical capabilities of the labor force; such capabilities rely on the level of advanced scientific and technical training; and finally, such advanced training rests on the foundations of science education in primary- and secondary schools. (Drori, 1998, pp. 50-51)

Therefore, the features of the above model guide the literature review in this section. Throughout the review, I asked: How is the role of science (and later STEM) education

conceived discursively in relation to the concept of development, and for what kind of development? By adopting a postcolonial perspective, I pay close attention to the power-laden nature of science for development discourses and the inherent assumptions undergirding their dominance.

It is worth noting that the central role accorded to science for national development does not merely spring independently from within nation-states. This relationship is also propagated in the practice of international development, such as the international congress organized by UNESCO in 1981 titled *Science and Technology Education and National Development.* This congress, which attracted participation of more than 80 countries, led to a publication that outlined how science and technology education contributes to development's twin dimensions: the personal (to be attuned to the environment, develop curiosity and independence, prepare for work) and the community (respond to collective needs, spur practical application) (UNESCO, 1983). In contemporary times, Schwachula et al. (2014) examined the discursive patterns around development and Science, Technology and Innovation (ST&I), associated with the role of international organisations such as UNESCO, the World Bank and Organisation for Economic Co-operation and Development (OECD). The agendas and programming of these international organisations entail technology transfer from the global North to the global South, guiding "many national governments in their decisions to follow specific models for ST&I policies in order to trigger a certain type of development" (Schwachula et al., 2014, p. 4).

Using countries such as South Korea and Singapore as examples, organisations such as the World Bank and the OECD have advanced human capital theory in order to explain the rapid development trajectory of these nations via investments in education (Komatsu &

Rappleye, 2019). Human capital theory posits that "through education, learning, and skill formation, people can become much more productive, and this contributes significantly to the process of economic growth" (Mehrotra, 2005, p. 300). Indeed, this theory has captured the imagination of many countries in the globalised economy, represented by aspirations to become "knowledge economies" characterised by research, knowledge transfer and the required manpower to actualise such aspirations (Verger et al., 2018). A fervent belief in the authority of international organisations has spurred many nations in the global South to channel significant investments towards developing human capital in science and technology, to varying degrees of success. While the Asian Tigers (Hong Kong, Singapore, South Korea and Taiwan) have enjoyed swift economic development, countries in Latin America and Eastern Europe have seen slower economic growth, and in some instances inequalities were exacerbated (Caillods et al., 1996; J. Smith, 2009). Furthermore, many studies focus on the role of science education for economic development, reflecting the spread of the science for development model across the world (Lewin, 2000; Nampota et al., 2009; Obilor, 2012).

Since the turn of the new millennium, discourse around development and science education has morphed into a contemporary focus on STEM education. The latter's global ascendancy with the U.S. as its point of origin upholds economic hegemony in development, borne out of the country's panic in the competition for national security and global superiority (Blackley & Howell, 2015; Vossoughi & Vakil, 2018). Across the world today, STEM represents a cluster of related subjects, an integrated meta-discipline as well as emerging pedagogical approaches, promoted by various interest groups (Kelley & Knowles, 2016; McComas & Burgin, 2020; Siekmann, 2016; Weinstein, 2016). International organisations such as OECD, UNESCO and the World Bank have also taken up STEM as a topic of

interest (Hammond et al., 2020; OECD, 2018a; UNESCO, 2019). Collectively they address concerns regarding gender balance in participation as well as demand for STEM skills in the economy. Emphasis on STEM is also included in regional agendas such as the Continental Education Strategy for Africa (CESA) (Tikly et al., 2018) as well as the recent effort by the Southeast Asian Ministers of Education Organization (SEAMEO) to establish the Regional Centre for STEM Education (SEAMEO STEM-ED Centre, 2021). Meanwhile, in a comparative study of STEM education spanning more than 20 countries, Marginson et al. (2013) argue that STEM education is intertwined with countries' economic policies, tied to notions of human capital and commercialisable innovation. Similar to science education and economic development, STEM education is largely perceived by governments in service of economic aims per the discourse in their policy documents (Gough, 2015).

A review of the literature also reveals that to a lesser extent, science and STEM education has also been researched in relation to the contemporary concept of sustainable development. This concept surfaced in an attempt to soften the economistic timbre of the development paradigm by balancing environmental considerations (Opstal & Huge, 2013). Literature in this regard suggests the various ways science and STEM education can be reoriented so as to become *about* or *for* sustainable development (Caiman & Lundegard, 2018; Eilks, 2015; Nguyen et al., 2020; Onwu & Kyle Jr., 2013; Tikly et al., 2018). With regards to the economic emphasis on STEM for instance, Tikly (2020) highlights the need to take on a more capacious view of the economy, with reference to the United Nations Development Programme (UNDP) concept of sustainable work. This entails

> a break with a purely instrumental view of work as being solely for financial gain or profit and recognises the many forms of work that are not paid, as well as informal

> work that is for profit but nonetheless makes a valued contribution to society and/or the natural environment. (Tikly, 2020, p. 155)

As a counterpoint, Knutsson's (2018) review highlighted more critical studies that question the very premise of sustainable development and education's role in legitimising the concept, calling for the need to "consider the global system of resource flows that enables technological 'progress' in some areas of the world and how this relates to the conditions of people and environments elsewhere" (p. 12). This critique highlights how sustainable development as an ideal—increasingly seen as universal via the Sustainable Development Goals (SDG) campaign—requires critical considerations of the political economy of development. Posed as a question: Who can afford to develop "sustainably" in which parts of the world, and often at whose expense elsewhere in a global system rife with inequality?

Related to the above, research on STEM education have traced the neoliberal, Eurocentric and human capital origins of its expansion tied to the economy and modernity (Carter, 2016; K. Jordan, 2018; Weinstein et al., 2016; Wolfmeyer et al., 2017). As a result, it is difficult to ignore constructs of power buoying the contemporary STEM discourse, as "those who can 'STEM' better and 'STEM' efficiently would have the upper hand in controlling the production and consumption of knowledge, and consequently the possible futures of our world" (Zouda, 2018, p. 1112). That possible future is largely hinged on the coupling of STEM discourse with the contemporary notion of the knowledge economy, where the supply of human capital is pertinent for the production of knowledge and its associated products through research and development (R&D) (Hancock, 2019). Therefore, a postcolonial critique points my attention to the ways in which the "new empire thus operates not so much through conquest, but through the imposition of norms (free-markets, US-style

democracy and cultural notions of consumption, and so forth)" (Escobar, 2004, p. 214). This observation is also reminiscent of Nordtveit's (2010) conception of post-globalisation, where nations in the global South calcify existing inequalities through continual adoption of ideologies of dependence that are often dictated in the West. Adoption of ideologies of dependence can also reflect a state's desire to demonstrate modernity on the global stage, as a means of sustaining their (perceived) legitimacy (Verger, 2014). The spectre of mimicry and ambivalence can be gleaned from this relationship associated with STEM education.

Subsequently, government manoeuvres at the national level to emphasise STEM among its citizenry as highlighted by Marginson et al.'s (2013) aforementioned review points to the concept of the pedagogical state. This relates to "the pedagogic strategies employed by the state and 'non-state' agencies—both within and outside of the formal educational sphere—to govern citizens." (Pykett, 2012, p. 8). From this perspective, as states negotiate and internalise the science (and STEM) for development discourses percolating internationally, they in turn attempt to shape their citizens to realise inter/national aspirations. Here, I adopt the term "inter/national" from Vavrus & Barlett (2012) to suggest how STEM education as an international discourse and policy is appropriated within the boundaries of the nation-state in variegated ways. Drawing attention to "spatial imaginaries" of development operating at various scales, a postcolonial perspective can shed light on the complex relationship and mutual construction of metropole and peripheries (McEwan, 2019). Based on my literature search, I am unable to locate empirical studies that attend to this spatial relationship vis-à-vis STEM education *within* the boundaries of a postcolonial nation-state. Specifically, I refer to the translation of a science/STEM for development model in the context of metropole (urban) and periphery (rural) spaces, from policy to implementation.

What kinds of aspirations for development are (re)constituted in the interplay of discourses and actors at this scale, in relation to STEM education as the intermediary of the postcolonial nation-state? Insights in this vein are crucial to further our understanding of the usefulness of the nation-state (and its constituent spatial components) as unit of analysis in questions of STEM education and inter/national development. Following on from this question, in the next section, I turn to reviewing the literature on rural science and STEM education to carve out the space for this study's line of inquiry.

2.3.2 Rural Science and STEM Education

I begin this review with a quick note on rural education and development, following which I transition specifically into rural science and STEM education. The priority of a particular kind of education in rural communities suggests a need to prepare their members for the future economy. Schafft (2016) argues that mainstream education can be counterproductive "if schooling implicitly devalues rural lifeways and livelihoods, implicitly undermining the aspirations of youth who would choose to lead rural adult lives." (p. 138). Literature in rural education have highlighted how schooling as it stands is meant to prepare young people to leave their rural communities, heading towards the city where opportunities abound for a better life, resulting in the decline and drain of rural spaces (Carr & Kefalas, 2009; Corbett, 2020; Robinson-Pant, 2016; Schafft, 2016). In this regard, teachers may be seen as ambivalent agents of modernisation and development that gesture towards modern and urban middle-class identities as universal aspirations (Morarji, 2016; Robles, 2016). As an example, Morarji (2016) observes that teachers in the rural Indian context "embody successful models of this vision of education-as-development in their middle-class lifestyles and values, their authority as guardians of seemingly unmarked, universalized forms of

knowledge, as state representatives, and in their attainment of much-coveted stable employment" (p. 226). Furthermore, Robinson-Pant (2016) highlights that given the priority towards formal schooling as preparation for transition outside of rural spaces, the potential of informal modalities of learning within communities is overshadowed. I will revisit the notion of informal learning, as well as aspirations that are hinted above, following a survey of rural science and STEM education below.

Further to the propagation of the science for development model as reviewed in the previous section, I hypothesise that for the purpose of national development, science and STEM education in rural contexts would be deployed as part of the modernising and urbanising project. I thus attempt to locate literature that gestures in this direction. In a review of science education in rural contexts, predominantly in the United States of America, Australia and Canada, Panizzon (2012) concludes that a focus on equity that transcends geographical urban-rural difference seems to be a more productive way forward. However, I argue that glossing over "place" and cultures associated with it run the risk of homogenising particularities and material differences that affect young people's lived experiences and attitudes towards science learning. Without seeking to essentialise categories such as urban and rural as fixed and stable, a postcolonial perspective guides me to metropole-periphery power dynamics that gestures towards the productive tensions between the universal(ising) and the particular (Tsing, 2005).

Postcolonial perspectives on science education highlight instances of hybridity and ambivalence across the non/Western borders of science. Carter (2006) suggests that a postcolonial analysis

> would construct more complex conceptualisations of cultural difference as hybridised and fluid, always in the making, and recast culturally diverse students' homogenised identities into multiple, mobile and provisional constructions, more accurately attune to conditions of living and learning under the indeterminacy of the transforming global world. (p. 286)

However, postcolonialism also enables attention to the power dynamics and the critique of continued hegemony of the West, translated into science education as a form of "powerful knowledge" (Burke & Wallace, 2020). Yacoubian (2020) also provides a recent survey of various perspectives employing post- and decolonial theories to attend to the relationship of nature and culture, neocolonialism and the interaction of indigenous knowledges in science education.

In this regard, there is an enduring body of knowledge that depicts the clash, tension and potential synergy between science education (as the conveyor of modernity) and indigenous as well as rural cultures and knowledges. Studies have, among others, pointed to the tension of localisation and contextualisation of science education vis-à-vis dilution of science content, the legitimacy of indigenous and traditional systems of knowledge and the preparation of teachers (Childs et al., 2012; Handa & Tippins, 2013; Robles, 2016; Shizha, 2008). Furthermore, research has also suggested the need to ensure the relevance of science content to the lives of rural students (Avery, 2013), and subsequently interesting ways of integrating religious elements, unique cultural resources as well as indigenous and rural oral traditions into science education (Avery & Hains, 2017; Chigeza, 2011; Imaduddin, 2018; Kassam et al., 2017). To borrow the metaphor from Tsing (2005), these studies reflect the "friction" between indigenous, particular and place-based knowledge, with science and STEM education serving as the intermediary for inter/national development. What is produced as a result points to "the importance of interaction in defining movement, cultural

form, and agency" (Tsing, 2005, p. 6). Therefore, rather than viewing such tensions negatively, could rural young people's agencies be differently harnessed in the wake of their intersubjective experience of STEM education and day-to-day lives? This appears to be an interesting question to consider as part of my study.

The particularity of place is central to questions of rural science and STEM education. This situated form of education is characterised by "geo- and body-knowledge" sourced from place, community and each other to be embedded within the curriculum and pedagogy (Carter, 2010; Quigley, 2009). Survey of the literature indicates sparse research on rural, place-based science or STEM education in the context of the global South, especially from the point of view of students (Klechaya, 2012; Ladachart et al., 2020; O'Hern & Nozaki, 2014). A dearth in this regard further advances the research agenda for this study. Meanwhile, examples from rural and indigenous contexts of the global North, such as the settler colonies of Canada, United States of America and Australia are more readily available, though this too is not extensive (Sutherland & Swayze 2012; Tippins et al., 2010; Zimmerman & Weible, 2017). Such studies reveal place as a key resource for enabling students to undertake relevant science education and social action, drawing on their day-to-day lives in specific environments.

Recently, R. Mills et al. (2021) also reiterated the importance of "place-conscious project work" in STEM education that can support young people's career aspirations in rural Australia, drawing on young people's attachment to people and place (p. 2346). As a counter-example from the global South, O'Hern & Nozaki's (2014) ethnographic work in a Kenyan rural school suggest that a contextualised, place-based approach to teaching natural sciences is impossible in the face of pressure to adhere to the rigid national curricula and

examinations, despite the proximity to landscapes that are favourable to such approach. Inculcating teacher and student agency, as well as place-based learning and aspirations remains a challenge amidst the state's tight control of education in conditioning national aspirations and identity—what Sriprakash et al. (2019) observe as "pedagogies of the postcolonial state" (p. 354). In light of constrains in formal education centralised by the state, and to return to Robinson-Pant's (2016) point about the potential of informal modalities of learning overshadowed by formal schooling, below I undertake a survey of informal STEM education and associated approaches.

2.3.3 Informal STEM Education

In general, the pedagogical potentials of STEM education are aimed at equipping young people with the skills to confront the real-life challenges in modern times such as climate change, as well as fostering integrated literacies that equip them to think critically, engage in problem-solving and manage complexity in their daily lives (Nguyen et al., 2020; Peters-Burton, 2014; Siekmann, 2016). Informal STEM education that is embedded in the daily lives of rural young people may help them foster such skills, especially when formal STEM education is confined by restrictions presented in the previous section. In the Malaysian context where I previously conducted research on informal STEM education (Anuar & Chankseliani, 2021), I have surveyed the nature of this provision as well as concerns that were highlighted in the literature. In brief, informal STEM education is often framed as enrichment activities to raise young people's STEM interests, and encompass modalities such as career talks, field trips, competitions, hands-on workshops and work placements (Banarjee, 2017; Horwarth & Scott, 2014). The various studies on informal science and STEM education

> highlight the balance and tension between learning, engagement and enjoyment, as well as between academic and social elements of the offerings. They also reveal the positive effect of informal learning activities on STEM interest and careers, in addition to their complementary role on the formal curriculum in school. (Anuar & Chankseliani, 2021, pp. 3-4)

In our previous study, providers of informal STEM education in Malaysia opined that their pedagogical approach was distinct from STEM teaching in schools, which left students craving for more hands-on approaches (Anuar & Chankseliani, 2021). Perhaps where there is inflexibility to contextualise science learning as reported by O'Hern & Nozaki (2014) above, informal learning might offer a flexible space to attend to young people's place-based knowledges, interests, concerns and aspirations. This is because informal modalities of STEM education are not usually bound by curriculum or directives at various levels such as national, state and local (Blanchard et al., 2020). Added to this, Stocklmayer et al. (2010) observe that there is potential for informal modalities to inhabit a third space "between the formal school system and the everyday world" given its unique characteristic of being "relatively immune to bureaucratic control and hence to ossification. It is relatively free to assist in the provision of worthwhile education by means of which young people become actively engaged in learning about science" (p. 26).

Therefore, such flexibility that is characteristic of informal STEM education should be harnessed to actively involve young people in addressing issues related to their community, hence counterbalancing the restriction of formal education. Blanchard et al. (2020) undertook a review of the citizen science movement as a form of informal STEM education to suggest the various efforts associated with environment and sustainability issues. Recently, citizen science has been fused with the potential of Youth Participatory Action Research

(YPAR) to produce a conception called Youth Participatory Science (YPS) (Morales-Doyle & Frausto, 2021). Meanwhile, applying postcolonial theory to science education, Boisselle (2016) highlights the importance of a community-service model that "allow[s] students to become aware of the challenges of the communities in which they reside, feel more connected to their communities, and so generate technological innovations that are indigenous to the needs on the ground" (p. 9).

Together, these advances in the literature suggest the enthusing potential for place-based, informal STEM education that is flexible and can be geared towards community development. The kinds of community development project imbued with informal STEM education that young people wish to pursue, I argue, are intimately connected with the aspirations they hold. It is to young people's aspirations in relation to development that I now turn to.

2.4 Young People, Development and Aspirations

In this section of the review, I first survey the intersection between the concepts of aspiration and development, both of which are central components of this study. Following this, I focus specifically on young people's aspirations in various rural sites.

2.4.1 Aspirations and Development

The previous sections in this literature review have highlighted (mostly economic) development associated with science and STEM education. Subsequently, cultural specificity associated with indigenous or rural populations can stand in tension with science and STEM education, which are framed as modern, universal endeavours. An attention to informal

modalities of education in place provides an enthusing platform for meaningful engagement among young people. Here, I introduce the notion of aspiration to the intersection of education and development, as a means of foregrounding young people's perspectives.

Following on from the definition of aspiration provided in Chapter 1, here I focus on a number of interrelated concepts. First, in advancing the notion of "capacity to aspire", Appadurai (2004) suggests that by framing the futurity of aspiration *as part of* culture, one is able to perceive development as expanding cultural boundaries, rather than opposing and abandoning it as relic. This proposition is consistent with the characteristic of aspiration as not necessarily being forward-looking, but also tied to a desire to maintain current favourable conditions (Hart, 2016). In the context of work with the poor in India, Appadurai (2004) acknowledges that inequalities can constrain the marginalised, making their exercise of aspiration more tentative, and less practiced than the more privileged who have the benefit of rehearsed confidence and social networks. Nevertheless, it is a navigational capacity that "thrives and survives on practice, repetition, exploration, conjecture, and refutation" (Appadurai, 2004, p. 69). In other words, people are better able to navigate into the future by utilising their toolkit of aspirations more frequently, strategically and purposefully. Appadurai (2004) places capacity to aspire in dialogue with Sen's (1999) notion of capabilities, suggesting their complementary nature to legitimise and reify one another.

As an economist analysing poverty, and inspired by Appadurai's anthropological perspectives, Ray (2006) extends his work through the idea of "aspirations window". As part of this metaphor, the work of aspiring relies on who/what one can see through this window—conditioned by access to information, social hierarchy—as a means of comparison. This is then closely associated with the notion of the gap between our current

position and the selected point of comparison, which thus affects our actions going forward (Ray, 2006). He further argues, "aspirations window *must* be opened, for otherwise there is no drive to self-betterment. Yet it should not be open too wide: there is the curse of frustrated aspirations." (p. 412). This suggests that aspirations require regulation so as to be realistic; otherwise it will result in the failure of aspirations. Also building on Appadurai's conception of aspirations are Sellar & Gale (2011) through their proposal of a new "structure of feeling" which builds on the original conception by Williams (1977). Specifically, Sellar & Gale (2011) tie their new formulation to student equity in relation to their work on access to higher education:

> Following Appadurai (2004), we align our discussion of capacities with Sen's (1985) work on capabilities and we argue that strengthening capacities to cultivate networks (mobility), shape futures (aspiration) and narrate experiences (voice) increases people's ability to access, benefit from and transform economic goods and social institutions. In turn, this access strengthens the exercise of these capacities. (p. 116)

The linking of various interesting concepts here under the umbrella of structure of feeling presents an interesting frame for further exploration, particularly in the context of rural young people's aspirations for development and the application of STEM education. As part of the synthesis at the end of this chapter, I will elaborate on why this is the case.

Extending Appadurai's (2004) acknowledgement of the material circumstances that influence people's horizons of aspirations, Baillergeau & Duyvendak (2017) question the general assumption that aspirations are naturally adjusted from "idealistic" to "realistic" in a resigned sense. Rather, they pay attention to opportunities for expanding spaces of agency wherein idealistic aspirations can be legitimised and supported, as well as calling for the analysis of more collective rather than individualistic forms of "preferences" among disadvantaged

young people (Baillergeau & Duyvendak, 2017). The point about legitimising of aspirations is also closely related to Ferguson's (2006) idea of "aspirational equality". Commenting on the tendency to view African aspirations towards (Western) modernity as inappropriate mimicry, he suggests that

> taking a hard, and sometimes uncomfortable, look at African aspirations to "likeness" with real and imagined Western standards can help to point serious gaps in some of our most cherished understandings of cultural diversity and global order…the question of likeness forces an unsettling shift from the question of cultural *difference* to the question of material *inequality*. (Ferguson, 2006, p. 20)

This argument, when coupled with a postcolonial perspective of development, provides an explicit reminder of the need to pay attention to material concerns that can be gleaned from aspirations. With all these conceptual tools in mind, I now proceed to review empirical studies that provide a window into young people's aspirations, focusing on the category of "rural".

2.4.2 Rural Young People's Aspirations

Generating new knowledge and potentialities by spotlighting rural young people in particular is in line with the adoption of a postcolonial critique of development that emphasises participation (McEwan, 2019). This review recognises that young people possess varying degrees of agency to shape their lives, rather than merely serving as passive objects of past and present, of history and development (Ansell, 2005). Within the context of aspirations, development can be understood as young people's conceptions of constitutive elements to a meaningful life, which Sen (1999) describes as the kind that people have reasons and freedoms to value. As part of the neoliberal, late-modern discourse, young people's contemporary aspirations are often characterised by decontextualized, mobile, cosmopolitan

lives with the promise of STEM-related careers in the labour market (Corbett & Forsey, 2017; C. Smith et al., 2017). While recognising this trend, I also endeavour to present rural, rooted counterpoints so as to open up novel ways of imagining development from the grassroots. Recognising that "rural" is a not a singular concept (Heley & Jones, 2012; Rigg & Salamanca, 2018), what is presented here is what the authors have deemed as rural within their respective research contexts. Nevertheless, I also highlight instances of hybridity and ambivalence, recognising that pure, monolithic representations of developments from within rural spaces obscure their complex reality of interaction, dialogue and negotiation with local, national and global forces.

Rural young people's aspirations are predominantly studied in relation to further education and careers, as well as the process of out-migration tied to such pursuits. B. White (2019) reviewed five recent surveys on aspirations of rural youth and concluded that their aspirations pointed to the preference for stable jobs in the formal sector, with less interest in entrepreneurship or farming. Meanwhile, in a large-scale study comprising the Philippines, India, Malawi, Mali, Morocco and Mexico, Elias et al. (2018) analysed gender differences in rural young peoples' career aspirations. They found that when aspirations for formal white- and blue-collar jobs fall through, young women were less keen on agricultural futures, compared to young men who would consider modern approaches to farming. Continuing on the theme of careers, Boateng & Löwe (2018) explored how in the absence of work in their communities, rural young people in Ghana aspire to migrate from their villages to other villages or urban areas to earn an income either in agriculture or mining. Meanwhile, in the rural contexts of Georgia and Kazakhstan, Chankseliani et al. (2020) highlight the challenges in higher education aspirations of rural young people, hampered by socio-economic

conditions and poorer performance in centralised examinations compared to their urban counterparts. Echoing this insight, Oyarzún's (2020) study of higher education plans among rural young people in Chile reflects how aspirations are also circumscribed by financial constraints. In such a context, aspirations may be put on hold while rural young people strive to gain employment that will enable them to eventually afford higher education (Oyarzún, 2020).

Elsewhere, rural and regional youth aspiration in India (Sugden & Punch, 2016), Indonesia (Naafs, 2018), Malaysia (Stivens, 2012) and Laos (Sentíes Portilla, 2017) are tied to consumption patterns that echo national and global inclinations, suggesting the far-reaching penetration of globalisation, amounting to the mobility of taste and sensibility. Sentíes Portilla (2017) vividly reports on examples of how Laotian young people in rural areas "experience being young in a fast-paced 'here and now' through motorbikes, hair dyes, junk food and other consumables…through the smart phone, they have the added opportunity to connect locally (or even globally) to other young people like them" (p. 1271). These patterns highlight how rural counterpoints to the normative contemporary aspirations of cosmopolitanism are never hermetically sealed as pure, untainted alternatives in the periphery. In the face of globalisation, young people's aspirations are in fact hybridised at the confluence of the different "scapes" suggested by Appadurai (1990) covering elements such as technology, media, finance, ideas and mobility of peoples. He thus calls our attention to the shifting and fluid nature of aspirations and the necessity to nuance any analysis of power and agency.

Nevertheless, the prevailing emphasis on aspirations in the economic sense overshadows other forms of aspirations associated with spirituality, familial and social relationships as well

as community engagement, all of which are tied to leading a meaningful life (Boateng & Löwe, 2018; Hart, 2016; Tieken & San Antonio, 2016). With reference to Sellar & Gale's (2011) earlier notion of the new structure of feeling, various permutations and contradictions of this structure involving mobility, aspiration and voice can be gleaned in the literature beyond just access to higher education. For example, in a study of aspirations of rural youth in Morocco, Giuliani et al. (2017) highlight how the participants in their focus group envision the "village of their dreams" as having good infrastructure that will enable them to comfortably further their education, raise a family and earn a sustainable living without having to migrate. Daum (2019) similarly highlight how amidst the pull of urban amenities, rural youth in his study within the Zambian context also spoke positively about "the social embeddedness and dense social networks that characterise rural areas for them" (p. 889).

The above examples reveal that aspirations of rural young people may also elucidate attachment to place and the social networks cultivated therein, so as to complicate the overwhelming narrative of migration into cities as their inescapable fate, what Farrugia (2016) terms as the "mobility imperative". Farrugia (2020) further highlights how these attachments to local place reflect the protection of "idyllic notions of their locality in terms of social cohesion and connection with the natural environment" (p. 239). Such varieties of aspirations deserve further attention in order to cultivate imaginaries of development that valorise rural spaces, reaping the benefits of urbanisation and globalisation without losing place-based characteristics that young people view as meaningful for their flourishing right where they are.

A postcolonial analysis of rural young people's aspirations cannot be separated from attention to the ways in which they are marginalised by the inequalities wrought by modernisation. This is reflective in challenges associated with rural aspirations in higher education described earlier (Chankseliani et al., 2020; Oyarzún, 2020). Similarly, Crivello (2011) demonstrates how rural young people in Peru, despite indicating high education aspirations, face the trouble of actualisation in the face of challenges tied to poverty and migration. Furthermore, in his study among rural families in Pakistan, Naveed (2021) highlights how educational aspirations—and the value of schooling—are overpowered by the lack of economic and cultural resources to address existing material poverty. Meanwhile, through an ethnographic study of indigenous Papuan youth in Indonesia, Munro (2018) explicates their sense of diminishment when rendered as minoritised, underdeveloped human resources as part of the state project of modernity. These instances of internalisation of despondency as a micro-sociological process over time may lead to young people's ambivalent relationships with the act of aspiring, potentially resulting in "dreamless futures" (Baillergeau & Duyvendak, 2019). Material inequalities and discrimination can dampen aspirations so as to render them obscure, thus diminishing agency and foreclosing alternative imaginations of development.

One recent empirical study by López-Muñoz & Ingelaere (2021) engages with Appadurai's (2004) notion of capacity to aspire among rural young people in Colombia as they navigate the provisions of local government. The authors argue that local government's actions can either directly support or hinder capacity to aspire among young people in relation to their perception of a meaningful life. The insights from this study assist me to situate my own study and contribution: I am interested particularly in how national government discourse

and policy associated with STEM education and rurality are negotiated by young people as they "speak back" their own aspirations for development. Equipped with a postcolonial perspective on development that foregrounds not only the voices of those marginalised, but also issues of language, representation and knowledge from the grassroots, I move to the next section that tackles these concerns.

2.5 Local, Situated Resources for Development Thinking

In this section of the literature review, I am guided by the following observation by Olufemi (2021):

> The way we talk about this life and living, the language we use, builds a kind of structure that turns the horizon (that point where potentiality meets the substance of our reality) into a mirage…linguistic structures affect how we think, breathe, move and act. The mould sticks to our skin. (p. 43)

Here, I anchor the discussion to the notion of the *local* and the *positioned*. By the former, I refer to the intended site of analysis (Malaysia) whilst the latter refers to my own subjectivity as a researcher from and of this site. As a commitment to postcolonial perspectives in the study of development and as a contribution to epistemologies of the South (de Sousa Santos, 2014), I pay specific attention to language—Bahasa Melayu—as a resource for development thinking. In some small way, I seek to chip away at the mirage highlighted by Olufemi (2021) above. This decision also aligns with Gkartzios et al.'s (2020) call for an attention to language politics and advancing scholarship that conceives of the rural in various ways of knowing and from an emic perspective.

In *Decolonising the Mind*, the postcolonial scholar Ngũgĩ wa Thiong'o (1987) highlights the intimate relationship between language and culture, where the latter is a vessel that "carries,

particularly through orature and literature; the entire body of values by which we come to perceive ourselves and our place in the world" (p. 15). This perspective also aligns with insights from linguistic anthropology, which suggests the close connection between conceptions of reality, our associated thoughts and the language we embody (Engelke, 2017). The attention to language beyond merely a communicative tool excavates its potency to help make sense of embodied experiences, thereby leading to the construction and articulation of insights. For instance, S. F. Alatas (1996) provides an example of how an attention to a local language—and therefore concepts—illuminates our understanding of migration in the Malay World[4]:

> Internal migration tends to be circular and migration to urban areas is temporary (Abdul Samad, 1983:64-65). Such information cannot be gleaned from reports and census data. This is partly due to the nature of questions asked in surveys. Abdul Samad directs attention to local concepts of migration such as *pindah* or *hijrah* (permanent migration), and *merantau* (leaving the state to earn a living with eventual return) (Abdul Samad, 1983:74-75) which reveal the circular nature of internal migration. (p. 134)

I encountered a similar insight in the work of Tsing (1993) among the Meratus people in Indonesia. She highlights that "Meratus conflate the Indonesian words *pembangunan* ('development') and *bangunan* ('buildings'), and they use them interchangeably; to Meratus, development *is* public construction work." (Tsing, 1993, p. 86). In my experience, the notion of development as synonymous with buildings also translates in the Malaysian context, given the linguistic similarity. The above terms in Bahasa Indonesia are exactly the same in Bahasa Melayu. Therefore, in the course of this thesis, I take seriously terms from Bahasa Melayu

[4] Here, I refer to Shamsul's (2005) conception of the Malay World as constitutive of the shared geographical and cultural region whose population "speak the Malay language and its various dialects. They inhabit present-day Malaysia, Indonesia, Brunei, Singapore, Southern Thailand, Southern Philippines and Southern Cambodia." (p. 103)

encountered in discourse as well as among participants in order to expand the possibility of development thinking rooted in empirical work in Malaysia.

Below, I review one term from Bahasa Melayu that I integrate with Appadurai's (2004) capacity to aspire and Sellar & Gale's (2011) new structure of feeling. To solicit the perspectives of young people, I foreground the word *rasa* in this study, following on from the word "feeling" in Sellar & Gale's (2011) proposed concept. Yaapar (2005) observes how the Malay poet and intellectual Muhammad Haji Salleh conceptualises rasa as a form of consciousness:

> In his critical writings, the term Muhammad uses for consciousness is *rasa*. However, his description of the term suggests that it is richer than consciousness itself. It includes feeling, intuition, conscience, taste, and sensitivity. According to Muhammad (1977b), 'these faculties are put to use along with that of the mind at one moment of thought'" (p. 295)

Subsequent to this, Lim (2003) observes that the word rasa is used in day-to-day conversations among Malays not only to indicate feeling, but also thinking, in that "if you ask them for their opinion, which is supposed to request their thinking, the Malays will be quick to respond with '*saya rasa*' (lit. I feel) although it is understood that they are actually thinking as well." (p. 148). The miscibility of thinking/feeling in this regard is not unique to the Malays, but has also been reported in other cultures in Micronesia and Indonesia (Lim, 2003).

Similar to the previous insight from Tsing's (1993) observation, rasa is also studied in relation to cultural practices in Indonesia—regionally this notion was introduced historically

from Sanskrit (Benamou, 2010; Lim, 2003; Stange, 1984). With reference to musical practices in Java, Benamou (2010) elaborates:

> When we speak of *rasa* as a faculty of perception, we have drifted quite far from the English word *feeling*. Nevertheless, when *rasa* refers to the outer sensory faculties of taste and hearing, it is easily assimilated into modes of thought associated with the English language: the terms "sensory perception," "taste," or "hearing" are quite close to this meaning of *rasa*. Not so, however, of the deeper faculty of intuition. This is an extrasensory faculty of perception, through which the properly trained heart can "feel" essences directly. (p. 50)

Therefore, the adoption of the term rasa in this study enables me to feel/think with young people in a shared language as I seek to learn about their aspirations for development and their enactment of such aspirations. Words like luar bandar defined in Chapter 1, as well as other terms from Bahasa Melayu that the reader will encounter in subsequent chapters become thinking tools for my conceptualisation and analysis. Close attention to language in this way reminds me that this study and the subsequent knowledge generated are situated and committed to a particular place. Nevertheless, there is always the possibility for concepts generated in a particular place to travel and transform within global circuits of culture and politics (Gluck & Tsing, 2009), thereby advancing collective understanding in education and inter/national development.

2.6 Synthesis and Focus of this Study

In this chapter, I began the survey by elucidating the postcolonial perspective of development, and its offshoot, postdevelopment. Subsequently, I adopted a postcolonial lens in the course of reviewing the body of literature associated with rural and informal STEM education and development, young people's aspirations in rural places and subsequently an attention to Bahasa Melayu as a resource for thinking about development.

Throughout the literature review, I have identified a number of avenues that converge, within which I articulate the focus of this study.

Having surveyed the movement of the science for development discourse across inter/national sites, I am interested particularly in how dynamics of metropole-periphery relationships associated with this discourse play out within the boundary of a postcolonial nation state, translated as the "urban-rural" divide. Identifying this as a kind of translation of national aspiration for development via concerted efforts tied to STEM education, I have yet to encounter studies in this domain to illuminate the dynamics of the nation-state as a frame of analysis. On this front, Tikly (2020) observes that different postcolonial states mediate global policy agendas in variegated ways in relation to their capacities and reliance on external financing. By taking Malaysia as the site of analysis, the pattern of mediation and translation specific to its national history, political configuration and development priorities can be illuminated in relation to the science for development discourse. Coupled with this, there is scant literature on the rural, place-based STEM education in the global South, especially from the point of view of young people as its intended beneficiaries. By placing these two lacuna in dialogue, I am interested to explore how young people's engagement with STEM education can form part of the work of "speaking back" from rural spaces—articulating aspirations for development rooted in their day-to-day lives, as they negotiate development-related policies and discourses translated by the state from the metropole.

Additionally, fusing the existing concepts of aspiration surveyed thus far in the literature—capacity to aspire, structure of feeling, aspirational equality—with concepts sourced from Bahasa Melayu such as rasa, provide a space for expanding the conceptual toolkit of studying aspirations in relation to education. I intend to build on the works surveyed in this review in

order to enrich the collective narrative of young people's aspirations from the vantage point of rurality. The task therefore is to provide more complex and nuanced accounts of "development" from those worked over by its projects and schemes devised far away in the metropole, the capital city. In doing so, young people may contribute to the epistemic and material project of development, thereby expanding the possibility of unsettling its dominant economic framing. Overall, the dimensions synthesised in this chapter have provided a clear focus for my line of inquiry. In the next chapter, I provide richer contextual details about Malaysia as the study site, before articulating the set of questions and research design to operationalise this study.

CHAPTER 3: The Malaysian Context

3.1 Introduction

In light of the literature review presented in the previous chapter, here I provide contextual details on this study in relation to Malaysia. Attention to the value of context has been an enduring concern in the field of CIE. Considerations in this regard includes the various dimensions of context in relation to development (history, politics, culture, social, history) (Little, 2000) as well as the foregrounding of context as ways of bridging research paradigms, scales, research sites and collaborators (Crossley, 2009). Subsequently, Sobe & Kowalczyk (2013) urge us to think of context not as a combination of static facts, but rather as assemblage—the contingent coming together of objects, practices and the associated ways of knowing that are conditioned by power relations. They go on to suggest that it is

> useful to return to the etymological roots of the word *context* as they help us see past the accrued meanings of "background" and "place" and "dimension" that have been added over time. The Latin verb *texere* means "to weave" and *con* signifies "with." Consequently, *contexere* is "to weave together" or "to interweave." The notion of interweaving allows us to focus on Contexts as assemblages of multiple discourses, practices, techniques, objects, and propositions that come together in particular places at particular times. (Sobe & Kowalczyk, 2013, pp. 10-11)

The above notion of context as shifting and contingent is further elaborated in the methodological sense through Barlett & Vavrus' (2018) conception of context in their CCS design. Drawing on insights from anthropology and geography, they argue that the context of a study cannot be neatly separated from the phenomenon that is being studied, and such confluence necessarily means that the context too is emergent as the study unfolds (Bartlett & Vavrus, 2018). Piattoeva et al. (2018) present a complement to this perspective by relying

on insights from Actor-Network Theory (ANT) to foreground the process of constructing contexts through relational ties between various actors.

Hence, in this chapter, I take on this conception of context as assemblage, and as emergent depictions of Malaysia at this time within the frame I have demarcated for this study. The Malaysian context presented here is a collection of discourses, numbers and actors on/in Malaysia in relation to each other. I augment this assemblage with a postcolonial lens to incorporate the legacy of colonisation and Malaysia's instances of mimicry in its development story. On occasion, I "interrupt" the narrative of this chapter to embed glimmers of my personal history and biography, thus imbricating myself onto the Malaysian context. I do this to suggest how my location as the researcher (and by-product) within this contextual assemblage of development eventually shapes this study. This practice follows the tradition of the "layered text" of bringing the researcher's self into social science (L. Richardson, 2003). Where the self is inserted in the contextual assemblage below, I indicate these elements in blue.

I start by sketching a macro-level portrait of the country, followed by depiction of Malaysia as a developmental state. Subsequently, an overview of the Malaysian education system is provided as a specific manifestation of the developmental state. I then conclude the chapter by summarising pertinent contextual details that set the scene for this study. This brief chapter is not meant to be an exhaustive survey of Malaysia. Eschewing the view of context as a static container merely prepared before embarking on actual research (Sobe & Kowalczyk, 2012), I provide sufficient grounding of the context (so far) from which to explore the questions that have arose out of the prior review of literature. This chapter is also developed to provide a point of reference as the reader engages with the findings in

subsequent chapters, which constitute thicker contextual details than presented here. Where relevant, I will signpost back to this chapter as the context, analysis and findings unfold in the rest of this thesis. This is so the subsequent insights can be read and weaved together with the details sketched in this chapter, thereby better orienting the reader who is otherwise unfamiliar with Malaysia.

3.2 Malaysia at a Glance

This section provides macro-level information about Malaysia, a nation that is geographically part of both mainland and maritime South East Asia. Here, I include a brief overview of Malaysia's history, administration, economy and demography with reference to government information, international metrics and information from the relevant literature.

Geographically, Malaysia is divided into Peninsular and East Malaysia. Peninsular Malaysia, which is part of mainland Asia south of Thailand, consists of 11 states[5] (Perlis, Kedah, Kelantan, Terengganu, Perak, Pahang, Penang, Selangor, Malacca, Negeri Sembilan, Johor) and two federal territories (Putrajaya—central government administrative capital, Kuala Lumpur (KL)—largest city in the country). My parents, older siblings and I were born and (partly) raised in the state of Pahang, which together with Kelantan and Terengganu are known as the east coast of Peninsular Malaysia. Meanwhile, the states of Sabah, Sarawak and the federal territory of Labuan on the island of Borneo are collectively referred to as East Malaysia. Each state is further divided into its own set of districts.

[5] The use of the term "state" here is not to be confused with references to Malaysia also as a state, for example in the subsequent Section 3.3 referring to Malaysia as a developmental state. When referring to states inside Malaysia as listed here, it is in the context of them as *non-sovereign* states. Such states have intra-national boundaries (see Figure 1) and their own governments, though they are subsumed within the federal government of the national, sovereign state of Malaysia, as described later in this section.



Figure 1: Map of Malaysia relative to surrounding nations in South East Asia (adapted from Mohd-Zaki et al., 2014)

Figure 1 shows the map of Malaysia relative to surrounding nations in South East Asia, with the states and federal territories indicated (adapted from the map by Mohd-Zaki et al. (2014)). Peninsular Malaysia, which was formerly known as Malaya, historically underwent successive bouts of colonisation by the Portuguese in 1511, followed by the Dutch (1641), British (1824), Japanese (1941) and once more the British (1945) empires, finally gaining independence on 31 August 1957 (Department of Information Malaysia, 2016b). Meanwhile, the states of Sabah and Sarawak were not under the direct influence of the British colonial office, but rather colonised through private British entities—the British North Borneo Chartered Company (BNBCC) in Sabah and the Brooke family in Sarawak (Tajuddin, 2012). On 16 September 1963, Malaya, Sabah, Sarawak and Singapore merged to form Malaysia,

with Singapore exiting in 1965 to form an independent nation (Department of Information Malaysia, 2016b; National Library Board Singapore, 2014).

Today, Malaysia is administered by a central government in Putrajaya through a system of parliamentary democracy with constitutional monarchy. The King is the Head of State whilst the Prime Minister leads the executive branch of the federal government guided by the Federal Constitution (Parliament of Malaysia, 2013). Within a federation setup, the aforementioned states in Malaysia have limited powers of government, as they have "surrendered part of [their] power such as financial, defense, education, foreign affairs and others, as stated in the Malaysian Constitution, which is administered by the Central Government." (Parliament of Malaysia, 2013, para 3). The central government (also known as federal government) thus sets up relevant ministries and agencies to administer functions such as finance, education, defence for the whole country, with state governments and district offices serving as organs of implementation and also administration of selected matters under their jurisdiction. Given its relevance to this study, the role and power of the Ministry of Education Malaysia (MOE) is further elaborated in Section 3.4.

The centralised and hierarchical nature of administration that shapes public life in Malaysia is reflected in the country's power distance value. Power distance is defined as "the extent to which the members of a society accept that power in institutions and organizations is distributed unequally" (Hofstede, 1985, p. 347). Compared to other countries in South East Asia, Malaysia's power distance value is the highest (100), relative to the regional average (80) and the world average (59) (Asaki & Ojima, 2021). This suggests that in general, the everyday Malaysian is more likely to accept the reality of unequal distribution of power across various hierarchies, defer to figures of authority, and are less likely to voice dissatisfaction with such

configuration. Sweetman (2012) observes that this situation is a result of the fusion of historical Malay feudal system and British colonial control.

According to the United Nations Development Programme (UNDP), Malaysia's Human Development Index (HDI) value of 0.810 places it in the "very high human development category", higher than all neighbouring countries in South East Asia except for Singapore and Brunei (UNDP, 2020). Meanwhile, the World Bank classifies Malaysia as an upper middle-income country (World Bank, 2021a). As a proportion of the Gross Domestic Product (GDP), Malaysia's economic sectors are distributed as follows: Services (56.7 per cent), Manufacturing (24.4 per cent), Agriculture (8.2 per cent), Mining and Quarrying (6.2 per cent), Construction (3.5 per cent) (Department of Statistics Malaysia, 2021c). This indicates that the Services sector is the largest contributor to the country's economy. Compared to the World Bank's aggregated unemployment rate of upper middle-income countries (6.9 per cent), Malaysia's unemployment rate is lower (4.5 per cent) (World Bank, 2021c). It is worth noting that this unemployment rate, based on 2020 data, is understandably higher than the average of previous years (less than 3.5 per cent) due to the impact of the COVID-19 pandemic (Department of Statistics Malaysia, 2021b).

The official language of Malaysia is Bahasa Melayu, whilst English, Chinese dialects, Tamil and indigenous languages are also spoken (Department of Information Malaysia, 2016a). These languages reflect the diverse demographic make-up of the country. In terms of demographic information, Malaysia's population currently stands at 32.67 million, with 69.8

per cent classified by the government as *Bumiputera*[6], 22.4 per cent Chinese, 6.8 per cent Indian and 1.0 per cent Others (Department of Statistics Malaysia, 2021a). As a member of the Malay ethnic group, I am categorised under the label of Bumiputera and therefore part of the majority and benefit from associated privileges. The country's racial distribution reflect the long history of migration in the region (Goh, 2008), followed by British colonialism as observed by Gomes (2007), where the colonial administration

> facilitated the growth of the tin mining industry, the establishment of rubber estates…and the expansion of the population of the Malay Peninsula through a migration programme which brought into the country many Chinese, Indians and Indonesians to meet the rising demand in the tin mining and rubber industries. (p. 46)

The legacy of the racialised colonial economy—Chinese as merchants in town centres and miners, Indians as plantation labourers, Malays as farmers in the rural economy and indigenous peoples subsisting far in the interior—continues to influence the geographic distribution of the population in postcolonial Peninsular Malaysia (Goh, 2008; Gomes, 2007). In the context of subsequent economic growth, employment opportunities are mainly focused in growing urban centres. Migration and urbanisation patterns can be gleaned based on the information provided in the *Dasar Pembangunan Luar Bandar* (Rural Development Policy). The proportion of residents in the luar bandar has shifted from 73.1 per cent in 1970 to an estimated 22.8 per cent in 2020 (Ministry of Rural Development Malaysia, 2019). My mother, originally from the luar bandar, was part of this migration wave as she pursued secondary and higher education, followed by employment. In the next section, I turn to

[6] In macro level statistics in Malaysia, Bumiputera (literally meaning "sons of the soil") is used as an umbrella term to represent multiple ethnic groups that include "Malays, Aborigines of Peninsular Malaysia and indigenous tribes of East Malaysia" (Nagaraj et al., 2015, p. 153). To reflect a political marker of indigeneity advanced by the Malay majority leadership, these groups are accorded special provisions in the Federal Constitution of Malaysia, such as in education and employment in the public sector (Koh, 2017).

exploring the dimensions of national development in Malaysia that will be salient for this study.

3.3 Malaysia as a Developmental State

The notion of national development for a postcolonial state like Malaysia must be framed in light of its colonial antecedent. Malaysian scholars have noted that following independence, the development philosophy of the aristocratic leadership retained the logic of economic liberalism and capitalism in service of British and foreign business interests, with insufficient consideration of the characteristics of the newly formed nation (Jomo, 1986; Maaruf, 2014). Following the formation of Malaysia, economic planning in the country has taken place through five-year plans known as *Rancangan Malaysia* (Malaysian Plan), focusing on infrastructure development in its early days (Gomes, 2007). Eventually, the influence of British interest began to wane when

> Tunku [Abdul Rahman] stood down as prime minister in 1970, and the New Economic Policy (NEP) allowed the government to take on a more proactive role in the economy to raise the living standards of the Malay or *bumiputera* population (N. J. White, 2004, p. 3)

The introduction of the NEP as mentioned above—to eradicate poverty and restructure the legacy of the racialised colonial economy—was intended to address a national trauma in the wake of bloody racial riots on 13 May 1969, arising from ethnic resentment around economic and social inequality (Gomes, 2007). Conscious social engineering by the state through the NEP, focusing on economic development in order to correct imbalance identified along the Bumiputera and non-Bumiputera divide produced lasting implications on questions of national identity to this day (Balasubramaniam, 2007). Additionally, the

government introduced the *Rukun Negara* (National Principles) in 1970 with the intent to unite all citizens of multi-ethnic Malaysia under a common set of beliefs associated with God, the King, the Federal Constitution, rule of law and standards of behaviour (Abd Rashid, 2002; Y. F. Lee & Gill, 2008). Thus, the pervasive state intervention in this regard gradually positions Malaysia as a developmental state, which is characterised by Castells (1992) in the following way:

> A state is developmental when it establishes as its principle of legitimacy, its ability to promote and sustain development, understanding by development the combination of steady high rates of economic growth and structural change in the productive system, both domestically and in its relationship to the international economy. (p. 56)

Indeed, the above characteristic is evident in Malaysia given the government's sweeping and entrenched development policies at the national scale, in essence seen as interchangeable with the state itself[7] (Embong, 2008). Agricultural development can be taken as an example, coupled with the rural community as its primary target. *Kementerian Pembangunan Luar Bandar* (Ministry of Rural Development) was first established in 1959 (Abd. Wahab & Abu Bakar Ah, 2007). Through successive premierships, the government established agencies such as *Majlis Amanah Rakyat* (MARA, Council of Trust for Indigenous People), as well as planning and policy documents among which are the Red Book and National Agricultural Policies (Gomes, 2007; Ngah et al., 2010). Additionally, land development and resettlement schemes, known as Federal Land Development Authority (FELDA) and Federal Land Consolidation and Rehabilitation Authority (FELCRA) were rolled out nationwide, coupled with various regional rural development projects known as KEJORA, DARA, KEMUBU, KETENGAH

[7] The pervasive nature of the federal government in Malaysia that often presents itself as speaking on behalf of the Malaysian state makes these two terms (state and government) interchangeable in this context. In reality, the government is a subset of the broader concept of "state", alongside the population, territorial boundaries and ability to forge inter-state relations (Robinson, 2013).

and many others (Dadzie, 2013; Gomes, 2007; Ngah et al., 2010). The town nearest to my mother's village was developed around a FELDA settlement in the 1970s. Following outmigration and completion of her higher education, my mother was employed in one of the regional rural development projects called DARA, situated in the southeast region of the state of Pahang. Here, my family's history in relation to the village and a regional project demonstrates the actualisation of rural development initiatives implemented by the federal government.

Studies of the Malay peasantry in relation to rural development in Malaysia often consider the *kampung* (village) as the primary unit of analysis; it is the smallest organisational subset of the larger *mukim* (parish) and even larger district, situated within wider social and historical change at the state and federal levels. The various works surveyed by Ibrahim (2021), ethnographies by Shamsul (1986) and Ong (1987) in the state of Selangor, and by Thompson (2012) in the state of Perak are some examples. The kampung, here translated simply into "village" in English, holds a multiplicity of meanings depending on the context. Shamsul (1996) observes that one's mention of their kampung can refer to:

> 1) the site of his or her house and immediate compound,
> 2) his or her mother's house (especially in the matrilineal system context),
> 3) the few houses that surround his or hers, especially those belonging to members of the extended family or clan,
> 4) the area surrounding the local mosque or *qaryah*,
> 5) the administrative village, or even
> 6) the whole locality, consisting of a cluster of 'administrative' villages. (p. 142)

Therefore, the concept of kampung acquires more than a physical constitution or a place, but also relational notions of family and community. It is also important to note that rural

development in Malaysia must be understood in relation to broader economic priorities that shifted in light of the racial riots of 1969. Shamsul (1986) observed this shift as such:

> After 1969, [rural development policy] became a strategy of reducing the overall priority of rural development relative to industrialization or urbanization policies and education. The new emphasis was not only meant to improve rural life and economic activity but also to prepare some rural Malays for inter-sectoral mobility while the rest wait for further opportunities to do similarly, when and if the *bumiputera* policy takes its full effect by 1990. In other words, the government hopes that the backwash effects of the *bumiputera* policy will convey development to the rural economy. (p. 85)

Related to the priority of urbanisation above, Thompson (2012) observes that the kampung is "a place of ongoing transformation especially in relation to migratory subjects and urban Malaysia centred on the capital of Kuala Lumpur" (p. 9). This means that as places in the luar bandar, kampungs are often constituted in relation to urban aspirations located elsewhere. The shift to industrialisation and urbanisation observed above can be reflected in the rapid modernisation efforts under the leadership of Malaysia's fourth Prime Minister Dr. Mahathir Mohamad from 1981 onwards. Early in his premiership, he instituted the *Dasar Pandang ke Timur* (Look East Policy) as a means of learning from the development successes of nations in the east like Japan, and retaliation against the British government's decisions regarding higher education fees for foreign students and tighter investment guidelines (Furoka, 2007). Here, mimicry of Japan must be read as the rejection of the West (Britain as the former colonial master) in favour of valorising the East—even when Japan too had historically colonised Malaya, as outlined in the previous section.

Science, technology and industrialisation also took centre stage in the imagination of Malaysia as a developed country by 2020, anchored by the aspiration of Wawasan 2020 articulated during Dr. Mahathir Mohamad's premiership (H. A. Lee, 2004; Mee, 2012). Recall

that an excerpt of Wawasan 2020 related to science was previously introduced in Chapter 1. Under Dr. Mahathir Mohamad's stewardship, national development was represented and realised in the public eye through various technological advances: the creation of the national car (Proton), development of Putrajaya as the new administrative hub, construction of Kuala Lumpur International Airport (KLIA) and the PETRONAS Twin Towers (at one point the tallest building(s) in the world) and the emphasis on multimedia and telecommunications (Gomes, 2007; Mee, 2012). During my professional career with the national oil company, PETRONAS, my office was situated in the aforementioned Twin Towers. Once again, I encounter and inhabit Malaysia as the developmental state. Attention to the symbolism of development in Bahasa Melayu as a language is crucial here. Many of the projects described above reflect large-scale construction work of buildings, translated as *bangunan* in Bahasa Melayu. It is perhaps no coincidence then that the nominalisation of the verb *bangun* (to rise) leads to *bangunan*, and consequently the word *pembangunan* to mean development in Bahasa Melayu and in Malaysia. Recall that in the previous chapter (Section 2.5), this association of development with buildings is also evident in Tsing's (1993) study context of Indonesia, given the linguistic similarity between these neighbouring countries in South East Asia.

In light of the national development milestones highlighted above as well as Malaysia's space programme in 2007, Mee (2012) observes "a defining feature of…Malaysia's public culture in general…is a deep-rooted belief in the importance of scientific and technological development" (p. 230). How might such importance be fostered through Malaysia's manoeuvre as a developmental state? In the next section, I explore the configuration of education in Malaysia as the state's lever to realise its aspiration for national development.

3.4 The Malaysian Education System

In this section, I provide an overview of the education system in Malaysia by focusing on the role and provision of the MOE across primary, secondary and tertiary education. The intent is to demonstrate the heavy involvement of the federal government in the design and delivery of educational provision in service of national development.

3.4.1 Centralisation of Education

Malaysia's education system can be characterised as a centralised system, wherein authority is largely concentrated at the level of the federal government, via the MOE. As the arm of the government in charge of education, the MOE develops policies, operational guidelines, curricula and textbooks for use in schools, as well as coordinates the national examinations (Ministry of Education Malaysia, 2013). Subsequently, the mandate of the MOE is translated nation-wide through a hierarchical system. In each of the 13 states and three federal territories highlighted in Section 3.2, the MOE is represented via the *Jabatan Pendidikan Negeri* (JPN, State Education Department) and subsequently *Pejabat Pendidikan Daerah* (PPD, District Education Office) in each district within every state. All education-related personnel employed by the MOE, JPN, PPD and schools, including teachers, are government employees recruited through a system at the federal level:

> To achieve its many roles, the Ministry is a massive operational delivery agency. It employs approximately 6,800 officials and support staff at the federal level, almost 6,400 at the state level, and a further 6,000 at the district level. This is in addition to approximately 420,000 principals and teachers in schools, and more than 13,100 officials and support staff in the IPGs [teacher training colleges], IABs [institute for school leaders], and matriculation colleges. (Ministry of Education Malaysia, 2013, p. 6-2)

Within a centralised system such as Malaysia's, officers at descending levels of hierarchy and teachers in schools as "staff in the periphery are responsible for tightening implementation of policies determined by the central government" (Bray, 2007, p. 181). Thus, at the school level, teachers play a day-to-day role in implementing and upholding the policies developed by the MOE, translating them into procedures in school as well as content and pedagogy in the classroom. Elucidating this facet of education centralisation in Malaysia is crucial to later understand the role of school teachers as intermediaries of national development agendas.

3.4.2 Education Pathways in Malaysia

The design of education pathways by the MOE also provides a window into Malaysia as a developmental state. Successive pathways within the Malaysian education system are reflected in Figure 2, which is adapted from the Malaysia Education Blueprint 2015-2025 (Higher Education) (Ministry of Education Malaysia, 2015). As stated in the Education Act of 1996, the national education system consists of pre-school, primary education, secondary education, post-secondary education and tertiary education (Ministry of Education Malaysia, 2013).

Based on Figure 2, following pre-school education, Malaysian students enter primary school for six years (Primary 1 to 6), typically from 7 years of age. This stage of education is compulsory for all and the enrolment rate in Malaysia is near universal (98.2 per cent) (Ministry of Education Malaysia, 2013, 2021). Based on the statistics from the MOE, 97.1 per cent students at this level are enrolled in public schools under its purview, compared to enrolment in private schools or schools under other government agencies (Ministry of Education Malaysia, 2020). Under the public education system, there are the mainstream

national primary schools with Bahasa Melayu as the medium of instruction, national-type primary schools with Chinese and Tamil as languages of instruction and other dedicated schools (such as for special education). The segregation along ethno-linguistic lines at the primary level is also a legacy of British colonialism and the associated labour migration, which resulted in the multicultural make-up of postcolonial Malaysia (Abd Rashid, 2002). Historically, at the end of primary education, students have sat for a national school-leaving examination known as *Ujian Penilaian Sekolah Rendah* (UPSR, Primary School Evaluation Test), although this was recently abolished in 2021 in favour of school-based assessments (Soo, 2021). Students then progress to secondary education. UPSR results at the end of primary school are also used as the basis for admissions to specialised secondary schools, described below.

Secondary education in Malaysia occurs in two stages, lower secondary (Form 1, 2 and 3) and upper secondary (Form 4 and 5), as demarcated in Figure 2. The latest statistics indicate that enrolment rates stand at 95.3 per cent at lower secondary level, and 87.6 per cent at upper secondary level (Ministry of Education Malaysia, 2021), which reflect attrition from primary education and between the two levels of secondary education. A study by Nagaraj et al. (2016) indicates that the probability of not being in school is higher among boys compared to girls, as well as in rural areas and among the Bumiputera other than the Malay ethnic group. The MOE similarly highlights school dropout concerns among boys and the smaller enrolment compared to girls leading up to tertiary education (Ministry of Education Malaysia, 2013). When young people drop out of school at this stage, they typically do so due to economic reasons, such as joining the labour force early to support their family (Ministry of Education Malaysia, 2013; Nagaraj et al., 2016).

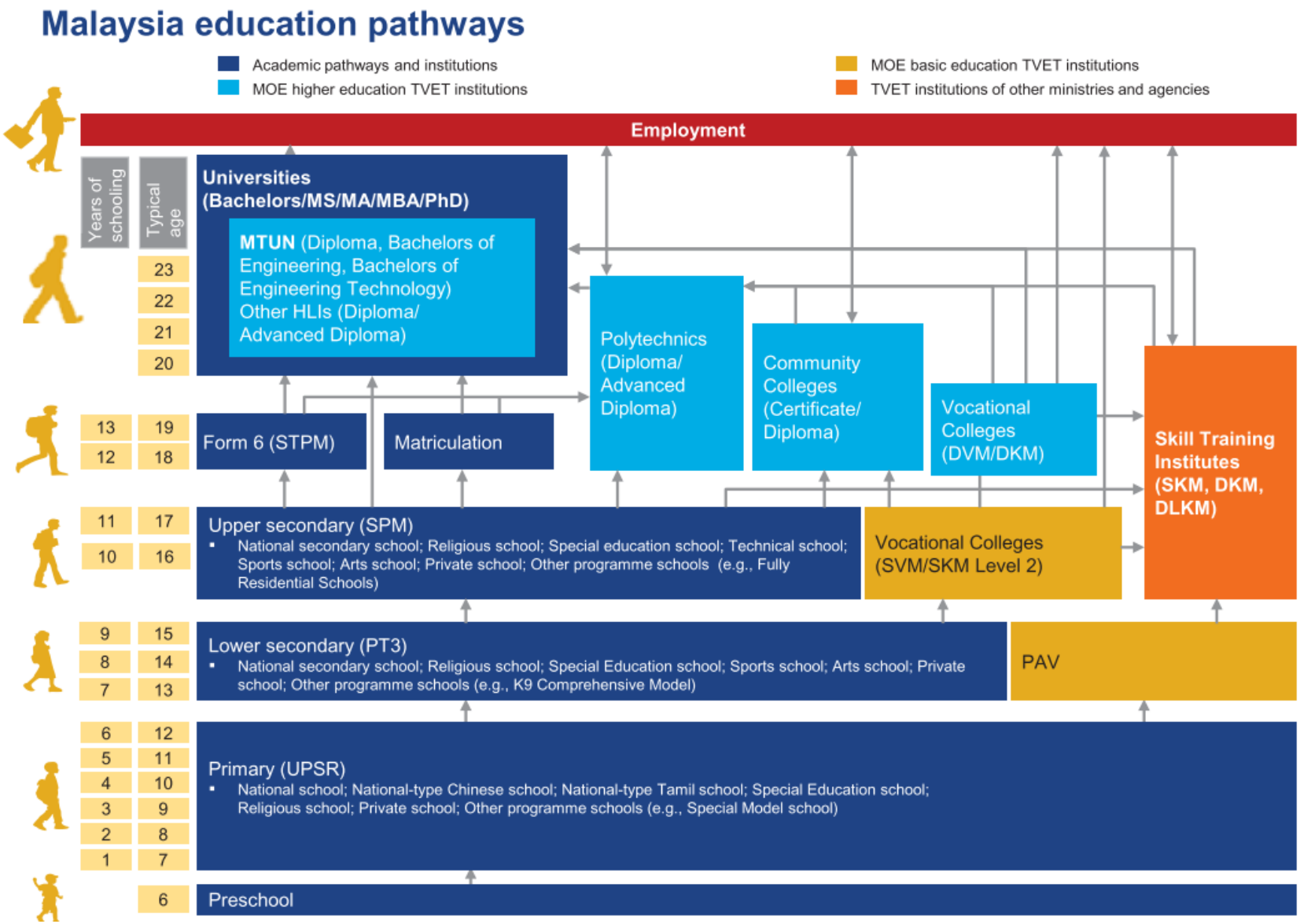

Figure 2: Pathways in the Malaysian education system (adapted from the Ministry of Education Malaysia, 2015)

For the majority who are in school, the MOE provides mainstream national secondary schools, as well as specialised schools such as those dedicated to arts, sports, Islamic studies, and fully residential schools (Ministry of Education Malaysia, 2013). At the end of the lower secondary level, students sit for a school-based assessment known as *Pentaksiran Tingkatan Tiga* (PT3, Form 3 Assessment) that can be used for admissions into the abovementioned specialised schools, as well as technical schools and vocational colleges. For students in mainstream schools, the results of PT3 are used as a basis for tracking students into different academic streams, based on a policy known as the "60:40 policy". This policy targets 60 per cent upper secondary enrolment in elective subjects skewed towards science and technology, whereas the remaining 40 per cent is for arts and humanities (Ministry of Education Malaysia, 2013). The 60:40 policy also led to the establishment of the specialised school known as fully residential schools, described by Ng (2016) below:

> [T]he Second Malaysia Plan (1971–1975), involved the building of 10 dedicated Science Secondary Schools by the Ministry of Education (MOE) and 2 MARA Junior Science Colleges (MRSM) by *Majlis Amanah Rakyat* (MARA People's Trust Council)...During the same period, four Religious National Secondary Schools were upgraded to Integrated Fully Residential Schools offering three streams; Pure Science, Religious Pure Science, and Technical Science. Currently, there are 69 Science Secondary Schools, 51 MARA Junior Science Colleges and 12 Religious National Secondary Schools. (p. 8)

After completing the UPSR examination at the end of primary school, I went on to attend one of the science secondary schools mentioned above, studying in the pure science stream. As such, like the majority of Malaysians in the public schooling system I have encountered Malaysia as a developmental state via the 60:40 policy.

Beginning with the publication of the Malaysia Education Blueprint 2013-2025 (Preschool to Post-Secondary Education)—developed via international consultations with organisations

such as McKinsey & Company (Noh, 2014)—the nomenclature "STEM" was adopted by the MOE. Subsequently, in 2014 the MOE convened a panel of stakeholders to further crystallise STEM education for the Malaysian context (Mohd Shahali et al., 2017). Based on this exercise, STEM education in Malaysia has been delineated along three dimensions, which are STEM fields, STEM stream and STEM approach. STEM fields acknowledge the various traditional and specialised disciplines or subjects in secondary and tertiary education, STEM stream is associated with the 60:40 policy and STEM approach is aligned with the rollout of the new secondary school curriculum (Mohd Shahali et al., 2017). The STEM stream is closely associated with the realisation of the 60:40 policy. I argue that this policy is related to the science for development model, which is a key area of inquiry for this study. Therefore, I explore such connections in more depth as part of the findings in Chapter 5. For now, I return to elaborating the typical path of secondary education in Malaysia.

At the end of secondary education (typically 17 year-olds), Malaysian students sit for the *Sijil Pelajaran Malaysia* (SPM, Malaysian Certificate of Education) examination. After completing this examination, students may proceed to post-secondary education and tertiary education. As shown in Figure 2, post-secondary education in Malaysia includes academic pathways that serve as pre-university education, as well as further vocational and skills training. The academic pathways include enrolment in Form 6 (offered in mainstream secondary schools, or at dedicated Form 6 institutions) and matriculation institutions (Ministry of Education Malaysia, 2015). Students progressing to university from Form 6—following the *Sijil Tinggi Pelajaran Malaysia* (STPM, Malaysian Higher Certificate of Education)—or matriculation institutions may then choose to enrol for an undergraduate degree at university. Additionally, some universities also offer their own specialised foundation and diploma programmes

(Ministry of Education Malaysia, 2015). Therefore, students who wish to enrol in foundation and diploma programmes apply to the relevant universities based on performance in their SPM examination at the end of secondary school.

Parts of tertiary education in Malaysia (including polytechnics, community colleges and universities) are under the purview of the Ministry of Higher Education (MOHE), which was first established in 2004 (Chang et al., 2018). For the later part of his career until his retirement, my father served as a senior-ranked officer in the MOHE. However, MOHE has since undergone oscillating instances of merger with, and separation from, the MOE depending on the government of the day (Chang et al., 2018). Tertiary education provision in Malaysia is offered through both public and private universities. In recent history, cumulative "enrolment in public universities, polytechnics, community colleges and private HLIs [Higher Learning Institutions] increased by 70% from 2004 to 2014 to reach 1.2 million students" (Ministry of Education Malaysia, 2015, p. B-7). Overall, the gross tertiary enrolment in Malaysia stands at 43 per cent, still lower than the 58 per cent aggregate for upper middle-income countries as categorised by the World Bank (2021b). In keeping with the country's aspiration to become a high-income nation, the higher education sector is therefore tasked with producing high-skilled workers for the labour market, spearheading research and innovation for the knowledge economy as well as attracting the enrolment of international students (Abd. Aziz & Abdullah, 2014; Chang et al., 2018).

The significant role of the MOE at all levels of education in Malaysia points to another dimension of the developmental state as previously highlighted in Section 3.2. Observing the historical development of education in Malaysia, Abd Rashid (2002) highlights the influence of human capital theory among policymakers, whereby "secondary and tertiary education

have been expanded to improve manpower training. The reform of curricula, particularly in fostering technical and scientific skills has been a part of the whole approach" (p. 104). As shown in this section, education is driven by the MOE as a significant lever of national (economic) development. To achieve the goal of the developmental state, the MOE funnels and organises students into various pathways and creates the 60:40 policy coupled with specialised schools focusing on science and technology. The MOE has subsequently expanded the higher education sector over time against the backdrop of the knowledge economy.

3.5 Summary of Malaysian Context

This chapter provided a snapshot of Malaysia, the site for this study. Through presentation of the country's history, geography, demography and various characteristics, I sought to provide an entryway to the reader about this country in South East Asia as the main site for this study. Given the centralised approach taken by the government to effect national development by (re)structuring the economy, Malaysia can be characterised as a developmental state. I provide here some examples of rural development and modernisation initiatives to suggest the state's reach, instruments and priorities for national development. Subsequently, the description of Malaysia's centralised education system and pathways also point to its characteristic as a developmental state, one that deploys an explicit focus on science and STEM education. I therefore render Malaysia as fertile ground to study the translation of science and STEM education in relation to development, as well as rural young people's response through their aspirations.

Throughout this chapter I have also weaved in various dimensions that point to elements of my positionality, to suggest how this study is reflective of my biography and embodied knowledge as both object and subject of national development in Malaysia. Building on this contextual knowledge, I elaborate on the research questions and other methodological elements of this study in the next chapter.

CHAPTER 4: Research Methodology

4.1 Introduction

This chapter presents the methodology adopted for this study. First, I articulate the research questions and justify them accordingly. Following this, the research design based on the CCS approach is outlined as a strategy for addressing the research questions. What follows is a section on researcher positionality. The multiple qualitative methods embedded within the research design are then described; these include semi-structured interview, participant observations, participatory methods as well as collection of documents and artefacts. Next, I present the data collection procedure that covers the research sites, selection of participants and the data collection timeline, which included a period of disruption associated with the COVID-19 pandemic. Following this, the analytical procedure is presented, where I utilised reflexive thematic analysis. I then reflect on the associated ethical considerations. Finally, a summary of the methodology is included, as well as the approach for presenting the findings in Chapters 5, 6 and 7.

4.2 Research Questions

In this study, I aim to explore the idea of development in Malaysia through young people's aspirations from a particular location in the luar bandar, as they encounter STEM education—the state's intermediary for national development. I adopt the relational approach in formulating the research question. By proposing the relational approach for research at the intersection of youth studies and development studies, Huijsman (2016) highlights that "it is about tying together different things, actors, dimensions, dynamics, or

forces. It emphasises relationships, networks, friction, interaction, negotiation, the everyday and power" (pp. 3-4). Therefore, taking into account this approach, the literature review and the Malaysian context presented in the previous chapters, my MRQ is "How do young people in the Malaysian luar bandar describe and enact their aspirations for development in relation to STEM education and their day-to-day experiences?" This MRQ is further specified as three sub-questions, which I describe below.

The first sub-question attempts to situate young people's aspirations for development in relation to the science for development model elaborated in Chapter 2. Essentially, this model highlights how national development hinges on science education that produces scientific labour force (Drori, 1998). Here, I am interested to trace the manner in which this model is indigenised in Malaysia, and translated into STEM education that young people encounter at school in the luar bandar. This model sets the scene for how I "meet" the young people in this study to learn about their aspirations for development. This is to say; the science for development model determines how the young people are tracked into specific classes in school by a particular policy related to STEM education. Thus, the first sub-question (RQ1) is:

> RQ1: How does the science for development model translate in the Malaysian context and what are young people's related aspirations for development in the luar bandar?

Attending to this question requires an exploration and description of how the science for development model translates in the Malaysian context. Here, the perspectives of other actors such as policymakers and teachers, as well as discourse captured in documents and artefacts are pertinent to establish the rich contextual backdrop. Hence, although this

question seeks to highlight young people's associated aspirations for development, the preceding contextual work calls for a research design that enables sourcing of data beyond the young people. With the characteristics of the science for development model elucidated and translated into STEM education, young people's aspirations for development in the luar bandar can be solicited and situated accordingly. Thus the mis/alignment of such aspirations with the national development agenda can be identified. The findings associated with RQ1 are presented in Chapter 5.

The second sub-question (RQ2) shifts the focus of young people's aspirations for development towards the particularity of a place in the luar bandar, and their day-to-day experiences within it. Having established their position in education vis-à-vis the science for development model, I then attend to another dimension of young people's positioning: day-to-day life in the luar bandar community surrounding the school. The line of inquiry is:

> RQ2: How does the national development discourse translate to the luar bandar and what are young people's related aspirations for development based on their day-to-day experiences?

Here, I am interested to explore how young people's aspirations for development relate specifically to their day-to-day experiences living in a particular rural community. Extending the interaction between a specific place and national aspirations from the previous question, here I focus specifically on the notion of the luar bandar—how this is perceived in national discourses related to development compared to how it is lived by young people themselves in their particular community. This follows Huijsman's (2016) argument that a study of development should be "people-centred and empirically rooted in the everyday. This means that local lives, structures, and processes are taken as the starting point" (p. 18). To enable

comparative work, I interweave young people's voices with the perspectives of experts, policymakers and teachers, as well as discourses in relevant documents. Thus, RQ2 attends to aspirations for development from *outside* the city, in response to an "urban-centric vision of human development, progress, and the good life that positions the city as the natural final destination of modernity" (Corbett, 2016, p. 273). Chapter 6 presents the findings for RQ2.

Subsequently, the third sub-question (RQ3) considers the intersection of elements from RQ1 and RQ2 in relation to the concept of capacity to aspire that was elaborated in Chapter 2. If the capacity to aspire helps young people to navigate their lives, and is one that requires practice and exercise to be strengthened (Appadurai, 2004), then I pay attention to education in this spirit. I ask:

> RQ3: How can young people enact their aspirations for development in relation to STEM education and their day-to-day lives in the luar bandar?

Having traced rural young people's aspirations for development in the preceding questions, RQ3 is specifically informed by Amartya Sen's (1999) vision of development tied to freedom, where he argues that "people have to be seen, in this perspective, as *being actively involved—given the opportunity—in shaping their own destiny* [emphasis added], and not just as passive recipients of the fruits of cunning development programs" (p. 53). Thus, through a participatory mode of research, I present a project on place-based informal STEM education, complemented by reflections of young people, teachers and experts on education in the luar bandar. How is the capacity to aspire activated when young people are given the opportunity to actively partake in a mode of education related to development in their immediate surroundings? Young people's aspirations for development captured through the preceding questions can thus be grounded in relation to their active involvement in one

participatory project in school. The approach to this participatory project is further elaborated in Section 4.6.3 and the findings of RQ3 are presented in Chapter 7.

Together, these three sub-questions attend to the aim and MRQ for this study. By focusing on questions related to young people's aspirations for development, as well as their enactment of such aspirations, alternative perspectives on development from the luar bandar can be brought to light. In the next section, I elaborate on the research design that will enable me to address these research questions.

4.3 Research Design: Comparative Case Study (CCS)

This study is primarily concerned with young people's aspirations for development in the Malaysian luar bandar. However, in order to contextualise these aspirations in relation to the broader social dimensions that young people navigate—such as STEM education and their day-to-day experiences—I trace aspirations for development as the phenomenon of interest across sites (from the metropole to the periphery) and scales (national to local). To do this, I adopt a CCS design in Malaysia. Within CIE, this design conceived by Bartlett & Vavrus (2017) involves "comparison that considers similarities, differences, and possible linkages across sites, across hierarchies of power/levels, and across time" (p. 17).

Building on the discussion of context in CIE presented in Chapter 3 (Section 3.1), I consider context as not limited in a static way to a single place or neatly bounded as in a traditional case study design that is interested in isolating the unit of analysis (Bartlett & Vavrus, 2017). Instead, I echo the authors' position that the context cannot be shielded from and "unaffected by history and politics; any specific location is influenced by economic, political,

and social processes well beyond its physical and temporal boundaries" (Bartlett & Vavrus, 2017, p. 12). Within a CCS design, the selection of a principal site anchors the inquiry, enabling attention to the manner in which broader social and historical forces and inter/national discourses affect the site of study (Vavrus & Bartlett, 2006). I elaborate more on the secondary school and surrounding community selected as the principal site in Section 4.5. In addition to the perspectives of young people, attention to context therefore includes the voices of actors both within the principal site (teachers) and outside of it (experts and policymakers) as well as discourses gleaned from relevant documents.

Barlett & Vavrus (2017) also emphasise the vertical attention to the micro, meso, and macro levels in researching how policy is formed and subsequently appropriated. In relation to RQ1 and RQ2, the micro level represents young people's negotiation of STEM education and day-to-day experiences at the interpersonal level among peers, family members and teachers, while the meso level represents teachers' implementation of education policy as the state's agents of development (Jakimow, 2015). Meanwhile, the macro level captures the nation-state discourse and policies related to STEM education and development in the luar bandar accessible through documents as well as the views of experts and policymakers. These levels are taken as heuristics to consider how young people's aspirations for development are negotiated with teachers and family members, and extending further outward, policy makers and experts. However, whilst tracing aspirations for development across these levels, I do not consider them to be discrete and thus do not organise my analysis along such levels. Instead, the relational nature of aspirations (Appadurai, 2004) direct me to the interweaving of young people's views with that of other various actors and discourses when they are considered vertically across these levels.

An attention to this vertical plane is aligned with the CCS design that enables the tracing and shadowing of phenomenon of interest across three axes: vertical, horizontal and transversal (Bartlett & Vavrus, 2017). However, within the scope of this DPhil timeframe, I am unable to attend to the three axes to the same degree of depth. Therefore, in the course of analysis, a focus on the vertical axis as described above is supplemented by secondary consideration of the horizontal and transversal axes. The horizontal axis in this research design recognises the various perspectives that each individual young person brings in relation to aspirations for development, though I do not consider each of them as distinct "cases". Working horizontally across the empirical data associated with the participating young people, their aspirations for development were aggregated and constructed into relevant themes, paying attention to coherence and contradiction. Meanwhile, though this is not a historical study, I also consider to a certain extent the changing nature of discourses related to the science for development model in Malaysia, as well as the day-to-day realities of young people's lives in the principal site in the luar bandar. In Chapter 8 (Section 8.4), I discuss the limitations associated with this choice of emphasizing the vertical over horizontal and transversal axes, in light of the overall findings and contributions of this study.

The adoption of a postcolonial critique of development elaborated in Chapter 2 also fits within the CCS design that pays attention to "*processes* of sense-making as they develop over time, in distinct settings, in relation to systems of power and inequality" (Bartlett & Vavrus, 2017, p. 10). Here, I utilise postcolonial theory as part of the design by foregrounding the voices of rural young people at the grassroots that are often sidelined in the development discourse, as they are considered objects to be worked over by development. The use of postcolonial theory here builds on my existing interest with colleagues on the utility of this

lens in CIE (Anuar et al., 2021). By utilising postcolonial theory, I also consider how young people's aspirations for development in the luar bandar can be framed by notions of mimicry, hybridity and ambivalence in relation to the state's dominant development discourse emanating from the bandar (Kapoor, 2008; M. P. Kumar, 2011; McEwan, 2019). Thus, I consider the luar/bandar[8] as a site for the negotiation and contestation of the interplay of metropole (bandar)-periphery (luar bandar) in relation to questions of development. Nevertheless, my adoption of the postcolonial lens in this study also accounts for "non-discursive", material concerns that affect young people's work of aspiring, thus taking the middle-way approach to utilising this theory (Crossley & Tikly, 2004; Tikly, 1999). Sustaining these two dimensions of the postcolonial analysis enables me to portray a complex, nuanced narrative of young people's aspirations, without resorting to purely romanticised or deficit accounts.

In foregrounding young people's perspectives, I also adopt a participatory approach in the design, which includes photovoice and graphic elicitation methods for RQ1 and RQ2, as well as a participatory project on informal STEM education in relation to RQ3. Specifically with rural actors, this participatory spirit is in line with communitarian approaches to research that accounts for their embodied experience in a particular place (Farrugia et al., 2015; Rodriguez Castro, 2018). I elaborate more on these methods in Section 4.6.3. The motivation to fuse a participatory approach with a postcolonial critique of development is associated with my reflections on specific ontological and epistemic positions for this study. In researching aspirations for development among young people in the luar bandar, I perceive the realities associated with the postcolonial manifestations of development as

[8] There are occasions in this thesis where I use this "luar/bandar" configuration as a discursive marker for how the luar bandar as a construct gains its meaning always as other than, and in relation to, the bandar.

being materially conditioned by various historical, political, cultural, social and economic forces, whilst there is room for such realities to be (re)made through participatory and emancipatory action (Lincoln et al., 2018). In this study, an attention to material conditions that circumscribe young people's aspirations and possibilities for realising them means that I take seriously the real effects of discourses advanced by the developmental state on young people's day to day lives in the luar bandar. Thus, I echo Tinsley's (2021) interest in illuminating "the power of colonial discourses by foregrounding the relationship between discourse and "real" social structures" (p. 10). As part of a postcolonial analysis, I take on the ontological view that such material conditions in the luar bandar within which young people do the work of aspiring are "real" insofar as they are structured and conditioned by hegemonic discourses espoused by the Malaysian developmental state (Lincoln et al., 2018; Tinsley, 2021).

Overall, the making of knowledge via this study involves attention to power, the associated construction of categories in Bahasa Melayu and material inequality while embracing a co-creation model with young people. I couple this approach with recognition of subjectivity and reflexivity regarding how my own values bear upon the research process. In the next section, I delve into my positionality and elaborate on my ethnographic sensibility, before presenting the research sites and methods associated with this research design.

4.4 Researcher Positionality

The cultural critic Stuart Hall argues that "[w]e all write and speak from a particular place and time, from a history and a culture which is specific. What we say is always 'in context', *positioned*." (Hall, 1990, p. 222). In this section, I stretch this observation to outline my

positionality as a researcher by also attending to the research steps that precede writing and speaking. Thus, the position of my own identity and subjectivity—as the instrument of this study—shape the development of research questions, methods, data collection and subsequent analytical procedures. Various elements of my identity make me both an insider and outsider in relation to the field site, the participants and the substantive research topic. I am a native researcher (Jacobs-Huey, 2002) in that I am a Malaysian researching Malaysia. My personal and familial biographies are intimately connected to this study, as explicated in Chapter 3. Therefore, I have a high degree of familiarity with existing discourses associated with STEM education and development in Malaysia. Possessing intimate knowledge of the research terrain in this way greatly facilitated access to the research site as well as the data collection process (Vavrus, 2021), which I will elaborate in subsequent sections.

I am a Malay Muslim categorised as part of the Bumiputera group, and I speak Bahasa Melayu as my native language, similar to the rural young people and teachers in this study. However, I am not native to the region of the principal research site, and thus do not converse fluently in the local dialect, though I mostly understand it. In this way, coupled with my Western education as a DPhil researcher from the University of Oxford, I can be considered an outsider to the participants in the principal research site. Based on my understanding of regional notions of belonging in Malaysia, developing rapport, for example, would have been easier had I spoken the local dialect. This notion of distinct regional identity and citizenship in Malaysia has also been reported in the literature (Ostwald & Subhan, 2021; Sadiq, 2009).

However, in the context of interviewing elite experts and policymakers—most of whom were based in the capital city—my affiliation with the University of Oxford afforded me an elite insider status and counteracted the inherent power imbalance. Some elite informants made reference to my attachment to the University of Oxford in very favourable terms and were keen to support my work as a Malaysian representative at such an institution. I reflect on how this particular dimension of my positionality, as well as my identity as a Malay-Bumiputera, influenced research with elite experts and policymakers within a postcolonial context in greater detail elsewhere (Anuar, 2022). At the same time, being a Malaysian researcher based outside of the country also meant that I was treated as a "foreign" researcher by the federal government, thus requiring additional procedures in order to gain access to research in Malaysia. I provide more details of this requirement in Section 4.7.1.

Although my birthplace was a rural area in the state of Pahang in Malaysia, I was raised near the capital city of Kuala Lumpur and had a largely urban upbringing. Nevertheless, growing up, I experienced living in my mother's kampung during the long year-end school breaks every year. I personally remain connected to my mother's kampung and have professional experience with education projects in other parts of the Malaysian luar bandar, such as in the states of Terengganu, Sabah and Sarawak. The particular pathway related to STEM education pursued by the young people in this study is analogous to my own experience in secondary school, although I attended a science focused residential school (as mentioned in Chapter 3) instead of a daily public school. Overall, the motivation for this study—especially in relation to RQ3—is also informed by my previous professional experience and academic research in informal STEM education in Malaysia (Anuar & Chankseliani, 2021).

My hybrid, shifting positionality as both an insider and outsider infused the ethnographic sensibility I bring to the research process. McGranahan (2014) observes that researching with such sensibility "is not static or fixed; instead, it is personal, transformational, contingent, and responsive to actually existing and often shifting conditions" (p. 24). Owing to my position as a native researcher in Malaysia, this project is coloured by the personal biography outlined above and in Chapter 3. I thus possess prior *lived* knowledge and various reference points—of local history and politics—to grasp the shifting terrain of the field as I am immersed in it. For instance, early in the fieldwork, the Minister of Education announced that the process of tracking students into various pathways (including STEM) in upper secondary school would be abolished. My informants revealed that nothing would in fact change in practice. There was heated public discourse as the new school year inched closer and I kept my ear to the ground.

In moments where I found myself as an outsider, the design choice of living in the principal site invited moments of surprise, disorientation, and possibility, transforming both the native researcher and the research methods. Because I loitered in the teachers lounge during the school day (though I was not actually a teacher, thus an outsider), a golden opportunity arose for me to coach the young people in an informal STEM education project as they prepared for an innovation competition. A participatory research project was thus born as a line of inquiry. My positionality reminds me of Tsing's (2012) observation that "relationships are encounters across difference, they have a quality of indeterminacy. Relationships are transformative, and one is not sure of the outcome" (p. 510). Given that I am an outsider embracing an ethnographic sensibility, the encounter described here and many more throughout the fieldwork transformed me as the researcher, and subsequently the design of

this study. I attend to this indeterminacy through the Malay notion of kebetulan in Section 4.7.2. The combination of critical and participatory research paradigms highlighted in the previous section also reflects my positionality. It points to my belief that grassroots perspectives of young people on development from the luar bandar are valuable insights to be foregrounded against the hegemonic discourses of the state, though I do not romanticise their perspectives. I also pay critical attention to the material conditions framing their aspirations. In the next section, I turn to elaborate on the selection of the research sites and participants that were also influenced and guided by my positionality.

4.5 Research Sites and Participants

This study is primarily focused in Peninsular Malaysia (see Figure 1). Data collection entailed periods spent at both metropole and peripheral sites. The metropole sites, from which national discourses and policies originate, are in and around the largest urban centre, Kuala Lumpur. This includes the federal administrative centre of Putrajaya. Subsequently, I moved out towards the east coast of the Peninsular, focusing on the state of Terengganu where the peripheral site is situated. In this state, 31.4 per cent of the population is categorised as luar bandar (the corresponding national average is 20.2 per cent) (Department of Statistics Malaysia, 2020). The state capital of Terengganu is Kuala Terengganu, where national discourses and federal policies are contextualised and administered. Within the state of Terengganu, the site (school and community) where I undertook prolonged engagement is situated in the interior district of Hulu Terengganu. The distance between the site in Hulu Terengganu and the state capital of Kuala Terengganu is up to one-hour drive, depending on various possible routes. Figure 3 depicts the map of the research sites in this study, with the geographical positions of the core and peripheral sites identified.

The Urban Metropole Sites: Experts and Policymakers

The selection of the metropole sites in the Malaysian capital region (Kuala Lumpur and Putrajaya) corresponds to the location of the majority of the experts and policymakers and their respective organisations associated with this study. In order to determine the participants in the metropole, I focused on a combination of non-probability purposive and snowball approach described by Tansey (2007). The initial list of elite interview participants was developed based on my familiarity as well as deep engagement with the local context, in relation to science and technology, STEM education and rural development (Goldstein, 2002). Here, elements of my positionality were activated to identify potential participants. As a Malaysian familiar with the context of this study given my personal identity as well as prior professional networks, I possessed an insider perspective on potential experts and policymakers to be included. I augmented this positional knowledge with desktop research, close attention to media coverage and scanning of influential policy documents.

Additionally, given the nature of federal and state policymaking in Malaysia as described in Chapter 3, I also relied on participants in the federal metropole sites to recommend corresponding experts at the state level in Kuala Terengganu to be included in the interview pool. One expert is an academic at the local state university, Universiti Malaysia Terengganu (UMT) whilst another is a senior officer at JPN, the State Education Department of Terengganu. In addition to their connection to the metropole, their approximate distance to the principal site also enables the state-level experts to provide rich perspectives from this "in-between" position that they occupy.

The Principal Site in the Peripheral Luar Bandar: Teachers and Young people

The selection of the principal site—one secondary school nested within a community in the district of Hulu Terengganu—was made following consultation with a gatekeeper who I identified through my previous professional network. This gatekeeper is the academic mentioned in the previous section who leads the STEM pre-university programme at UMT and associated outreach efforts with secondary schools in Terengganu. I selected one school in the district of Hulu Terengganu as the principal site, which I call Sekolah Luar Bandar. The school principal also agreed for me to undertake data collection there.

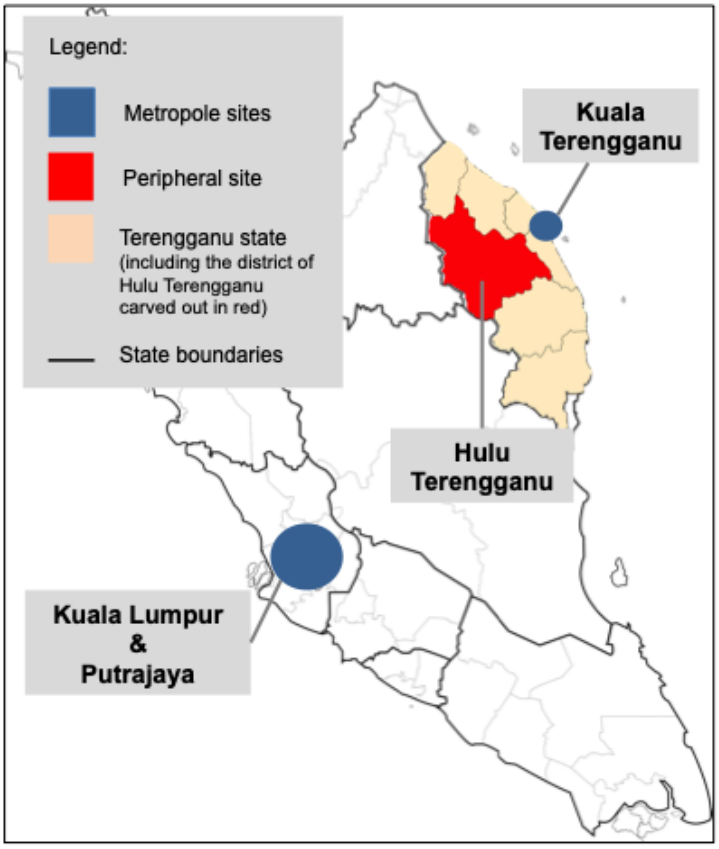

Figure 3: Map indicating the position of research sites in the metropole and periphery

Deciding on Sekolah Luar Bandar took into account the location of interest (relatively remote, interior) related to the definition of luar bandar in Chapter 1 (Section 1.3.5). Remoteness in Malaysia can be identified by population density, as well as a more contemporary measure such as internet penetration. Based on data from the mobile network analytics organisation Opensignal, Hulu Terengganu is one of the districts in Category 2 (10 to 50 people per square kilometre) with an average of 62.3 per cent 4G-connection availability (Khatri, 2019). Compared to other parts of Terengganu and wider Peninsular Malaysia, this is considered low[9]. Additionally, Hulu Terengganu is the only district in the state of Terengganu with a population density of less than 50 people per square kilometre, thus making it one of the 46 districts classified as an interior district in Malaysia (out of a total of 146 districts) (Ministry of Rural Development Malaysia, 2019).

Subsequently, the young people selected at Sekolah Luar Bandar were Form 4 (16-year olds) students tracked into the STEM stream at the start of the school year. Selecting the young people at this age group—the first year of upper secondary education—enabled me to solicit their views as they are being tracked into the STEM stream, and their associated aspirations for development. Concurrently, the participating teachers include the principal, deputy principal in charge of academic matters, teachers of STEM-related subjects for Form 4 as well as the guidance counsellor. Despite the benefit of prolonged and in-depth engagement, the decision to focus only on one school and a small number of young people is not without its limitations, which I address in Chapter 8 (Section 8.4). Additionally, the initial design included the family members of the young people as participants. However, due to

[9] Nonetheless, there areas which are considered much more rural and remote in Malaysia, such as in the states of Sabah and Sarawak in East Malaysia. For comparison, Opensignal's analysis indicated there are districts in these two states included in Category 1 (Up to 10 people per square kilometre) with an average of 44 per cent 4G-connection availability. No districts in Peninsular Malaysia are considered part of Category 1.

challenges associated with the COVID-19 pandemic, this was not possible within the fieldwork period. I discuss this and other associated challenges of data collection in the upcoming sections.

4.6 Research Methods

The use of qualitative methods here is congruent with an interest in "understanding how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences" (Merriam & Tisdell, 2016, p. 6). In line with a CCS design coupled with an ethnographic sensibility, this study relies on the combination of multiple qualitative methods to comprehensively trace aspirations for development as the phenomenon of interest. In this section, I present each of these methods in turn, linking them to the relevant participants and sub-research questions in the research design.

4.6.1 Semi-structured Interviews

Semi-structured interviews were utilised for all participants (experts and policymakers, teachers, and young people) spanning all domains of the research question (RQ1, RQ2 and RQ3). I make use of this method due to its potential to generate in-depth descriptions of "people's biographies, experiences, opinions, values, aspirations, attitudes and feelings" (May, 2011, p. 131). Interviews also provide room for participants to articulate the process of meaning making in their own words, via description of their experiences as well as reasoning for decisions and actions (Kvale & Brinkmann, 2015). Given my aim to trace aspirations for development, the use of semi-structured interview as a method lends itself to rich descriptions, with specific sets of interview schedules developed to solicit the

perspectives of different participants. Below, I describe the development of each of these interview schedules corresponding to experts and policymakers, young people and teachers respectively.

Experts and Policymakers

This study includes interviews with experts and policymakers in the realm of development, science and technology as well as STEM education. Given the stature of these participants in the public domain as well as their respective organisations, this dimension of the study entails research with elites. Precisely because it involves engagements with individuals who are embedded in webs of power, influence and social capital, interviews with elites present distinct challenges, such as potential resistance to the research topic or sidestepping of the interview questions (Harvey, 2011). In preparing the semi-structured interview schedule for this group of participants, I had to ensure that the framing of the questions demonstrated my awareness and understanding of related policies and contemporary discourses, so as to be taken seriously and seen as worthy of their time (Liu, 2018; Walford, 2012).

I developed the semi-structured interview schedule particularly focusing on the science for development model, STEM education in rural areas and alternative conceptions of development. The goal was to gain a macro-level description of "development", the logics behind associated policies and how—in their views as knowledgeable experts and technocrats—such policies will contribute to development. This will enable comparative work with young people's aspirations in the luar bandar, far away from where these discourses of development originate. The "policy as practice" approach by Levinson & Sutton (2001) emphasising the ways and locations in which policies are shaped and

subsequently appropriated as practice by multiple actors also informed the development of interview questions for this group of participants as well as other actors.

The interview questions were arranged under the following broad headings: Introduction on development, science for development, education and development, alternative development. Prior to the beginning of fieldwork, the semi-structured interview schedule was developed and piloted in English with three individuals involved in STEM education in Malaysia, and one individual with experience in development economics. The pilot took place in May to June of 2019. Following the pilot, a number of questions were rephrased for simplicity and to avoid leading statements, some questions were dropped while others added, and prompt cards were developed to guide the conversation. The schedule was also translated into Bahasa Melayu, where participants had the choice of either language depending on their preferences. The pre and post-pilot versions of the semi-structured interview schedules in English and Bahasa Melayu are included in Appendix A.

Young People

Interviews with young people is a means of foregrounding their perspectives on development, especially in a rural context where, as noted by the OECD (2018b), they often have limited opportunities to participate in shaping development dialogues directly affecting their lives. Thus interviews here take on an empowering potential where young people in the luar bandar—as a marginalised group in relation to development—have their views heard as sources of knowledge (Edwards & Holland, 2013). Prior to the fieldwork, the interview schedule was developed in Bahasa Melayu, to solicit young people's perspectives about development, their aspirations over time and the relationship between STEM

education and their aspirations. At this point the questions included reflections about their aspirations across their lifespan, the choice of STEM subjects and relationship with aspirations, and interaction with teachers and family members. As a result of ethnographic immersion in Sekolar Luar Bandar and informal interactions with the young people, the interview schedule was then refined. This refinement included questions on their experience being involved in the informal STEM participatory project, more specific questions tied to a graphic elicitation activity that was developed in the field (aspiration timeline, see Section 4.6.3), as well as in reference to Baillergeau & Duyvendak's (2019) micro-sociological framework on how aspirations develop and wither. The final interview schedule included the following themes: Introduction about development, aspirations for development, STEM education, culture and aspirations. This semi-structured interview schedule in Bahasa Melayu and English translation are included in Appendix B.

In the initial design of the study, I had planned for the interviews to be preceded by a photography activity. Following this, the photos would have been used as prompts for the semi-structured interviews. Once I was immersed in the field, practicality concerns associated with access to young people's time and the sequencing of research methods in relation to the COVID-19 pandemic disruptions necessitated a change in the design. Nonetheless, graphic elicitation was still included in interviews with young people, via an aspiration timeline activity that was conducted prior to the interviews. The plan to conduct two rounds of interviews with young people (before and after participatory activities together) was also abandoned due to practicalities associated with the pandemic. I address these design changes in greater depth in Section 4.7.1.

Teachers

Semi-structured interviews with teachers are useful to provide contextual details in two ways. First, teachers can provide a perspective on the manner in which the science for development model and associated education policy are interpreted and "enacted" as practice in interaction with young people in the school (Ball et al., 2011). Additionally, teachers can provide adult perspectives and perceptions of young people's day-to-day lives in a rural place (Çiftçi & Cin, 2018). Given their role in teaching and mentoring students that come before and after the young people who participated in this study, teachers are also able to provide a transversal view of young people's engagement with education over the years they have taught in the school. The interview schedule (in Bahasa Melayu) was developed in Sekolah Luar Bandar during ethnographic immersion, utilising insights gleaned from the previous interviews conducted with experts, policymakers and young people, informal conversations with teachers, as well as my own observations and reflections in the field. Presented below are some excerpts from my fieldnotes where I reflected on possible interview questions for teachers:

> It would be interesting to get the view of teachers on the "exchange value" of STEM subjects compared to other pathways. Potential question for teachers:
>
> - How long have you been teaching this subject?
> - If you had the freedom (in terms of exams and syllabus), how would you teach this subject differently?
> - Other than the textbook, can you show me some teaching materials that you use?
>
> (Fieldnotes, 20 January 2020)

> When did you first hear about the term "STEM", and what were your impressions about it? Has there been a change in the way you teach since STEM became popular? (Fieldnotes, 8 July 2020)

The final semi-structured interview schedule developed in Bahasa Melayu and English translation are included in Appendix C. This research choice departed from the initial plan where the interview schedule was to be developed together with the young people in a focus group, who would then act as co-researchers. However, this was not possible given school closure associated with the COVID-19 pandemic. I elaborate more on design challenges associated with this disruption in Section 4.7.1.

4.6.2 Participant Observation

Given that the research design is tied to tracing aspirations for development across sites and scales, coupled with an ethnographic sensibility, I consider the notion of observation both broadly and specifically. Initially, prior to prolonged engagement in Sekolah Luar Bandar, I observed discourses associated with science for development in the media and across public events in the urban metropole. Public events included STEM carnivals and forums that I attended in between interviewing experts and policymakers. Subsequently, observation in Sekolah Luar Bandar was focused on the day-to-day happenings in school related to STEM education among teachers and the young people, coupled with contextual details of the wider community that I lived in. I also observed various participatory activities with the young people that I will describe below, even as I was actively involved in such activities. Throughout the fieldwork in Malaysia, both inside and outside Sekolah Luar Bandar, I maintained detailed fieldnotes, noting their importance as a means of providing "the primal, even foundational moments of ethnographic representation" (Emerson et al., 2001, p. 352).

In addition to observations, my fieldnotes also included comments, questions and reflections related to such observations (Walford, 2009), as well as methodological choices and

preliminary analytical thoughts. For example, below is one of my methodological reflections in the field:

> As method, I pay attention/try to notice/be attuned to all 'signals' that support the state's discursive regime of science for development…what I read in the newspaper, what I listen to on the radio, what I see on billboards, even down to what is said at a seemingly unrelated literary conference. In essence, I gather data in the contextual site by engaging all my senses as part of my own lived experience in the day-to-day reality of this discursive regime. (Fieldnotes, 30 November 2019)

To augment written fieldnotes, I also captured photographs in the field to aid with memory and description (O'Reilly, 2012). The photographs are associated with representations of STEM education, development and the environment as well as activities in Sekolah Luar Bandar. The corpus of fieldnotes included the combination of the handwritten variety in notebooks, as well as digital versions using the Evernote software. While the former is typically in narrative form resulting from face-to-face observations and encounters, the latter enables the linking and attachment of materials and resources collected in the online space, such as news articles, videos, reports as well as photographs I have taken in the field. The granular quality of fieldnotes provided me with the backdrop to situate and enliven the data collected using other methods for all elements of the research questions. My fieldnotes were written in English, peppered with words and phrases in Bahasa Melayu related to the study where applicable.

4.6.3 Participatory Methods

Consistent with the postcolonial critique of development highlighted in the research design, I employed a number of participatory methods in order to foreground and encourage the active involvement of young people in this study as co-producers of knowledge. Data from

these participatory methods were utilised to address all domains of the research questions (RQ1, RQ2 and RQ3). I present these methods in turn below.

Informal STEM Education Project

The serendipitous manner in which this project came about was previously mentioned vis-à-vis my positionality in Section 4.4. Prior to my fieldwork in the principle site, as I was thinking of a potential participatory element for this study, I recorded the following as part of my fieldnotes:

> I think I will delay the proposal on the community development project until after I have been in the school and conducted floating observation. There might be a way to integrate this participatory component into existing activities, without having to come up with something new. I will only know this when I've spent time in the school and talking to teachers. (Fieldnotes, 6 November 2019)

The informal STEM education project was conceived in the vein of YPAR. This research method focuses specifically on the empowerment of young people in knowledge production, while addressing social issues intimately connected with their lives (Cammarotta & Fine, 2008; Mirra et al., 2016). Within the context of rural education, YPAR has been used to research with young people on alternative modes of schooling, challenges in access to higher education and improving the school climate (Baggett & Andrzejewski, 2017; Mathikithel & Wood, 2019; Means et al., 2020). At Sekolah Luar Bandar, I utilised the opportunity for the young people to participate in a STEM innovation competition to conceive this project, coupled with the emphasis on exercise and repetition as part of the capacity to aspire (Appadurai, 2004). The conception, implementation and reflection on this project forms the basis for addressing RQ3, and as such will be elaborated in Chapter 7. I also captured

photographs of young people and teachers engaging in this project, carried out informal conversations with them, and recorded extensive fieldnotes throughout the process.

Aspiration Timeline and Booklet

The use of creative approaches in studies related to imagination and aspirations also allows greater depth of analysis beyond conventional verbal and textual methods (Gannon & Naidoo, 2019; Zipin et al., 2015). As part of soliciting views about young people's aspirations for RQ1 and RQ2, I engaged them in two creative and reflective pen-and-paper activities. The first involved drawing a timeline of their past, present and future associated with their aspirations. According to Bagnoli (2009), this activity allows "young people to reflect on the different temporal dimensions of past, present, and future in their lives…[and] to link the individual dimension of lives with the macro level of collective biographies and histories" (p. 560). I also intended to use this activity as a means of building rapport, and providing the young people a tangible reference and source of elicitation during the subsequent semi-structured interview. The timeline included some personal and academic details, as well as their career aspirations and associated locations at key points in their past (12 years old: at the end of primary school), present (16 years old) and future (18 years old: after secondary school, 26 years old: 10 years from the present). In short, in this activity concerned with the temporal dimension of aspirations, I sought to ask: "Where have you been, where are you now and where will you go?" This timeline activity was meant to encourage the young people to actively reflect on their histories, the present moment, and project into short and long-range futures, tied to the places associated with such aspirations.

The second activity, the aspiration booklet, entailed creation of a mini booklet using an origami folding technique with an A4 paper, followed by young people sketching various dimensions of their aspirations within it. The various dimensions of aspirations were inspired by an activity called *Dream Big Dreams* as part of a guidebook used by the school's guidance counsellor, which she had shared with me in our informal conversations. This guidebook titled *My Future Map* was developed by a Malaysian guidance counsellor and used in schools in Malaysia by other fellow counsellors as a reference for activities with students (Md. Yusoff, 2018). I adjusted this activity to suit the context of the study. After making the booklet together, students wrote their name on the front cover after the phrase "*Masa Depan*…" ("The Future of…"). There were six pages in the booklet for the participating young people to sketch the various dimensions of their aspirations: (1) Academic performance in the SPM examination at the end of secondary school (2) Higher education (3) Career (4) Place they would like to visit (5) Material possessions (6) Any other dimension.

Figure 4 shows my initial sketch of this booklet with the six aforementioned dimensions of aspirations written in Bahasa Melayu (Fieldnotes, 22 July 2020). The concept of a booklet was to signify an "open book" in which young people would sketch their possible futures, thus representing a window into their aspirations. In this way, the use of a visual method lends richness to the description of aspirations as well as assist with expressing ideas that might be abstract—heretofore sourced via verbal and textual approaches (A. Clark, 2010; Pain, 2012).

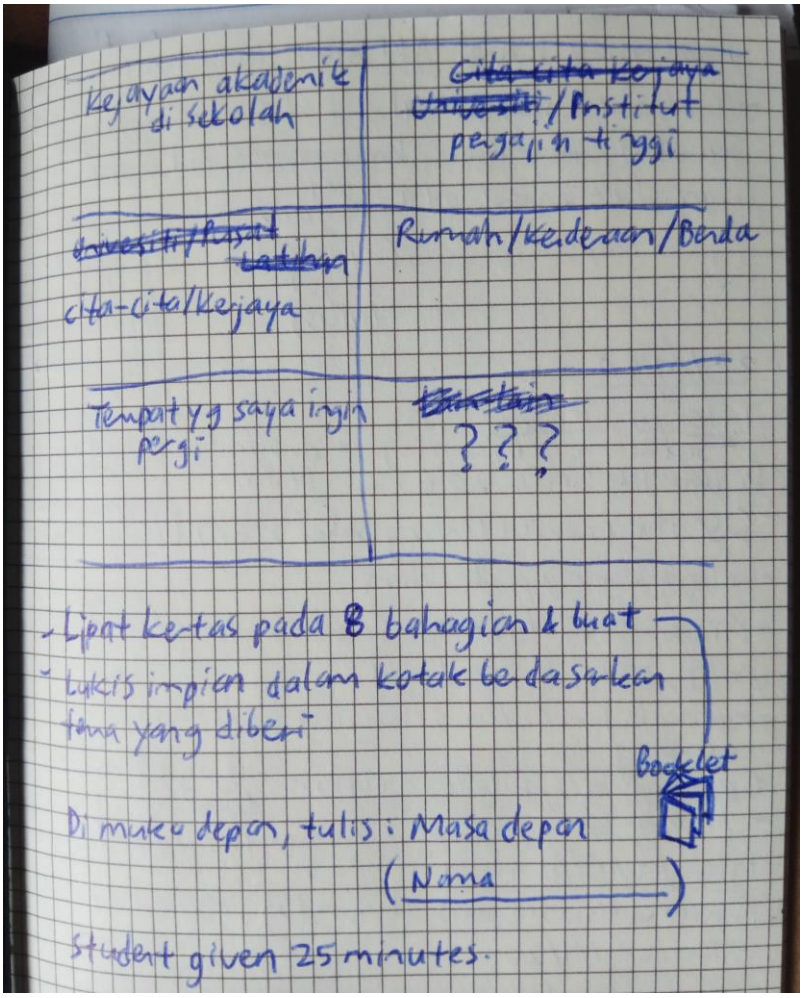

Figure 4: Initial sketch of aspiration booklet activity in the fieldnotes. The six dimensions of aspirations are outlined at the top

Photovoice

Photovoice is a visual method to "document and honor knowledge(s), voices, and experiences of community members about particular issues affecting their lives (Call-Cummings et al., 2019, p. 399). The use of photovoice with rural young people is a powerful method for illuminating their sense of place as well as the associated emotional attachments (N. G. Power et al., 2014). In their review on the use of photovoice in relation to sustainability issues, Derr & Simons (2020) associate photovoice with a pedagogic role of

place; uncovering "what *physical place* can teach us about larger issues, such as sustainability of building design, inequities, identity, or culture" (p. 364). I was interested in gaining a deeper understanding of the day-to-day lives of young people beyond the school environment and how that might relate to their aspirations for development. Photovoice thus facilitated access to elements of young people's experience which I otherwise would not be able to glean (Pain, 2012), exacerbated by challenges associated with the COVID-19 pandemic during fieldwork. The use of photovoice was primarily to address RQ2's focus on young people's day-to-day experiences in a particular place in the luar bandar, though it also complemented RQ1.



Figure 5: Photo taken by Ana of the path in her kampung where she goes jogging in the afternoons

I provided a prompt to the young people and also encouraged them to include a short description for each photo that they captured using their own mobile phones: "Take a photo of your day-to-day experience. This includes place, activities, objects or people that are meaningful in your life." Alongside the prompt, I reminded the young people to request permission from people they would like to include in the photographs intended for sharing with me (Barker & Smith, 2012). Where there could potentially be identifiable personal details in the photographs, I employed an image management technique (cropping or colour adjustments) to protect anonymity (S. R. Jordan, 2014). Figure 5 shows an example of a photo taken by Ana, one of the young people in this study as part of the photovoice activity. Here she indicated a path in her kampung where she goes jogging in the afternoons.

4.6.4 Documents and Artefacts

I make use of documents and artefacts as a research method that complements interviews, observations and participatory methods. Analysis of documents and artefacts contribute to building the macro context of the field (Fife, 2005), while also providing additional perspectives to the data collected by other aforementioned methods. This latter dimension also enables the process of triangulation; findings can be compared and corroborated across various research methods (Bowen, 2009). To build the macro context of the field, documents and artefacts spanned relevant policy documents, circulars, brochures, posters, infographics and media articles associated with the science for development model and development in the luar bandar. By assembling an archive of sorts, the temporal, discursive portrait of the context illuminates the "public culture" associated with aspirations for development (Khoja-Moolji, 2018). Information gathered in this archive also helped to

refine other research methods, open up new lines of questioning, and provide complementary (or competing) perspectives and discourses.

Meanwhile, at Sekolah Luar Bandar, STEM-related textbooks were also included in the analysis. Additionally, artefacts produced by the young people during the participatory activities described above were also collected. These include their aspiration timelines, as well as images from their aspiration booklets[10]. This decision is aligned with P. Woods' (1986) assertion that the educational ethnographer is interested in students' "creative exercises [that] will take us into secret places…and that cannot always be readily 'observed' or obtained by interview" (p. 101).

Table 1: Matrix that maps the methods and participants onto the relevant research questions

Research Methods/Questions		RQ1	RQ2	RQ3
Semi-structured interview		X	X	X
Participant observation		X	X	X
Participatory methods	Informal STEM education project			X
	Aspiration timeline & booklet	X	X	
	Photovoice	X	X	
Documents and artefacts		X	X	X

Note: "X" indicates applicable

To summarise, Table 1 presents the matrix of methods in relation to the relevant research questions they are meant to address. Semi-structured interviews involved all participant

[10] I decided that the young people would retain the aspiration booklets they produced as a keepsake to potentially reflect on their sketches in the future.

groups while participant observations mainly focused on teachers and young people. Meanwhile, participatory methods were utilised with the young people. More details about the documents and artefacts are included in Section 4.7.1 and the associated appendix.

4.7 Data Collection

In this section, I present the data collection procedure associated with the research design and methods elaborated above. These procedures are situated and explained in line with the timeline of data collection, including disruptions associated with the COVID-19 pandemic. Additionally, I make special mention of the Malay concept of kebetulan as well as other considerations of rigour infusing the data collection process.

4.7.1 Data Collection Timeline and Procedure

Before initiating fieldwork, approval from the Malaysian government was required due to my status as a researcher from a foreign institution. Approval for the research pass was granted on 29 August 2019 per the letter attached in Appendix D. However, this approval was subject to my agreement on a condition set by the MOE: "Observations and video recordings of student teaching and learning activities are not allowed". This stipulation thus precluded my ability to observe formal classroom instruction for STEM-related subjects, which I had intended in the initial design. I revisit this element of data collection later. This study had also received ethical approval from the Central University Research Ethics Committee (CUREC) on 30 April 2019. However, slight changes in the research design due to challenges associated with the COVID-19 pandemic necessitated additional CUREC approval whilst in the field—this was granted on 26 May 2020. The initial and updated

CUREC approval coupled with the itemisation of ethical considerations, as well as approval for the risk assessment are included in Appendix E.

The principle of informed consent was applied throughout the data collection process. This meant that participants were provided with all the required information about the study in order to make the informed and voluntary decision to participate, with the consent form issued accordingly for documentation (Cohen et al., 2018). All participants were anonymised and assigned pseudonyms, with the exception of experts and policymakers (unless they requested anonymity). The decision not to anonymise elite interviewees by default was made to acknowledge the power—and therefore responsibility—they held to represent positions of authority and the associated perspectives disclosed in the research process (Gaztambide-Fernández, 2015; Walford, 2012). Fieldwork in Peninsular Malaysia took place over 11 months between October 2019 and August 2020, divided into two phases largely based on location and focus of the study.

First Phase (October to December 2019)

The first phase of the study—between October 2019 and December 2019—mainly took place in the urban metropole (Kuala Lumpur and Putrajaya) as well as Kuala Terengganu. This entailed semi-structured interviews with experts and policymakers as well as visits to public events related to STEM education. For the interviews with experts and policymakers, I issued invitations via email that included a participant information sheet in English or Bahasa Melayu. Out of the ten invitations issued, six yielded favourable responses that led to interviews. The details of these elite participants are included in Table 2. Prior to the interviews, each participant signed a form indicating their consent to participate. Appendix F

shows the invitation email, participant information sheet and the consent form associated with this stage. The interviews were held either in Bahasa Melayu or English, depending on each participant's preference. There were often instances when both languages were used in the same interview. With the exception of Dr. Laili Che Rose who I interviewed later in the second phase to match her availability, all other interviews were conducted in this first phase. Most of the interviewees in Table 2 know one another in some capacity, as they operated within the same or similar domains.

Table 2: Details of experts and policymakers interviewed

No.	Name	Gender	Position	Affiliation
1.	Dr. Madeline Berma	Female	Fellow & Retired Professor of Development Economics	Academy of Sciences Malaysia (ASM)
2.	Hazami Habib	Female	Chief Executive Officer	Academy of Sciences Malaysia (ASM)
3.	Professor Noraini Idris	Female	Chairperson	National STEM Movement
4.	Dr. Ihsan Ismail	Male	Head	National STEM Centre, MOE
5.	Dr. Laili Che Rose	Female	Director	STEM Foundation Centre, Universiti Malaysia Terengganu (UMT)
6.	Mr. Tengku (pseudonym)	Male	Senior Officer	Terengganu State Education Department (JPN), MOE

Figure 6 presents the interconnections of these various actors relative to Sekolah Luar Bandar, which is a public school under the MOE. It is one of the adopted schools for the STEM outreach programme organised by Dr. Laili Che Rose at UMT. Dr. Laili Che Rose is

also part of the National STEM Movement alongside Professor Noraini Idris. Meanwhile, Mr. Tengku is the state level officer for the MOE, whilst Dr. Ihsan Ismail is part of the same organisation at the federal level. Dr. Madeline Berma was appointed as the Deputy Chair for the National Education Policy Review Committee by the MOE. She is also affiliated with the same organisation as Hazami Habib. These examples demonstrate that there is a network of experts and policymakers in the STEM education ecosystem in Malaysia that span multiple organisations and scales.

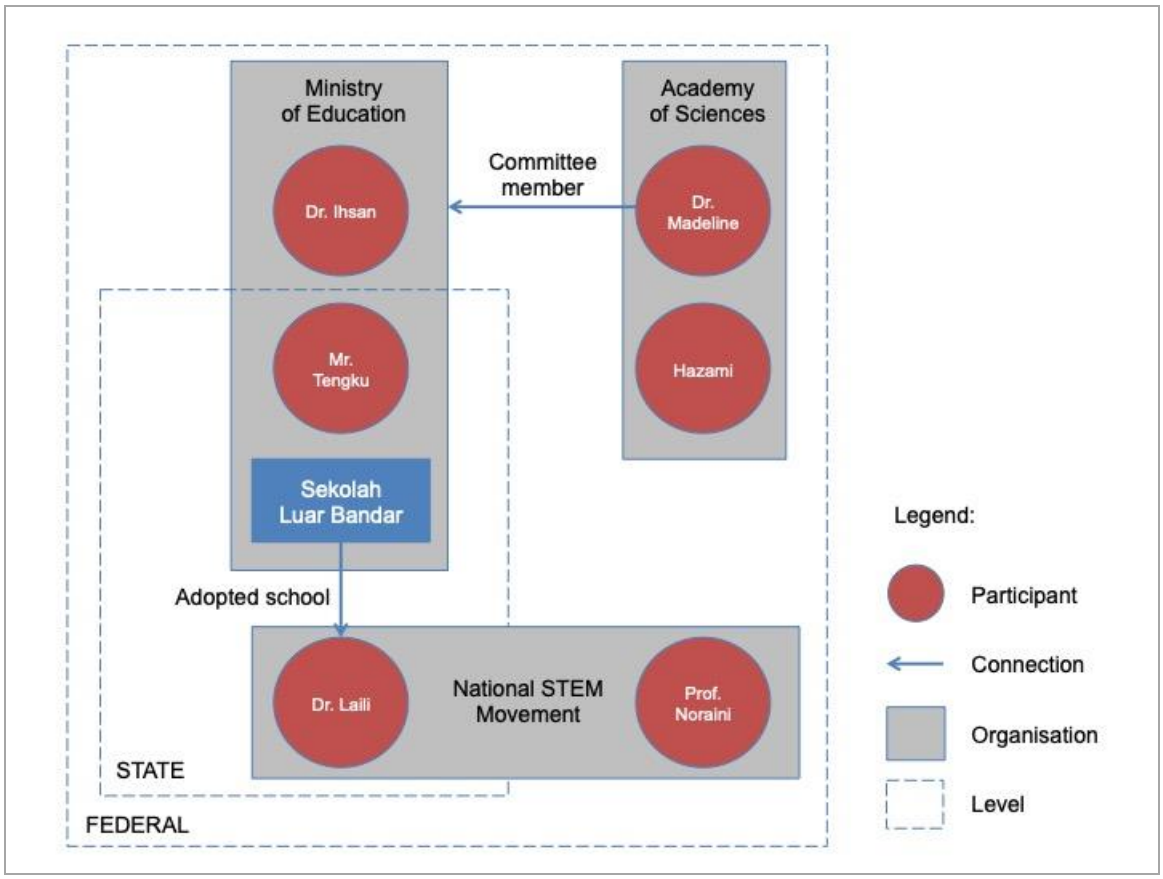

Figure 6: Experts and policymakers interviewed in this study and the various interconnections

The interviews lasted between 38 to 97 minutes and were audio-recorded. Only Mr. Tengku requested that I use a pseudonym. Following each interview, I recorded my initial

impressions in my fieldnotes for reference later during transcription and analysis. In addition to the above interviews, I also attended three public STEM-related events that coincidentally took place in and around Kuala Lumpur in this phase of data collection. These were the Petrosains Science Festival (1 November 2019), Kuala Lumpur Science and Engineering Festival (2 November 2019) and Forum on STEM Education: Engagements with Parents, Teachers and Community (14 December 2019). At these events, I paid attention to discourses related to STEM, captured photographs and also collected relevant documents. Following the events I also recorded extensive fieldnotes related to these experiences. Together, these data collected in the first phase mainly contribute to addressing RQ1 and RQ2, and to a lesser extent, RQ3.

Second Phase, Part 1 (January to March 2020)

The second phase of data collection entailed prolonged engagement in Sekolah Luar Bandar from the start of the school year in January 2020. Prior to beginning data collection in this school, I conducted a familiarisation visit on 6 November 2019 to present my research plans to the teachers and arrange logistical matters associated with fieldwork. The school administration generously offered me accommodation in one of the warden's lodgings in the school hostel. Thus, during my time collecting data at Sekolah Luar Bandar, I dwelled on the school grounds and was able to properly embed myself in the school community and the day-to-day lives of its members. Early in the fieldwork, the teachers were very curious as to why I chose to conduct research in this school, noting that this was a rare occurrence. One teacher remarked as we were in his car after Friday prayers at the kampung mosque one day:

> On our journey back to school from the mosque, he tells me "You chose to come to the most *hulu* (upriver, also synonymous with remote) kampung in Hulu Terengganu" (Fieldnotes, 3 January 2020)

Often, teachers remarked on the school's remoteness in contrast to my positionality as a Malaysian student at a prestigious institution like the University of Oxford. "Of all places, why here?" was often the sentiment. This feature of remoteness, the hulu-ness of this place will figure later in the analysis, especially for RQ2 (Chapter 6).

My data collection approach in Sekolah Luar Bandar involved a selective, intermittent time mode of ethnography. Time in the field depended on progressive focusing that began with floating observations, gradually focusing on the topic of interest, with flexibility to move in and out of the field throughout the engagement (Jeffrey & Troman, 2006). During school breaks when the hostel would be closed, I returned to my family home, a four-hour drive away. Thus the rhythm of my engagement in the field largely followed the young people's school schedules and the academic year more generally. The young people at Sekolah Luar Bandar eligible to participate in this study were Form 4 (16-year olds) students tracked into the class that offered the STEM package of subjects at the start of the school year. I name this class "4-STEM". At the start of my fieldwork in January 2020, 11 students were tracked by the school administration into class 4-STEM and thus would be eligible to participate. Nevertheless, students' movement in and out of the class throughout the fieldwork period proved to be a challenge and also contributed to the findings for RQ1. I elaborate more on the latter in Chapter 5. At this point, suffice to say that in total, eight young people who were in class 4-STEM consented to participate (via parental approval) after our various informal engagements and briefing of the scope of the study. The associated participant information

sheet and consent form are included in Appendix G. All data collection with the young people was conducted in Bahasa Melayu.

The young people that agreed to participate are Ceney, H4lfiey, Petir, Chik, Ana, Wan, Mila and Damia. These are pseudonyms either chosen by them in the first instance, or otherwise assigned by me. As part of their consent, I leave open the notion of (non)participation, which is to say, they were by no means obligated to participate in every component of this study. This meant there were instances where some young people did not participate in certain activities out of their own volition, and I did not press further for the sake of data "completeness". My choice was tied to an ethical stance, where I attempt to reflect on power relations and extraction related to the idea of participation in the research process. This choice is also aligned with Ludhra's (2012) reminder on researching with young people:

> …if researchers are to truly understand young adolescents and their lived experiences, then they must research in less restrictive ways in order to gain their perspectives and ensure space for them to articulate and reflect on their opinions at length and over time. (p. 100)

Therefore, I strived to be less restrictive in data collection, and to provide the young people space to engage with my research as they saw fit within this period of prolonged engagement.

As mentioned at the start of this section, I was not permitted by the MOE to observe classroom teaching and learning activities in the school, which hindered my initial plan to "follow" the young people as they engaged in formal instruction of STEM-related subjects in the classroom. The teachers I spoke with speculated that this restriction might be associated with the recent enforcement of the policy on *Melindungi Masa Instruksional* (Protecting

Instructional Time) where my presence may be seen as disrupting classroom activities. Teachers themselves did not see a problem with my prospective presence in their class and some persistently invited me to join them throughout the course of fieldwork. However, I had to refrain due to the order issued by the MOE far away in the urban metropole as a condition of my research pass. Therefore, aside from chats during recess and in between classes, my engagement with the young people during the school day took place through "relief periods". Throughout the week, there would be a number of 30 minute to one-hour blocks where class 4-STEM's schedule opened up because a teacher was away from school on personal leave or attending to other duties. These were called relief periods and students in class 4-STEM were meant to use these periods for independent study. The teachers agreed that I could spend time with the young people during such periods to catch-up or engage in specific activities tied to this study. Thus, I utilised these moments of *relief* in the school day to engage them in the participatory activities (STEM project, aspiration timeline and booklet) as well as the semi-structured interviews. I discovered every morning if there were relief periods in any given day as this list was generated by the school administration on a daily basis.

When not engaging with the young people directly, I spent time in the teachers' lounge throughout the fieldwork period, where I was provided a cubicle in close proximity to the STEM-subject teachers. I used this time and space to build rapport with teachers, engage in informal conversations about the young people, the school and the broader community. I kept detailed fieldnotes of these encounters and anecdotes. It is through time spent in the

teachers' lounge that on 12 January 2020 I was informed by *Cikgu* Maryam[11], head of the science and mathematics panel in Sekolah Luar Bandar about an upcoming STEM innovation competition organised by Dr. Laili Che Rose's team at UMT (one of the experts I interviewed). Cikgu Maryam enquired if I would be interested in mentoring the young people in class 4-STEM for this competition, which would take place on 6 February 2020. This invitation became the impetus for developing a participatory informal STEM education project at this stage of the fieldwork (14 January to 6 February 2020). I elaborate on this project in more detail as part of the findings for RQ3 in Chapter 7.

For the rest of this fieldwork period until the mid-term school break on 13 March 2020, I participated in the day-to-day school activities such as the sports day, the parent-teachers association meeting as well as a career-related event organised by the guidance counsellor, Cikgu Nor. Immersion in school activities provided opportunities to develop rapport with the school community and learn more contextual details about the research site. I also engaged with the young people in the aspiration timeline activity (19 February 2020), with an example by Damia shown in Figure 7. Additionally, I completed the semi-structured interviews with Ceney, H4lfiey, Petir, Wan, Mila and Damia (25 February to 5 March 2020). The interviews with the young people took between 25 to 53 minutes and were audio-recorded. During the interview, we referred to the aspiration timeline they had previously drawn up as a source of elicitation. The interview and timeline activity with Chik was completed remotely later (as he had moved to a technical school in Kuala Terengganu by this point). Meanwhile, Ana chose not to participate in the interview.

[11] The prefix *Cikgu* is Bahasa Melayu for "teacher", often used as a salutation of respect for a learned figure. I also deploy it in this study to distinguish teachers from other participants (experts and policymakers, young people).

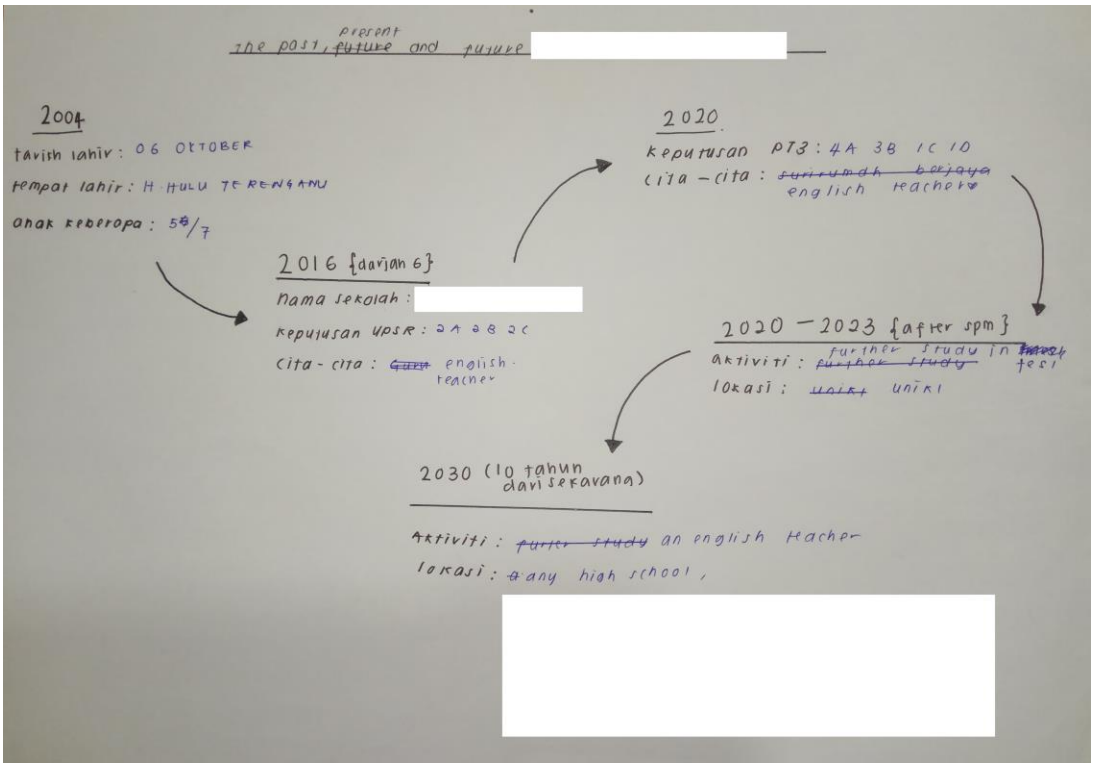

Figure 7: An aspiration timeline drawn by Damia (identifying details removed)

Together with Cikgu Maryam and Cikgu Linda, who were closely involved in the participatory informal STEM education project, I discussed the details for the school's annual STEM Week that was planned for 29 March to 3 April 2020 following the mid-term school break. I then left Sekolah Luar Bandar on 13 March 2020 to return to my family home across state lines for the one-week school break. I had assumed that fieldwork would resume after a week, and I would be heavily involved with organising the STEM Week. This was before the Malaysian government announced a national lockdown associated with the COVID-19 pandemic from 18 March 2020, which altered the course of my fieldwork and all the research plans therein.

INTERLUDE: COVID-19 Disruptions to Fieldwork (March to June 2020)

Early during the mid-term school break, the Malaysian government announced a national lockdown to curb community spread of the COVID-19 pandemic, beginning from 18 March 2020. This meant that learning in schools would be moved online and interstate travel would be forbidden. Commencing with a two-week lockdown, this measure was further extended every two weeks until schools were allowed to reopen for face-to-face learning on 24 June 2020. In the early days of lockdown, I decided to wait for the possibility of schools reopening, but as lockdown continued to be extended, I had to make the decision to pivot certain elements of data collection into the online space in order to progress with remote fieldwork with participants in Sekolah Luar Bandar. CUREC approval was secured on 26 May 2020 for online/phone interview with teachers as well as data collection via an instant messaging platform (WhatsApp) with the young people. In this time of great uncertainty, I maintained informal contact with teachers and young people at Sekolah Luar Bandar, but was hesitant to engage in formal data collection to be sensitive to their adjustment with online teaching and learning, as well as the day-to-day lives in lockdown. Perhaps, I too was mourning the unexpected loss of my own aspirations tied to this study, which I had designed before being blind-sided by a global pandemic. In *Staying with the Trouble,* the feminist scholar Donna Haraway (2016) presciently writes:

> Mourning is about dwelling with a loss and so coming to appreciate what it means, how the world has changed, and how we must ourselves change and renew our relationships if we are to move forward from here. In this context, genuine mourning should open us into an awareness of our dependence on and relationships with those countless others being driven over the edge of extinction. (pp. 38-39)

Thus in this period of disruption, I considered my decision to wait as an ethical posture. In the spirit of staying with the (research) trouble—eventhough I recognised the practical need

to change the approach to research—I prioritised the relationships that had been developed with teachers and young people in moments of encounter prior to the lockdown. The "ethics of disruption" as espoused by Crivello & Favara (2021) vis-à-vis managing research relationships is especially crucial in this moment of potential distress for participants. Therefore, I argue that choosing to wait constitutes an ethics that centres care for the participants, which supersedes the immediate pressure of data collection.

Despite not engaging in formal data collection with participants from Sekolah Luar Bandar, I used this moment of pause to gather additional contextual public data in the online domain and proceeded with research-related work. These included attending a webinar on STEM education delivered by Dr. Ihsan Ismail, Head of the National STEM Centre who I had interviewed earlier, transcribing interviews, updating fieldnotes and reviewing additional literature for Chapter 2, as well as revising the research design and associated CUREC application. I also wrote draft manuscripts for academic publications and participated in the virtual Comparative and International Education Society (CIES) conference. Throughout this period of limbo, I maintained the writing of detailed fieldnotes, even though the notion/location of the "field" became difficult to pin down. Subsequently, I have reflected on this scholarly and personal interlude associated with the COVID-19 pandemic in more detail via a number of publications.

Below, I insert a letter addressed to the COVID-19 virus that will be published in an upcoming volume on international student mobilities in Asia Pacific during the pandemic (Anuar, in press). I embed this output of epistolary into the body of the thesis to signify ruptures (and openings) that alter the *shape* of a typical academic project, and consequently the insights illuminated in the subsequent chapters. I invite the reader to pause and sit a

while with this letter. Indeed, it presents an exceptional interruption for an exceptional time to be researching, and to be living.

Suspended there and back again: Ambivalent meditations and lifeways of the DPhil fieldwork at home

14 February 2021

Dear SARS-CoV-2,

Shall I start by asking how you are doing? That seems disingenuous. I witness your handiwork everywhere I (can) go, in interrupted plans and dreams, in patterns of living and hoping so drastically altered.

The reason I write is to reflect on my experience conducting DPhil fieldwork at home in Malaysia. At this moment, I am back in Oxford, United Kingdom, in midst of yet another national lockdown. Sometimes I wonder if I should have remained at home. Otherwise, I am grateful to have made the journey back. For now, I am safe, I am healthy. It feels remarkable I made this long journey from Malaysia to the United Kingdom as you cast a foreboding shadow, transcending geographical boundaries. An advisor wrote back when I updated him of my whereabouts: "You have done well to be crossing continents in Covid times, and in collecting the data you wanted - well done!"

Allow me this nostalgic journey back in time. From 2018 to 2019, before returning home, I spent a whole year in Oxford reading, thinking and designing a research project. I look back to that period now—coloured by a hopeful naiveté—with the weight of hindsight. I suppose you can think of this correspondence as a tale of mourning, but please do not see it as just that. There are moments of wonder too, reminders of lifeways that persist in adversity. Life finds a way.

In that hazy transition between 2019 and 2020, when I first heard about you, it seemed that you were a contained concern in a distant eastern land. I travelled 4 hours across state lines from my family home to board at the rural school where I planned to conduct my DPhil fieldwork. I looked forward to spending half a year in the community to learn about young people's aspirations. Even as murmurs began to surface locally that you had landed on our shores, I was roaming the hallways at school, chatting with students during recess, working on a STEM project with them during free periods and after school. Early in the school year, when they travelled to the state capital for a competition, the students I mentored won a gold medal for their project—jubilant in the face of this rare victory. As the school break approached, I made plans with teachers to organise a science carnival when students returned. It seemed DPhil fieldwork was going well.

With the certainty that I would be returning to school after the one-week school break, I left the car I borrowed from my mother at the school hostel. By this time in March 2020, your presence had become more keenly felt. The air was thick with nervous energy. Then one day, the sense of certainty dissolved. I was at home in the living room with my father, when the Prime Minister announced a national lockdown for two weeks on television. Inter-state travel would be forbidden. Students wondered aloud in our group chat if the school break

would be extended. Yes, I tell them, at least until the end of the month. In the wake of school closure, they asked if I managed to return home. I assured them I was safe with family. Do not take you for granted, I cautioned them. As the lockdown persisted, I reminded the students to always wash their hands with soap and explained how this warded you off. I wonder if this flatters you?

Even as I stayed in touch with the teachers and students, I felt my fieldwork was grinding to a halt. Every two weeks, the national lockdown was further extended as you continued to make your way through the Peninsular and across Borneo. Schools remain closed and learning moved online. In moments of despair, I contemplated suspending my DPhil, given the lack of activity across static days that merely looped over and over. My supervisors gently suggested I prepare a contingency plan for my fieldwork. Perhaps I could move my research online? I hesitated, choosing instead to wait you out. Surely you will soon be on your way!

March slowly passes into April. Despite being in limbo, I was grateful to be enveloped by the lulling comfort of my parents and two younger sisters who had hastily returned from the capital. My grandmother, two aunts and uncle live next door. Everyone is healthy, we have food on the table and we could afford to be ensconced at home. During a call with my eight-year-old nephew, he divulged an exciting secret in a hushed voice: his mother is pregnant! Even though you continue to claim human lives, there is always the prospect of life springing anew. Such is the cycle.

At one point, in the aftermath of yet another lockdown extension, my mother asks what I will do with my suspended fieldwork. Half-joking, half-exasperated with you, I remark that I will quit the DPhil. She turns serious, reminding me to finish what I had started after I

suddenly left a comfortable corporate job a few years before. I ask her to pray for me. Grudgingly, I began adjusting my research design, pruning my elaborate plans. A teacher from the rural school calls to check in and relays a message from the security personnel—as it had not moved since March, my mother's car that I had left at school has four flat tyres.

Even as you led to the suspension of my DPhil fieldwork, I continued to nurture other dimensions of my academic identity; such are writing and peer reviewing. I admit to you that it was not easy to keep going. There were times when I just wanted to stay in bed, wishing the next day would be different. As I lamented my catatonic fate, a reminder from a Brazilian friend far away in Portugal brings me comfort: "It is time to have patience and tranquillity, as our research is not disconnected from social flows…and that includes this pandemic."

Gradually, you showed signs of slowing down. May rolls into June. The fasting month of Ramadan makes way for Eid al-Fitr celebrations. What is usually a festive affair with family reunions is instead simple and subdued, as inter-state travel remained largely suspended. My fieldnotes read: "Break, no mood to work on DPhil!" By the end of June, as lockdown was eased and you appeared to be taking a bow, I was able to return to the school to continue my fieldwork. Were it not for you, by this time I would have already finished fieldwork, having been in school since January. But of course you threw a wrench in that timeline. Nevertheless, I was able to spend more time with my ageing parents than I would otherwise. Somehow, hardship is always accompanied by some form of ease.

Resuming fieldwork, I bore witness to how you altered schooling. In the misty mornings, students had their temperatures checked at the gate. Everyone followed arrows taped to the

floor that dictated our movements around the school. Teachers reminded students to observe physical distancing and to use the hand washing stations installed outside classrooms. Despite various restrictions you imposed, I was grateful to properly conclude my DPhil fieldwork with various adjustments. In August, I said goodbye, thanking the teachers and students for their time, wisdom and kindness. These days, I think of them fondly as I attempt to finish my DPhil.

Before I made the long return journey, everyone around me asked if it would be safe to re-enter the United Kingdom—it seemed that you were more difficult to control in that western land. I had mixed feelings too. My father suggested that returning to Oxford would help me focus on finishing my DPhil. I suspect my mother preferred that I stayed home, but since mid September I have been in Oxford to finish what I started. In late November, my first niece was born, pink and healthy. Indeed, life finds a way…

In the background, the song *Semalam di Malaysia* (Yesterday/A Night in Malaysia) plays on a loop as I think of these moments of suspension from afar—in both time and space. More than a year on, you still hang in the air. There are still times where I feel frozen in motion, and I accept any kind of progress, however minute. I must learn to make peace with that.

Thinking of you,

Aizuddin

4.7.1 Data Collection Timeline and Procedure (cont'd)

Second Phase, Part 2 (June to August 2020)

Eventually, once the national lockdown was eased, I was able to return to Sekolah Luar Bandar on 23 June 2020 following the agreement of Cikgu Fahmi, the school principal. Once again, I lodged in the wardens' quarters at the school hostel. Students returned to school on a staggered basis and the participating young people were back in Sekolah Luar Bandar on 15 July 2020. I utilised the period prior to their return to conduct document analysis of STEM related textbooks and also began semi-structured interviews with teachers.

Table 3: Details of participating teachers in Sekolah Luar Bandar

No.	Pseudonym	Position	Gender	Years of teaching (overall)	Years of teaching (in Sekolah Luar Bandar)
1.	Cikgu Fahmi	Principal	Male	31	5
2.	Cikgu Jun	Deputy Principal	Female	28	5
3.	Cikgu Maryam	Head for Science and Mathematics Panel & Teacher-Mathematics	Female	17	17
4.	Cikgu Halim	Teacher-Technical Graphic Communication	Male	16	16
5.	Cikgu Malik	Teacher-Physics	Male	17	17
6.	Cikgu Adam	Teacher-Additional Mathematics	Male	17	9
7.	Cikgu Salmah	Teacher-Chemistry	Female	19	1
8.	Cikgu Linda	Teacher-Science (also mentored the informal STEM education project)	Female	19	2
9.	Cikgu Nor	Guidance counsellor	Female	18	3

Note: As mentioned in Footnote 11, the prefix Cikgu which means "teacher" in Bahasa Melayu is included to distinguish teachers from other participants. This is also a marker of respect in Malaysia. The name of teachers here are pseudonyms.

Each teacher was supplied with a participant information sheet and a consent form to sign, included in Appendix H. Interviews with nine teachers were completed face-to-face. Table 3 presents some background details of these teachers. The interviews were held in Bahasa Melayu, audio-recorded, and ranged between 33 to 105 minutes. After each interview, I wrote down my initial impressions as part of my fieldnotes.

Before the young people in this study returned to school, I interviewed one of them remotely via phone (Chik, who had left Sekolah Luar Bandar to attend the technical school in Kuala Terengganu). I also delivered the prompt for the photovoice activity in the WhatsApp group established following CUREC approval and the young people began submitting their photographs captured with their mobile phones. The prompt was: "Take a photo of your day-to-day experience. This includes place, activities, objects or people that are meaningful in your life." This activity was conducted asynchronously. I encouraged them to continue submitting photos in the WhatsApp group until the end of the fieldwork period. Similar to the preceding phase of fieldwork in Sekolah Luar Bandar, I utilised the relief periods to engage with the young people; we completed the aspiration booklet activity at this stage of fieldwork and also engaged in many informal conversations. My engagement with them at this point was limited to the school day as afterschool activities were suspended in line with the strict operating procedures associated with the ongoing pandemic. As such, the initial design where I had intended for the young people to become co-researchers required alteration. As co-researchers, they would have participated in focus groups to develop

questions and subsequently conducted interviews with their teachers and family members. Given that this degree of social interaction was no longer possible due to the constraints of the school operating procedures, I conducted the interviews with teachers myself. I was also unable to solicit input directly from the young people's family members.

Overall, Table 4 shows the participating young people, as well as the extent of their involvement across the many methods of data collection.

Table 4: Young people's participation across the various research methods

No.	Pseudonym	Gender	Research method				
			Semi-structured interview	Informal STEM education project	Aspiration timeline	Aspiration booklet	Photovoice
1.	Ana	Female		X	X	X	X
2.	Ceney	Male	X	X	X	X	X
3.	Chik	Male	X	X	X		X
4.	Damia	Female	X		X		
5.	H4lfiey	Male	X	X	X	X	X
6.	Mila	Female	X	X	X	X	X
7.	Petir	Male	X	X	X		X
8.	Wan	Female	X	X	X	X	

Note: "X" indicates participation

Towards the end of my fieldwork, I visited the District Office of Hulu Terengganu to gather demographic data of the community surrounding Sekolah Luar Bandar. I also travelled to the state capital, Kuala Terengganu to interview Dr. Laili Che Rose, Director of the STEM Foundation Centre at UMT (who I was not able to interview in the first phase due to scheduling conflicts). Per the teachers' suggestion, I conducted the aspiration booklet activity with students in a few other classes outside of the coverage of this study as a gesture of

reciprocity. Eventually, after completing data collection, I concluded my fieldwork and left Sekolah Luar Bandar on 14 August 2020.

Throughout every phase of fieldwork, I also collected relevant documents related to the science for development model, STEM education and rural development as and when I encountered them. Given that document analysis is meant to complement other methods—instead of serving as the main research method—I did not include a systematic search criteria or approach. Rather, the accumulation of relevant documents was based on ethnographic encounters in the field. For example, policy documents were sourced based on the interviews with experts, policymakers and teachers, and media clippings corresponded to contemporary discourses during the time of fieldwork. Brochures were collected at STEM related events and from experts and policymakers. By the end of fieldwork, documents collected included media clippings, policies and reports, circulars, brochures, STEM subject textbooks, as well as artefacts produced by the young people from the various participatory activities described above. Appendix I itemises the documents collected and included in the analysis.

4.7.2 Kebetulan and Considerations of Rigour

My approach to this study has been fused with the Malay notion of kebetulan. In the Malay World, this concept—translated into "coincidence" in English—has been studied in relation to the plot structure of *Wayang Kulit* (shadow puppet) in Indonesia by Becker (1980):

> Wayang plots are built primarily around coincidence, a word which we in the West use to explain-away things of no meaning. "A mere coincidence" cannot, in the West, sustain prolonged scrutiny and analysis…In wayang theatre coincidence motivates action…meaningless within a chain of causes and effects, but symbolically very rich. (pp. 145-146)

I draw on this observation of kebetulan to reflect on my postcolonial approach to social science research, paying attention to my native language as a source of conceptualising. The root-word for kebetulan is *betul*, which translates to "truth" (Becker, 1980). Whilst in the field, Cikgu Linda demonstrated an instance of kebetulan during our interview. Discussing the progression of the science curriculum from lower to upper secondary level, she observed how the change in the national curriculum coming into effect in 2020 aligned with the day-to-day practice during the pandemic. Once schools reopened after the lockdown, every morning, students' body temperatures were measured with an infrared thermometer before being allowed to enter the school premises. Cikgu Linda tells me:

> For the basics learned in Form 1, there is the clinic thermometer and the laboratory thermometer. But in Form 4 there are more, including the thermometer we are using now, the infrared one. Kebetulan…it's a direct application. So now the students know [about that thermometer], they already learn it in Form 4 [as part of the new curriculum]. It's so appropriate with the current [pandemic] situation.

Hence, could an approach to research—and thus knowledge-making—infused with the notion of kebetulan constitute a form of rigour in research, an inching closer to the understanding of reality? This proposition might be counterintuitive in positivist notions of rigour that foreground a systematic, replicable design and an approach to data collection that attempts to control and isolate the conditions of the field. However, kebetulan is congruent with an ethnographic sensibility, wherein "learning in and out of the field is uneven, usually unforeseen, and rests more on a logic of discovery and happenstance than a logic of verification and plan" (Van Maanen, 2011, p. 153).

Indeed, in this study, I concede a degree of methodological control to the possibilities of kebetulan. This is not to say the research was aimless or not pre-planned. Rather, an embrace of kebetulan as an approximation of betul—of truth—entertains the potency of surprise and wonder, of the research design altered by unexpected, serendipitous events. As such, I attempted to remain patient and open to kebetulan throughout the course of fieldwork. Kebetulan drove action, motivated by the desire to seize the incredible moments it proffers. It was kebetulan when relief periods (mentioned before in Section 4.7.1) suddenly opened up in a school day so I could engage with the young people in Sekolah Luar Bandar; this could not have been planned ahead of time. It was kebetulan that I conducted fieldwork in Sekolah Luar Bandar at the same time as a STEM innovation competition was organised by Dr. Laili Che Rose, who I interviewed as part of this study. The opportunity to join this competition led a to participatory informal STEM education project that fit within the remit of this study. It was kebetulan that as I was interviewing experts and policymakers in the metropole, the Minister of Education announced that tracking students into streams (STEM or otherwise) would be abolished. Rich conversations with the participants ensued as a result. Though it leaves its trails, kebetulan is somehow unexplainable—an intangible force. I am thus reminded of Pandian's (2019) questions in the field of anthropology, which I bring into education, about the place of the "invisible" in our inquiry:

> What would it mean to be faithful to these images of another reality beyond the givenness of the here and now? What kind of empiricism could accommodate the presence—perhaps even the truth—of such spiritual beings and intangible forces? (p. 33)

Though I offer no answer to these difficult queries, I argue that an embrace of kebetulan can offer the possibility of strengthening the data collection process and thereby the potential insights from this study. The examples demonstrated above—instances where kebetulan

animated fieldwork—enriched the research process in ways I did not expect (or plan) prior to entering the field for data collection.

To enhance the rigour of this study, I couple the potency of kebetulan with measures of triangulation as demonstrated by the combination of multiple qualitative methods described in Section 4.6, as well as multivocality, where I have sought to contextualise the perspectives of young people with that of experts, policymakers and teachers. Alongside prolonged engagement, thick description of context and keeping a reflexive diary, the aforementioned measures were embedded in the methodology to ensure the rigour of this study (Korstjens & Moser, 2018; Tracy, 2010).

Additionally, being mindful of my positionality and the power relations with the research participants, particularly the young people, I aligned myself with Laher et al.'s (2019) call for particular considerations of rigour pertinent in the global South, incorporating "a more reflexive approach to power dynamics, and the assurance of treating participants as agents in their own right and experts in terms of their own experiences and contexts" (p. 399). As mentioned in Section 4.7.1, I leave it open for young people to decide on their own (non)participation, respecting their choices and co-constructing knowledge in the field on their terms. I also take seriously their views on aspirations as a kind of grassroots expertise, rooted in their daily lives in the luar bandar. I further elaborate on the ethical considerations of rigour in Section 4.9. With all these considerations of data collection in mind, I now move to describe the analytical procedure applied to the corpus of empirical data.

4.8 Analytical Procedure

In this section, I present procedures associated with data analysis. First, I describe the organisation of the corpus of data, followed by the adoption of reflexive thematic analysis.

4.8.1 Data Organisation

The data gathered through various methods required careful processing and organisation prior to analysis. Audio recordings of interview transcripts were labelled with pseudonyms (where applicable i.e. young people, teachers and one of the experts per his request) and the date of the interview. Subsequently, these recordings were selectively transcribed in .docx format in their original language (Bahasa Melayu or English) with reference to the research questions. Handwritten fieldnotes from observations and participatory research were also transcribed in .docx format and also photographed for preservation in digital format. Photographs collected from the students through the photovoice activity were labelled with their pseudonyms and stored in one folder. I also photographed their aspiration timelines and booklets, labelling them according to their pseudonyms. Meanwhile, documents collected in hardcopy form were also photographed and stored together in a folder with documents collected in .pdf format. All of these folders were backed-up in a password protected online cloud service. Subsequently, all documents were imported into an NVivo 12 database for coding and analysis.

4.8.2 Reflexive Thematic Analysis

Here, I elaborate on the use of reflexive thematic analysis (TA) as the chosen approach for this study. To recap, the MRQ is as follows:

> How do young people in the Malaysian luar bandar describe and enact their aspirations for development in relation to STEM education and their day-to-day experiences?

As reflected above, the main focus is to explore rural young people's own descriptions of aspirations for development in Malaysia. I also intended to relate such aspirations with two dimensions of interest, the manifestation of the 'science for development' model (Drori, 1998) in the country, as well as young people's day-to-day experiences in the luar bandar vis-à-vis the national discourse of rurality. An active, agentic dimension of the MRQ is represented by the manner in which young people exercise and enact such aspirations in relation to the aforementioned dimensions of interest. Here, the concept of capacity to aspire (Appadurai, 2004) presents a useful lens for analysis. The MRQ therefore attempts to "explore participants' experiences and sense-making (variously described as understandings, perceptions, motivations, needs, and views)" and therefore fits within the typology of questions where reflexive TA would be an appropriate analytical strategy (Braun & Clarke, 2021, p. 8).

Concordant with Braun & Clarke's (2021) notion of the *reflexive* in reflexive TA, the approach to analysis herein embraces my subjectivity—hinted by the positionality elaborated in Section 4.4—as a resource for analysis, coupled with the commitment to continually be reflexive and transparent with regards to my position, moves and choices in the analytical process. Thus the themes on aspirations for development produced in this study did not *emerge* from the data. Rather, as the researcher, following Braun & Clarke (2021), I *construct* such themes at the point of analysis, bringing in my subjectivity to bear on the data. Additionally, I acknowledge that even such data produced by the participants in the course of data collection involve a degree of co-construction with me as the instrument of research,

driven by an ethnographic sensibility (O'Reilly, 2012). This is to say, as the researcher; I am situated within the corpus of data I gather, rather than standing outside dispassionately and at a distance.

Below, I describe the phases of reflexive TA adopted in this study. Throughout, I provide examples using empirical material as a means of demonstrating how I have approached the analytical process. I make use of the phases specified by Braun & Clarke (2012) which are data familiarisation, coding of data, generating initial themes, reviewing themes, naming and defining themes, and producing the write-up. However, I do not adopt a rigid, regimented or linear approach to these phases. The process of constructing themes is a recursive one and even when they are finally reported, the themes remain provisional, partial and open to reconstruction (Braun & Clarke, 2021).

Data Familiarisation

First, the issue of language and translation must be highlighted at this stage. As the corpus of data is in both Bahasa Melayu and English, familiarisation occurred across both languages, which I possess advanced comprehension. The constant shuttling between both linguistic terrains reflects the hybridity in analytic languages described by Srivastava (2006)—the "'*language of the data*'…and the '*language I use to think in*' (English)" (p. 211). In the context of this study, the hybridity is taken a step further. Both Bahasa Melayu and English are the language of data and that which I think in. While the linguistic separation of the data is more easily delineated[12], the separation in my thinking is less so. Indeed, the latter appears impossible, though in the end the language of analysis as represented in the text is

[12] Although teachers and young people use Bahasa Melayu with occasional phrases borrowed from English, for experts and policymakers, the conversations are hybridized to a much greater degree.

predominantly English. I embrace this "double consciousness" of the postcolonial, hybrid subject (Mukherjee, 2019) and see this as a resource for analysis. Recognising that translation may constitute a form of violence in the dislocation of meaning from its cultural roots for the consumption of the target-culture (Venuti, 1993), I take an ethical stance of minimising translation. As such, I chose not to translate the corpus of data in the course of analysis, and only do so at the point of reporting, wrestling with all the limitations, contradictions and epistemological dilemmas inherent in any decision (Temple & Young, 2004). Ensuring I maintain reflexivity throughout the process of analysis and reporting is an attempt to be accountable to my choices regarding translation.

By considering the in-between place I occupy and Bahasa Melayu as both the language of thinking and data for this study, I consciously pay attention to specific words and phrases that can be surfaced and retained in the course of analysis and writing (as highlighted in Chapter 2 (Section 2.5)). Commenting on the challenges of translation in cross-cultural research within the field of development studies, Maclean (2007) posits that during "the analysis stage, an exposition of the 'other' language is key to destabilising the terms of the academy" (p. 785). Therefore, as part of my contribution to research, I utilise my positionality to enrich collective understanding about young people's aspirations, rurality and methodology by attending to the epistemic dimensions of Bahasa Melayu. Some words travel across geographies, in this case between Malaysia and Indonesia, to be rooted in particular times and practices, conceptually enriched and transformed in the process (Gluck & Tsing, 2009). Carefully considering words like pembangunan, luar bandar, rasa and kebetulan—their construction, how they are used in the day-to-day—illuminates their incredible potency

for analysis. Thus attention to Bahasa Melayu as a conceptual resource serves as a pertinent dimension in this study.

Immersion and familiarisation with the data took place even before the full corpus of data was assembled and imported into NVivo 12. Even in the process of transcribing interviews, for example, I simultaneously annotated the transcripts with bursts of preliminary analytical phrases—memos in the briefest sense. These are mnemonic comments to myself on elements that I found striking in the data, in relation to components of the research question (D. Mills & Morton, 2013). I later consider these initial, "gut" insights in the process of coding and construction of themes while not necessarily being wedded to them. I demonstrate this with annotations from one of the elite interview transcripts in Figure 8.

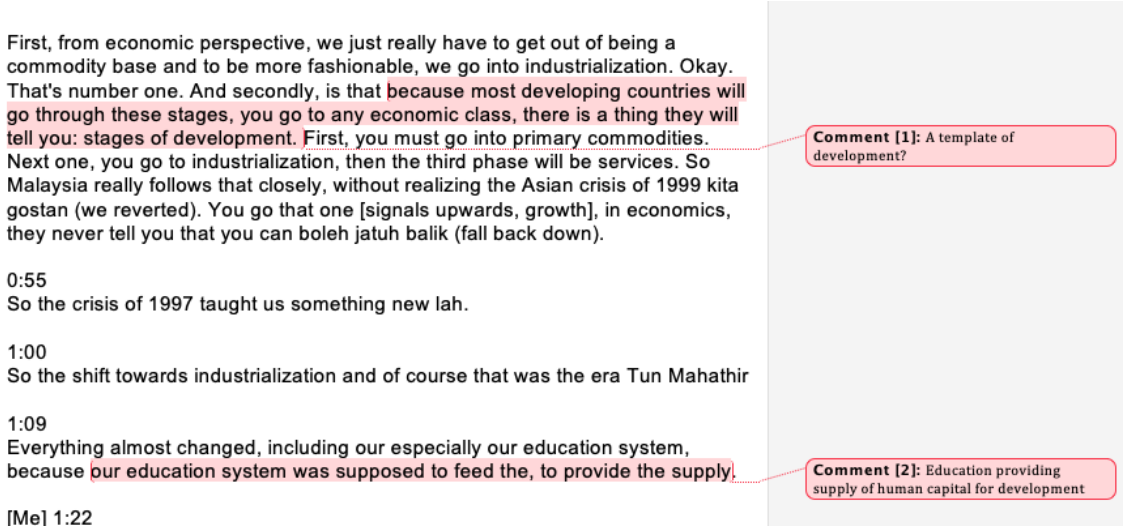

Figure 8: Example of annotation during data familiarisation stage

Data familiarisation entailed reading and rereading fieldnotes, interview transcripts, documents and artefacts produced by the young people across both Bahasa Melayu and English. Throughout this cyclical process, I thus made notes (in English) of potential lines of

analysis, questions to ask of the data and of my own positionality. This approach of note taking persists throughout the subsequent stages of data analysis. The aim of this stage was to take stock and reflect on the totality of the corpus of data, and where links across various types of data might be preliminarily drawn. Despite the various sources and modality of data mentioned above, together I consider the whole corpus to be "text" (O'Reilly, 2012) that can thereby be subjected to coding and theme construction. While I acknowledge that different modalities of data (such as text and visual) indicate different modes of representation and therefore perhaps different ways of knowing, it is not uncommon for different types of data to be considered in conjunction during analysis (Pain, 2012). In the context of this study, where I am primarily interested in the description of aspirations, I consider textual and visual data as sources of such description that complement each other. Hence, I aggregate these various modalities of data at the coding phase, making no distinction between them as I code. The coding phase is described below.

Deductive and Inductive Coding

The coding phase entails both deductive and inductive approaches. The deductive dimension is where I anchor the development of codes in relation to conceptual frames of reference, such as the science for development model (Drori, 1998) and the capacity to aspire (Appadurai, 2004), which were elaborated in Chapter 2. Nevertheless, consistent with a reflexive approach to TA, this deductive form of coding does not make use of a "codebook". This is to say that I did not clearly delineate specific dimensions of the abovementioned frames of references as codes, onto which the data can be mapped. I take a more fluid approach. Here, Braun & Clarke (2021) stress that a "deductive orientation in reflexive TA involves using preexisting theory as *a lens through which to interpret* the data;

deductive reflexive TA is not about 'testing' a preexisting theoretical framework"(p. 6). Meanwhile, the inductive approach allows for insights beyond the conceptual frames of references to enrich data analysis. Here, I bring to bear my subjectivity, assumptions, understanding and knowledge of the Malaysian context, attention to concepts in Bahasa Melayu, as well as identification of links across the corpus of data itself into the coding process.

I carried out the coding process in NVivo 12. All codes were developed in English, even when the corpus of data was read in Bahasa Melayu in an effort to minimise translation at the later stage. Throughout the coding process, I kept in mind the various elements of the research questions as guides for the development of codes. I demonstrate by way of an example below. For ease of demonstration, I use examples of excerpts from transcripts that were in English (experts and policymakers):

Code: Streaming in the Malaysian education system Description: Reference is made to the process in upper secondary education where students are "streamed" into various pathways, such as science/STEM etc.
He said one of the concept of streaming, and secondly he said you know we are still in old school, *masih takuk lama lah* (caught in the old ways).
Then now during my time we only have two streams. Now got six streams, you know? Then latest last week, they announced no streams!
…we also touch on our concern on the decline of a lot of students into Form 4 pure sciences
I know slowly the trend shows that we are going towards liberal education as you know, no streaming.

The above code was developed deductively in relation to RQ1: "How does the science for development model translate in the Malaysian context…" By closely reading the interview transcripts, I focused specifically here on the science for development model, recognising

that as part of the logic of this model, science may be emphasised over other subjects by the state in order to pursue human capital development (Drori, 1998). I couple this with my understanding of the streaming process in Malaysian education where students are tracked at the upper secondary level along the STEM or arts streams. Thus the development of this particular code involved a certain degree of interpretation (Braun & Clarke, 2012), which was informed by a particular lens (science for development) as well as my lived experience and knowledge of the Malaysian education system.



Figure 9: Photo taken by Petir coded as "Spending time with family"

Other literal textual data (fieldnotes, documents) were coded in the manner described above, through close reading. Below, I provide an example of how visual data is coded. For RQ2, I was interested in "…what are young people's related aspirations for development based on their day-to-day experiences?" In addition to narrating their day-to-day experiences during the interview, the young people also represented such experiences through the photovoice activity. Figure 9 shows a photo sent to me by Petir, who shares that he was making a barbeque stand with his father during the lockdown period when schools were closed. I coded this image as "Spending time with family", alongside other young people's descriptions that gesture to similar activities. Young people's captions or narratives supplied alongside the photos aids with the coding process. Other visual data, such as images in textbooks or infographics, are also coded with reference to textual details framing them, and in relation to the research questions.

Overall, the coding process was recursive, in that I would return to previously coded data once new codes were generated. For example, in RQ2, when a new code "rural education and development" was developed, I revisited the code "education and development" to further clarify if chunks of data could be recoded for accuracy. This was to ensure that the coding phase remained thorough and comprehensive. As new codes were formed, some codes were collapsed especially when there were overlaps in description. This phase blurs with the next phase. When similar codes were identified between different types of participants (for example, teachers and young people) who were coded separately in the beginning, they can be brought together in the process of comparison during the construction of potential themes. I describe this further through examples in the next phase.

Construction, Refinement and Naming of Themes

This phase of the analysis can be characterised by a process of mixing, matching and linking of codes in order to identify a central organising concept that anchors a collection of codes together, thus constructing a theme (Braun & Clarke, 2012). The research questions continue to guide this phase.

I take RQ1 as an example: "How does the science for development model translate in the Malaysian context and what are young people's related aspirations for development in the luar bandar?" In response to this line of inquiry, I generated a number of codes about young people's aspirations for development. These include "Development as making a name for the country" and "Development as novelty". Together, these codes cohere around young people's ideas of carving a distinct national identity. Related to these are codes that position their national aspirations in relation to the global: "Cosmopolitan aspirations", "Development as keeping up with the outside world" and "Outward looking in sourcing examples". All of these codes possessed some form of relation to components of the science for development model such as the link with globalisation. Through various iterations and reflections, a preliminary theme was developed to link these two clusters of ideas: "Globalised distinction". With this theme in mind, I scanned the corpus of data to check the degree to which this theme provides explanatory coverage. This step also assisted in nuancing the description of this particular theme, subsequently refining the theme accordingly to reflect this revised description. At this stage, I referred to my reflexive memo which I developed in the process of constructing codes and themes in order to remind myself of potential blindspots or perspectives which I had not fully considered. I include

some excerpts of this reflexive memo in Appendix J. Eventually, I named this theme "The balance of global desires and national distinction".

Given this study's vertical comparative dimension, I enrich the themes associated with young people's aspirations for development with codes tied to other sources of data both inside and outside of Sekolah Luar Bandar. For example, the particular theme demonstrated above is also weaved with codes that reflected experts' perspectives on globalised benchmarking. The process of refining the theme enabled the establishment of this connection and provided analytical depth. In this way, a comparative, dialogic character is infused in this theme, demonstrating how young people's aspirations at the grassroots are not hermetically sealed from forces beyond their immediate locality.

The constructed themes were eventually brought together in order to weave an analytic narrative that addresses the research questions (Braun & Clarke, 2012). The accurate wording of the themes, and the rearranging of codes constituting the themes, continue to evolve in the process of developing a narrative for this thesis. I argue that the process of weaving the narrative of the findings chapters were also pertinent dimensions of analysis which remain contingent and open to multiple possibilities. In this regard, I join the movement of qualitative researchers who are attentive to writing as part of the inquiry and analytical process, rather than merely an output of analysis in a linear sequence (Bhattacharya, 2017; Mitchell & Clark, 2021; L. Richardson, 2001). Rooted in the empirical data, I continue to remain reflexive of the choices I have made in the process of (re)constructing and refining the themes during the course of writing. I describe this writing process as part of the summary of this chapter, after reflecting on the relevant ethical considerations underpinning this study.

4.9 Ethical Considerations

Attention to ethics is absolutely central in any research endeavour. In this particular study that is rooted in a postcolonial critique of development and a participatory spirit, questions of power relations require constant reflexivity. Coupled with this are the ethical implications that influence the methodological choices I have made. Guillemin & Gillam (2004) remind researchers of two kinds of ethics: the procedural and the practical kind. As mentioned in Section 4.7.1, matters of procedural ethics tied to CUREC were considered and subsequently approved on 30 April 2019 and 26 May 2020. Appendix E presents the CUREC approval and the itemisation of related ethical considerations, which I will not repeat here. To summarise, included in the itemisation are matters of confidentiality, anonymity and privacy, handling of data as well as personal safety in the field. These concerns are also reflected in the methodological decisions presented in previous sections of this chapter.

Rather, I focus here on practical ethics that I continuously negotiated throughout the data collection, analysis and writing phase. Attention to practical ethics is coupled with a postcolonial ethics in terms of remaining mindful of power dynamics rooted in the insider/outsider role I negotiate, particularly with the young people (Tikly & Bond, 2013). I have touched on a number of these concerns such as questions of (non)participation among young people in Section 4.7.1. The question of (non)participation cannot be separated from actively interrogating the power imbalance between my status as an adult researcher and the young people in this study. Surrendering a degree of methodological control in this regard was my attempt to respect young people's agency in the research process—including the

choice *not* to participate in any component of the study—above concerns of data completeness on my end.

I also reflected on what Swartz (2011) refers to as an "intentional ethics of reciprocation" (p. 50) in designing the participatory components. While I do believe the young people gained some benefit in reflecting about facets of their personal lives (aspiration timeline and booklet, photovoice) and taking action (informal STEM education project), I do not mistake this degree of participation with the idea that I have empowered them to a great degree. Instead, I am aware that much of these activities are still researcher-initiated—largely reflecting my research agenda and interests instead of the young people's. Ultimately, even the analysis of data and subsequently how young people are represented, does not involve them to an equal degree, a concern many participatory researchers wrestle with (Tilley & Taylor, 2018). Personally, the tension between the procedure of member checking—in the spirit of co-construction of knowledge—while recognising that this is an additional intrusion into the young people's lives is one I am acutely aware of (Candela, 2019). As I have left the field and continue to focus intensively on this research within the timeline of a DPhil, the lives of the young people have marched on at a different temporal rhythm above and beyond my research. I cannot be certain if an interest in this project is top priority for the young people in the midst of preparing for the national SPM examination at the end of secondary school. By remaining in touch with the young people, I share updates on the project with them from time to time. Looking ahead, as I continue to maintain contact, I hope to be of help to them in some way as they navigate their aspirations, given how much they have taught me in the course of undertaking this research. A commitment to mutuality in this

regard is a necessary ethical posture if one aspires to meaningful long-term ethnographic research (Vavrus, 2021).

On the matter of representation, I had highlighted the dilemma associated with translation from Bahasa Melayu to English in Section 4.8.2. Another dimension is how rurality often becomes relegated as marginalised and deficient within the discourse of development. There is a risk that the quest for "accurate" representation of young people's lives in the luar bandar might lead to damage-centred research characterised by a myopic view, one that centres conditions of suffering and oppression (Tuck, 2009). A disciplined exercise in reflexivity through the maintenance of memos throughout the analysis and write-up phase has been paramount, coupled with an ethics of care that emphasises "mutuality, kindness, respect and connectedness between researcher and researched (including their communities)" (Swartz, 2011, p. 48). Carefully, I attempted to balance the foregrounding of young people's voices from the luar bandar, without eschewing the responsibility to illuminate the material conditions from where such voices arose. I had also thought deeply about the ethics of care as I paused the data collection process during the national lockdown in Malaysia, as depicted in Section 4.7.1. I resisted the tendency for research to be extractive, or for the young people's lives inside a pandemic to be commoditised in that moment, as an object of research. Overall, these ethical concerns reflect continuous negotiation and reflexivity that extend beyond the data collection process.

4.10 Summary and Presentation of Findings

This chapter provides the methodological choices surrounding the MRQ ("How do young people in the Malaysian luar bandar describe and enact their aspirations for development in

relation to STEM education and their day-to-day experiences?") as well as the associated sub-questions. I provided justifications for how the CCS design attends to these lines of inquiry, and explicated my positionality that underpins the development of various qualitative methods (semi-structured interview, participant observation, participatory methods and collection of documents) as well as the selection of the research site. Subsequently, the data collection timeline and procedure that was staggered into two phases from October 2019 to August 2020 was described. As the world was disrupted by the COVID-19 pandemic, my fieldwork was also altered, thus necessitating changes to the initial research design. I represent this disruption through a brief interlude that "interrupts" this chapter. I also propose the Malay notion of kebetulan among a set of approaches to ensure rigour, expanding the scope of data collection and taking the research design in unplanned directions. A reflection on the ethical dimensions of this study is preceded by the elaboration of reflexive TA as the analytical strategy demonstrated using empirical data.

The three chapters that follow present the findings of RQ1, 2 and 3 respectively. The themes developed to address the research questions in each chapter are arranged as follows. I first set the scene by weaving the themes associated with the relational dimension of young people's aspirations. This follows the sequence of the research question's wording. For instance, in Chapter 5, the themes related to the translation of the science for development model in the Malaysian context are presented, followed by young people's associated aspirations for development. This juxtaposition of the themes then provides a contextual reference point for the vertical comparison to take place: Contrasting the national discourse with young people's own descriptions of aspirations for development from the luar bandar, thereby addressing the research question. A similar structure is reflected in Chapter 6. For

chapter 7, I start by presenting a narrative of the collaborative development of an informal STEM education project, before elucidating themes related to young people's enactment of aspirations. In the next chapter, I commence the presentation of findings for this study starting with RQ1, exemplifying the structure described above.

CHAPTER 5: Technological and Global Aspirations Through the Science for Development Model

5.1 Introduction

This chapter presents the findings associated with the first research question:

> RQ1: How does the science for development model translate in the Malaysian context and what are young people's related aspirations for development in the luar bandar?

Here, I pay attention to how education and schooling serve as manifestations of development priorities, and the manner in which young people describe aspirations for development within this context. This line of inquiry follows Huijsmans' (2016) claim that "young men and women negotiate the contradictions of schooling as a modernising project that is part and parcel of the broader cultural politics of development" (p. 21). To address the first part of this question, I rely on reflexive TA of empirical material from interviews with experts, policymakers, and teachers, artefacts from participatory activities, document analysis as well as my fieldnotes. In Section 5.2, I describe how the science for development model outlined by Drori (1998) translates in the context of Malaysia's education system. I then locate this translation specifically in Sekolah Luar Bandar, the principal site of this study. This first section will situate and provide a basis for comparing young people's aspirations with national discourses of development that travel and translate across sites (metropole to periphery) and scales (national to local).

In Section 5.3, I attend to the young people's own aspirations for development as they are emplaced in the context described in Section 5.2. Throughout this part of the chapter, while

I foreground the perspective of young people participating in this study, I also weave the perspectives of various actors inside and beyond Sekolah Luar Bandar. I do this in order to highlight what I deem to be the "dis/juncture" between young people's aspirations for development and national aspirations as translated by the science for development model. The findings of this chapter are then summarised in Section 5.4.

5.2 Translation of Science for Development Model in the Malaysian Education System

The translation of Drori's (1998) science for development model is analysed through close attention to how the features of this model figure in the Malaysian context based on the empirical data gathered during the course of fieldwork. Thus, my analysis of the data in this section focuses on discourses in national development and science education associated with "narratives of modernity that were globalized and legitimized through organizational procedures" (Drori, 1998, p. 66). Presented in succession as a translation of the science for development model, the themes in this section are related to the discourse of science and development at the national level, quantification of the science for development model through the 60:40 policy, the tweaking of this policy via adoption of the "STEM" nomenclature, and how the 60:40 policy is implemented to track the young people in this study into the STEM package in Sekolah Luar Bandar.

5.2.1 National (Science for) Development Discourse: From Rukun Negara to Wawasan 2020

In Malaysia, discourses associated with science figure prominently in the project of nation building and development. This national discourse can be exemplified and legitimised by two

state apparatuses widely circulating in the public, namely the Rukun Negara (National Principles) and Wawasan 2020 (Vision 2020), both previously mentioned in Chapter 3. I present both apparatuses in succession. The Rukun Negara as a national ideology was instituted by the Malaysian government in 1970 following the bloody racial riots of 1969, in order to cohere different racial groups and subsequently create a national identity grounded by a number of central tenets (Y. F. Lee & Gill, 2008). Early in my fieldwork, I observed science's place in the Rukun Negara:

> One of the preambles of the Rukun Negara printed on my nephew's school issued notebook can be translated as "Build a progressive society that uses modern science and technology". (Fieldnotes, 10 October 2019)

In addition to its socialisation through students' recitation and memorisation in school, Rukun Negara (and the aforementioned preamble related to science and technology) is also reified through print media, such as in government issued textbooks used by students in public schools (Y. F. Lee & Gill, 2008). For instance, I sighted the Rukun Negara printed inside the cover of the STEM subject textbooks used by the young people in Sekolah Luar Bandar.

Subsequently, Wawasan 2020, which was devised by the fourth Prime Minister Dr. Mahathir Mohamad in 1991 to outline Malaysia's vision for becoming a developed nation by 2020, includes an explicit focus on science and technology, as presented before in Chapter 1:

> The sixth is the challenge of establishing a scientific and progressive society, a society that is innovative and forward-looking, one that is not only a consumer of technology but also a contributor to the scientific and technological civilisation of the future. (Mohamad, 1991)

With the passage of time from 1970 to 1991, the discourse of science in relation to the project of nation building evolves. From the use of modern science and technology as stated in the Rukun Negara, Wawasan 2020 subsequently calls for the added role of contributing to the future civilisation grounded in science and technology. This represents a shift in aspiration from mere consumption to active production. In the course of my interviews with experts and policymakers on the eve of the year 2020, the scientific dimension of Wawasan 2020 was discussed in relation to its continued relevance in the collective project of national development, and how the vision has yet to be achieved. For instance, Professor Noraini Idris, the Chairperson of the National STEM Movement has this to say on Wawasan 2020:

> Oh yes still *tak tercapai* (not achieved), you know? So, when he [referring to Dr. Mahathir Mohamad]…shared this with the public in the country, by right all the division involved either at the school level, the human resource, the planning of like MIDA (Malaysian Investment Development Authority), or MITI (Ministry of International Trade and Industry), trade and all those things, they should work as a team. That's why just now we are…talking about Malaysian STEM Agency to link on this thing. So actually we should pick up together…

What is reflected here is how the aspiration of science for development is a *shared* project requiring cooperation at multiple levels of society. The wide dissemination of these apparatuses at a national scale is important to gain public buy-in and support for the project of nation building. Together, both Rukun Negara and Wawasan 2020 as state apparatuses demonstrate the historical and political prominence accorded to science in the project and aspiration of national development in Malaysia. A crucial dimension of the science for development model is science's social legitimisation as a national project (Drori, 1998), which is demonstrated here in the Malaysian case. In the next section, I present how this national, state-sanctioned discourse is then translated into education policy.

5.2.2 The 60:40 Policy to Quantify Aspirations for Development

To continue tracing how the science for development model translates in the Malaysian context, I focus specifically on discourses related to an education policy known as the "60:40 policy", which was briefly mentioned in Chapter 3. Essentially, this is a policy that ascribes a numerical target for tracking students primarily by academic ability into "streams" (Hallinan, 2011), based on their examination results at the end of lower secondary education. Crafted in 1967, this policy at the national level reflects a target of 60 per cent enrolment in the science and technology (S&T) stream against 40 per cent in the arts stream of upper secondary education in Malaysia (Zainudin et al., 2015). In *Dasar Modal Insan—60:40 Dalam Sains & Teknologi* ("Human Capital Policy—60:40 in Science & Technology"), Hussin & Zakuan (2009) go into great detail regarding the history of this policy. Data also point to how the 60:40 policy is justified in relation to the subsequent supply of human capital required for the changing economy and national competitiveness. For example, the Malaysian Education Blueprint 2013-2025 (Preschool to Post-Secondary Education) introduces its section on STEM as follows:

> The Ministry will ensure that it prepares students with the skills required to meet the challenges of a world that is being transformed by the applications of Science, Technology, Engineering and Mathematics (STEM). It will also work in laying the foundations at the school level towards ensuring that Malaysia has a sufficient number of qualified STEM graduates to fulfil the employment needs of the industries that fuel its economy. (Ministry of Education Malaysia, 2013, p. 4-6)

This blueprint, the latest education reform document in Malaysia, acknowledges "a world that is being transformed by the applications of Science, Technology, Engineering and Mathematics (STEM)." Here, we can see an alignment in Malaysia vis-à-vis the literature on

the global ascendance and circulation of STEM discourse reviewed in Chapter 2. I return to the translation of this discourse in the Malaysian context in the next section.

By quantifying the enrolment numbers of students at upper secondary education that will translate into enrolment in higher education and subsequently qualified STEM labour, the 60:40 policy becomes an instrument and driver for science (education) for (economic) development. In this regard, the contemporary discourse associated with the 60:40 policy in Malaysia is its observed underachievement. The following are examples of headlines from two main newspapers in Bahasa Melayu and English gathered during the course of fieldwork from 2019 to 2020:

> Govt. worried over dwindling number of STEM students ("Govt. Worried", 2019)
>
> *Hanya 19 peratus pilih aliran Sains* (Only 19 per cent choose Science stream) (Farush Khan, 2020)

In a similar vein, Hazami Habib, the Chief Executive Officer of Academy of Sciences Malaysia (ASM) that functions as the nation's think tank on issues related to science, technology and innovation remarked:

> …during that time, the leaders already see the importance of STEM. It is good to have a target. In 1967 they already set that. When we did our Science Outlook 2015 [report], we highlight that to the cabinet. We highlight that since 1967 we have this target. And slowly now we see the percentage is going down, down, down. Latest is 18% or 21% [in S&T stream]. That's very low…

Therefore, the 60:40 policy in Malaysia reflects how the science for development model is translated into an education policy that can be quantified and tracked, thus linking science to the accumulation of human capital in service of economic development. This policy is therefore congruent with an aspect of the science for development model wherein "the

vision of national development is reduced to *economic* development, i.e. the type of national development that is easiest to quantify and easiest to monitor" (Drori, 1998, p. 52). Despite its introduction in 1967, enrolment in S&T stream at upper secondary level currently hovers between 18 to 21 per cent, instead of the target of 60 per cent. Therefore, in Malaysia, the national development aspiration via science is characterised by the inability to realise the 60:40 policy. This situation is framed as a concerning phenomenon that requires attention in the education system. In the course of fieldwork in 2020, the 60:40 policy has also undergone an adjustment tied to the adoption of "STEM" as a nomenclature in the Malaysian education system. I now turn to this theme in the next section.

5.2.3 "STEM" and the Tweaking of the 60:40 Policy

The theme *"STEM" and the Tweaking of the 60:40 policy* encapsulates the discursive shift from "S&T" to "STEM" which was observed in the course of fieldwork. I describe here the cascading of the term STEM within the Malaysian education system, and how this shift impacts the operationalisation of the 60:40 policy as a quantifier of the science for development model.

The term STEM formally entered the education discourse in Malaysia as part of the Malaysian Education Blueprint 2013-2025 (Preschool to Post-Secondary Education) (Bunyamin, 2015). Since then, the term is adopted in Malaysia as part of discussions related to science education, also demonstrated by its use in the various quotes highlighted in the previous section. In the poster called *Inisiatif Pengukuhan Pendidikan STEM* (Fortifying STEM Education Initiative) developed by the MOE that I acquired during fieldwork, STEM education is defined as follows:

> The integrated learning of Science, Technology, Engineering and Mathematics that applies the real world context by connecting education institutions, community and industry to yield talent and a STEM-literate society towards spurring national economic development.

It is clear here that the MOE—acting as an arm of the federal government—frames the utility of STEM explicitly in relation to economic development. Subsequently, the trickle of STEM into the curriculum is reflected in the new national secondary school curriculum, called *Kurikulum Standard Sekolah Menengah* (KSSM), which was gradually rolled out in 2017 beginning with Form 1 students nationwide. According to *Buku Penerangan KSSM* (KSSM Guidebook), STEM is included as one of the six core elements of the curricular framework, alongside (1) communication, (2) physical and aesthetic development, (3) humanity, (4) self-competence, and (5) spirituality, attitudes and values (Ministry of Education Malaysia, 2016).

The term STEM is subsequently reflected in the rollout of the KSSM to upper secondary education (Form 4) all over Malaysia for the first time in 2020 following the initial rollout to lower secondary education in 2017[13]. Depending on the availability of offerings at every school, students may choose from two main packages of elective subjects at the upper secondary level, which are the STEM package or the Arts and Humanities package (Ministry of Education Malaysia, 2019). Thus, despite the change from "streams" to "packages", the 60:40 divide is effectively maintained. Three options of subject combinations are offered under the STEM package based on the circular issued by the MOE:

[13] This means that students beginning lower secondary education (Form 1) in 2017 who were part of the initial rollout of KSSM—moving to Form 2 in 2018 and subsequently Form 3 in 2019—had reached upper secondary education (Form 4) by 2020. The young people in this study are part of the national cohort pioneering this curricular change.

- **Option 1:** Selecting all pure science subjects (Physics, Chemistry, Biology) and Additional Mathematics
- **Option 2:** Selecting any two of the pure science subjects and Additional Mathematics and at least one STEM elective subject in applied science and technology or one subject from non-STEM electives
- **Option 3:** Selecting at least two STEM elective subjects in applied science and technology or any one of the vocational subjects (MPV)

(Ministry of Education Malaysia, 2019, p. 10)

The above options expand the coverage and calculation of the 60 per cent target in the 60:40 policy (from only those taking pure science i.e. Option 1) to include the combination of STEM electives with non-STEM electives and vocational subjects (MPV). This policy tweak is described by Mr. Tengku, the senior officer from the JPN (State Education Department) in Terengganu, the state where Sekolah Luar Bandar is located*:*

> If we look at [this state], less than 20 per cent [select pure science subjects]…But when they change to STEM package I feel it is much…broader. Which means they can categorise vocational subjects (MPV) as STEM, and technology-based subjects. The STEM package has three kinds: STEM-pure science, STEM-technology and vocational subjects (MPV). So the probability of the percentage rising is higher. But in reality, the students selecting pure science are decreasing over time. That is what we are concerned about even though the numbers look great when we change to STEM, but beneath that…I spoke to Dr. Ihsan [Ismail], he admits [the percentage for] pure science is decreasing.

Mr. Tengku's mention of his colleague above refers to Dr. Ihsan Ismail, the Director of *Pusat STEM Negara* (National STEM Centre) who I also interviewed. Housed in the MOE at the federal level, Pusat STEM Negara was set up in 2018 to boost STEM education in Malaysia through teacher training, production of learning materials, raising public awareness and consolidation of knowledge related to STEM. Both the MOE circular and Mr. Tengku's quote above indicate how the adoption of the term STEM in Malaysian education vis-à-vis the 60:40 policy allows for the expansion of 60 per cent target to cover upper secondary

enrolment that previously was limited to pure science (Option 1 in the STEM package as highlighted above). Mr. Tengku's comment that "even though the numbers look great when we change to STEM" point to the changing quantification of the science for development model in Malaysia afforded by the nomenclature STEM. However, this changing quantification is characterised by ambivalence. While the figure tied to the 60 per cent target may rise as a result of the expanded options under the STEM package and signify the progress of the government's national development agenda, it may obscure the reality of declining enrolment in pure science as highlighted by Mr. Tengku above.

As things stand, this decline in enrolment in pure science—which is the original measure and drive of the 60:40 policy since it was introduced in 1967—is not arrested by the discursive shift to STEM. Rather, it expands what can be *measured* as part of the 60 per cent enrolment target beyond just pure science. In the next section, I trace how the science for development model is translated through the enactment of the 60:40 policy and the STEM package in Sekolah Luar Bandar, the site of interest for researching young people's aspirations for development.

5.2.4 The Tracking of Young People into Class 4-STEM

As part of RQ1, I am interested in learning about young people's aspirations for development as they navigate the 60:40 policy and the STEM package of subjects, which I argue serve as intermediaries for national development. Therefore, this section describes the in-school operationalisation of the 60:40 policy, focusing specifically on Sekolah Luar Bandar (and the young people therein) as the site of analysis.

As mentioned in Chapter 4, the 16-year old young people eligible to participate this study are Form 4 students that have been assigned to class 4-STEM[14] at the beginning of 2020 based on academic performance in the preceding year's PT3 examination, marking the completion of lower secondary education. According to the teachers in Sekolah Luar Bandar, results for the PT3 (especially in Science and Mathematics) mainly formed the basis for the school to track 11 students into class 4-STEM at the start of 2020. In this class, in addition to the core subjects, they will enrol in four elective subjects aligned with Option 2 described in the previous section. These elective subjects are Physics, Chemistry, Additional Mathematics, and a choice between Technical Graphic Communication (GKT) and Accounting Principles (PA). It is worth noting that since 2014, Sekolah Luar Bandar has not offered a combination of pure science subjects (Option 1) due to decreasing number of eligible students, echoing the downward enrolment trend at the state level mentioned in the previous section by Mr. Tengku.

This relatively small number of 11 students in class 4-STEM compared to the other non-STEM classes in Form 4 (ranging from 17 to 24 students) at Sekolah Luar Bandar reflected academic eligibility in the most lenient sense. In other words, the number of students in class 4-STEM would have been much smaller if the administration adhered to the default criteria specified by the MOE in tracking students into the STEM package. Cikgu Jun, the deputy principal in charge of academic matters, shared with me the reality:

> If we follow the criteria that are given, it's Maths and Science. At least grade B, I can't remember, I think grade B. That is the first choice. But if we look at our

[14] This is a pseudonym for the actual class name. Historically in Malaysia, it was not uncommon for classes to be called '4-Sains 1' and '4-Sains 2' for example, to denote two different Form 4 classes in the S&T stream. My choice to use the pseudonym '4-STEM' here is also an impish nod to STEM's status as a new buzzword that appears to supplant science in Malaysia.

> students, they do not meet these criteria…we might or might not have students that received at least grade B for these two subjects. Because [of that] we also take those with at least passing grade in order to fulfil the quota.

The quota that Cikgu Jun mentions above is related to upholding the 60:40 policy. Here, the school administration must ensure that there is sufficient number of students in class 4-STEM so that it remains "open". As mentioned in Chapter 3, due to the centralised education system in Malaysia, schools all over the country must implement policies that were developed far away in the metropole. Teachers, as government employees must therefore ensure their respective schools contribute to realising the 60 per cent target of STEM enrolment. Over the course of my fieldwork in Sekolah Luar Bandar from January to August 2020, the viability of class 4-STEM as a manifestation of the science for development model at the local scale appears tenuous. Indications of rupture were apparent very early in the school year. I recall my fieldnotes documenting an informal discussion with students in class 4-STEM with Cikgu Halim, the GKT subject teacher:

> We begin with a question and answer session about choosing between two different elective subjects: GKT or PA…There were 11 students in the class (six male, five female). At one point, one student (Ana) says she does not want to choose either subject…Cikgu Halim asks students who are interested to change to non-STEM classes to raise their hands (five students raised their hands)…As the session ends, a student comes in to inform that Cikgu Fahmi (the principal) wants to see the five students, which are those who intend to change to non-STEM classes. (Fieldnotes, 6 January 2020)

This arithmetic drama of "should I go or should I stay" in class 4-STEM—portending the viability of the science for development model on a local scale—forms the backdrop for my fieldwork in Sekolah Luar Bandar from January to August 2020. In midst of such decision-making that will influence their possible futures, eight of these young people originally tracked into class 4-STEM consented to participate, with varying degrees of involvement

across the study (see Table 4). In the upcoming Section 5.3, I foreground their aspirations for development. By doing this, I situate their aspirations within the context set out in these preceding sections. By the end of the chapter, I revisit and reveal the eventual fate of class 4-STEM in Sekolah Luar Bandar as a local receptacle for the science for development model.

5.3 Young People's Aspirations for Development—Technological and Global Dis/junctures with the State

As they are tracked into class 4-STEM in Sekolah Luar Bandar, the young people articulate their aspirations for development that I later contrast with the science for development model. Here, their aspirations are organised along two themes—"Maju as quotidian convenience via technological advancement" and "The balance of global desires and national distinction". Following this, I present the dis/juncture of their aspirational pathways in relation to the government aspiration at the national level. Also highlighted here is the extent to which young people's aspirational choices contribute to the viability of class 4-STEM as a local receptacle for the 60:40 policy, and thus the science for development model.

For each of the themes described below, while I foreground young people's perspectives, I occasionally weave in views of other actors inside and outside of Sekolah Luar Bandar to reflect dialogues of aspirations for development that vertically traverse the national and the local sites.

5.3.1 Maju as Quotidian Convenience via Technological Advancement

As they reflect on the promise of development, young people in Sekolah Luar Bandar yearn for a version of modernity that brings about convenience in their day-to-day lives. Through

the application of technology, the development of infrastructure and conveniences can occur, enabling them to lead more meaningful lives. In discussing what they view as the meaning of development, the young people are quick to equate it with modernity and maju (the march forward of progress):

> Development is like, the kind of development that is modern and maju (Mila)
>
> National development is like…maybe for me it is like an economy that is maju, a country that is maju, that really has a difference from then to now. (Petir)

I foreground the use of the term maju here in Bahasa Melayu, which highlights a forward direction from past to present, hinted by Petir above. In Bahasa Melayu, the term "developed country" translates to *negara maju,* suggesting a temporal direction where a country forges ahead. Although there are instances when maju is referred to in the larger scale (such as vis-à-vis the national economy), for the young people in this study, maju and modern mainly means the opportunity for more infrastructure development, right there in their kampung. In response to my question about his aspirations for development at the state or national level, Chik remarks: "If it's too far to imagine, I don't have aspirations…I usually only think at my individual level". This position points to a priority for the promise of development to be keenly and materially felt in one's immediate surroundings first. Lamenting the state of their surroundings, they aspire for it to be more modern and maju. This is exemplified by my exchange below with Wan when I asked what her aspirations are for development in her kampung:

> Wan : To be more maju
> Aizuddin : It is not maju now?
> Wan : Not maju
> Aizuddin : You mean maju in what way?

Wan : Like a lot of amenities, like a bus for instance

Aizuddin : That is not here now? Meaning now if people want to move about do they have to take the motorcycle?

Wan : Not really, usually we use an informal van service

Young people therefore highlight development aspirations tied to basic local amenities that they can materially enjoy. In essence, they are referring to quotidian conveniences that improve their day-to-day lives, the infrastructures at the local level that reflect maju more than the "too far to imagine" national scale.

Such conveniences are facilitated by the adoption of technology that enables maju, taking us "from then to now", to borrow Petir's phrasing above. Subsequently, Petir clarifies that the temporal difference from then to now can be reflected in the adoption of technology tied to ride-hailing apps such as "Grab" and "redBus" on the smartphone, which are much more convenient for traveling to Kuala Terengganu (the state capital) compared to the long wait for taxis in the past (see Figure 3 for the location of the state capital). The importance of adoption of technology to signal modernity is also shared in Ceney's view below, who pointed out other parts of Malaysia that seem further ahead than where they currently dwell:

> For example KL (referring to Kuala Lumpur, the largest city in Malaysia) has a lot of technology…In [the state of] Johor we can also see schools are using thumbprint [technology] now. Here we don't have that. For example if we do development here we won't be too excluded from others right?

Technology here is therefore seen as instrumental for a sense of inclusion in the wider project of development. In my encounters with the young people in this study, they demonstrate a keen interest in technology, even when they are faced with challenges especially related to unstable internet connection and purchase of internet data plans. The

aspirations of young people tied to infrastructure in the specific locality of Sekolah Luar Bandar is echoed by Mr. Tengku all the way in the state capital of Kuala Terengganu, which has seen much more infrastructural development compared to the periphery. He observes:

> …even the government is not interested in developing that area. So how long will that continue?…Not just investment in terms of buildings, but infrastructure, especially internet. Create job opportunities, they need hubs to start online businesses. That doesn't happen if it is focused in the bandar centre. It means that in interior areas, maybe the focus should be on districts as the centre.

The centrality of technology in young people's lives is a dimension that warrants more attention. In this study, the young men especially demonstrate a keen interest in technology, which they frequently shared with me. There were a lot of conversations around mobile games, racecars and surfing the internet. The teachers also highlighted students' increasing use of mobile phones over the years as tools of leisure and socialisation, which they claim distracts students from formal learning in school. An example of interest in technology is also presented here by Petir, who shares a photo from a training facility he visited with his father, shown in Figure 10.

Accompanying the photo, he comments on how interesting this Integrated Building Systems (IBS) technology is, and imagines he could build a "gaming room" with it. Collectively, young people's interest in technology point to their desires to benefit from it, to be part of the project of maju. I place the aspirations of quotidian conveniences tied to technological advancements in relation to the aforementioned science for development model. As evidenced above, young people in the luar bandar indeed express aspirations for development reflected by the Rukun Negara preamble: "Build a progressive society that uses modern science and technology". In order to progress forward and become maju, the young

people reflect aspirations tied to the adoption of technology that will improve infrastructure, mobility, and connect them with the world beyond the luar bandar.

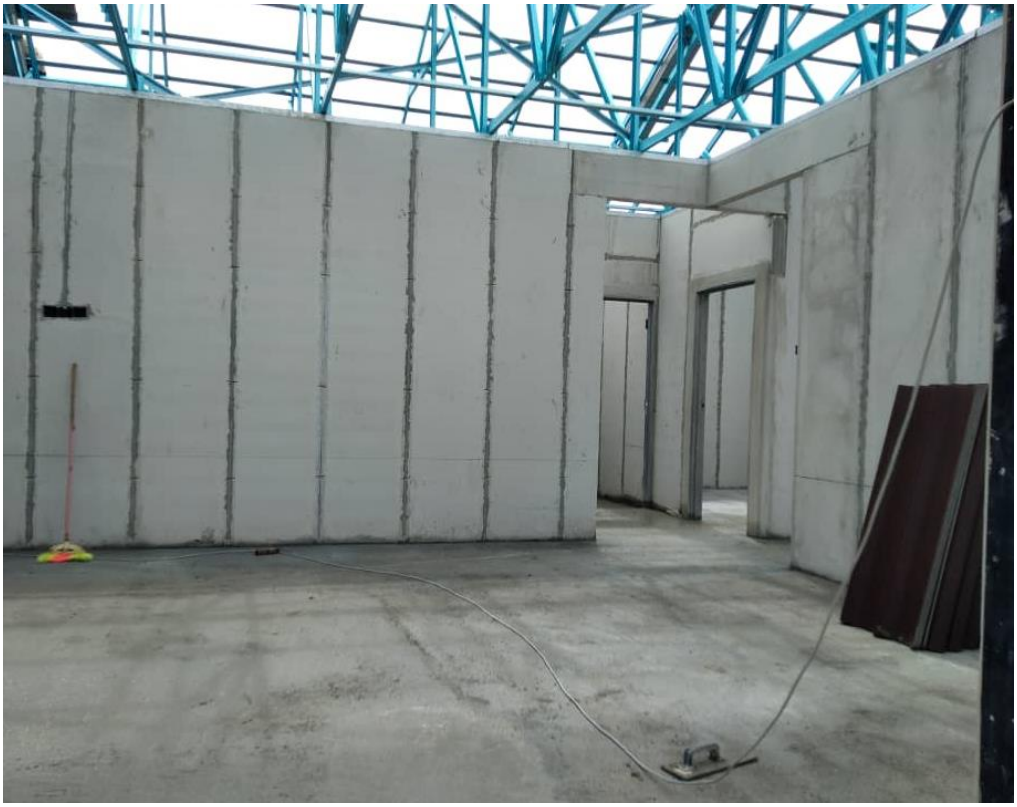

Figure 10: Petir shares a photo of a building technology he encounters at a training facility

However, what is interesting is how these aspirations *shared* with the science for development model may or may not be linked with the translation of this model at the local level. This is to say, although there is consensus in aspiration between the government and young people in the luar bandar on adoption of technology, such aspirations do not necessarily translate into their choice to remain tracked in class 4-STEM at Sekolah Luar Bandar, thus contributing to human capital in STEM for the country. I return to this dis/juncture later on. For now, I pick up and expand on the thread of young people connecting with the world

beyond their locality, as they gaze outwards into the global realm and continue expressing their aspirations for development.

5.3.2 The Balance of Global Desires and National Distinction

The participating young people in Sekolah Luar Bandar looked outwards into the global stage when comparing and discussing aspirations for development, despite their location in a geographic periphery. Nevertheless, globalised benchmarks are also tempered by a desire for distinct nationalism.

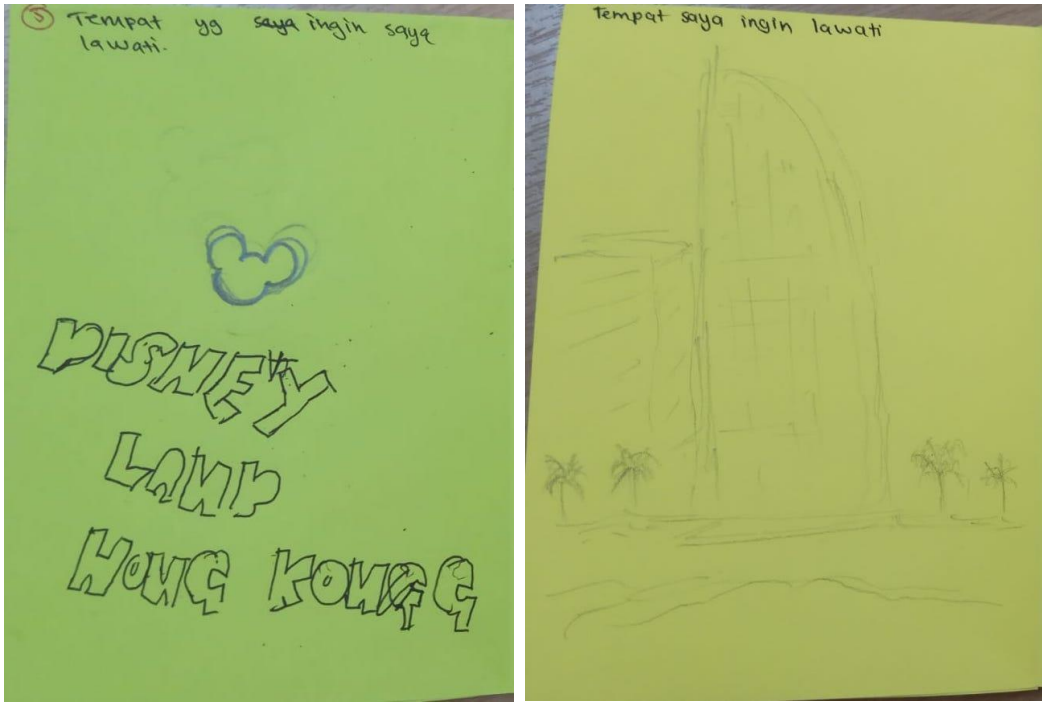

Figure 11: Mila (left) and Wan (right) sketch places they wish to visit

To begin, on the individual level, some young people express their wish to travel outside of their locale to other parts of the world in order to gain new experiences and broaden their horizons. Figure 11 highlights Mila and Wan's responses to the question of where they

would like to visit. Both locations they highlight (Disneyland and Burj Al-Arab) are emplaced in cosmopolitan cities that in successive moments of recent history have stood as beacons of modernisation: Hong Kong and Dubai.

Additionally, following on from the previous theme on technology, young people use their access to the internet to reach out into the global realm. For instance, H4lfiey shares that he plays mobile games with "the whole of Asia". Meanwhile, in discussing development and the environment, Ceney relays an example related to development and the environment sourced from outside the national boundary:

> If we follow other countries, eastern countries like Japan they will dispose waste properly in the bin, if they litter they will be fined.

Aside from Ceney, other young people also cite Japan as an exemplar. Damia talks about more political stability there compared to at home, while H4lfiey aspires to study architecture in that country because he feels the people are decent, clean and respectful. Adopting such countries as benchmarks indicates the young people's favourable attitudes towards modernisation in the luar bandar, which Drori (1998) argues is one of the socialisation effects of science education as part of the science for development model.

Additionally, young people's specific attention to Japan is aligned with the enduring legacy of the Dasar Pandang Ke Timur (Look East Policy), which was an anti-Western economic development strategy mooted by Dr. Mahathir Mohamad, the fourth Malaysian Prime Minister early in his premiership in 1982 (Furuoka, 2007). Recall that I had previously highlighted this policy in Chapter 3. Indeed, as they benchmark Malaysia against other countries in terms of development, the experts and policymakers I interviewed also make

reference to Japan. Dr. Madeline Berma, a Fellow of the ASM and expert in development economics remarked about Dr. Mahathir Mohamad's legacy in relation to Japan:

> Now, you must understand Tun Mahathir. Tun Mahathir is a hardcore nationalist. Real, real, real nationalist. That's why he is very much influenced by the Japanese, the Japanese model and he, I mean, there is no shame to it. He admitted it. So, the Japanese are very, very proud people…Because Japanese will do anything in order to perfect something, they don't do things to please others. "It is about me, if I am a sweeper I must be the best sweeper. If I am a researcher, I must be [the] best"…I think Tun Mahathir saw it that Japan can develop without having to let go of whatever that is Japanese…

Reminiscent of Dr. Mahathir Mohamad's stance above, the participants' global outlook in articulating their aspirations for development is also tempered by the need to form a distinct national identity. For example, H4lfiey highlights how Malaysia needs to

> compete with other countries…To develop the country so it is well known. If the country is developed people will respect it…People are more attracted to a country that is well known.

This desire for a distinct national identity that is subsequently acknowledged on the global stage is encapsulated in the following exchange between Mila and myself. Here, she gingerly describes her aspiration to open a bakery overseas, having watched a number of television shows like "Kids Baking Championship" and "Cake Boss":

Mila	:	If I can, I want to open a company overseas…[she laughs]
Aizuddin	:	Okay, why overseas?
Mila	:	It's okay, scratch that. I want to open one in Malaysia. Maybe a place like…
Aizuddin	:	Overseas is also possible. A lot of Malaysians start businesses overseas. But why overseas?

Mila : Because, so that, so this bakery is famous, so that *orang putih*[15] (white people) know that Malaysian bakeries make delicious cakes.

Aizuddin : But will the cakes be Malaysian cakes? Or not necessarily?

Mila : A mix of Malaysian and orang putih's cakes.

This anecdote succinctly sums up the theme of young people's aspirations for development, which reflect a balance between globalised desires and national distinction. Young people in this study demonstrate a desire to partake in the global community, while carving a distinctive national identity that is acknowledged by others. In the next section, I explore if they see themselves contributing to this project of national distinction in ways that align with the science for development model espoused by the state.

5.3.3 Dis/juncture of Aspirational Pathways

In this section, I highlight the dis/juncture between young people's aspirations that were previously described (Sections 5.3.1 and 5.3.2) and the manifestation of the science for development model driven by the federal government (acting on behalf of the Malaysian state). Here, I take dis/juncture to mean the hybrid instances of alignment between aspirations of the young people with the state's science for development model (juncture), coupled with misalignment that may compromise the fulfilment of national aspirations for development (disjuncture). Specifically, I focus on how young people see the utility of enrolling in class 4-STEM (a localised manifestation of the science for development model presented in Section 5.2.4) towards the realisation of their aspirations for development.

[15] The term *orang putih* here is a description used in Bahasa Melayu to describe the white person, a terminology inherited from colonial times. For a contemporary exploration of this term in the Malaysian context, see Schultz (2020).

In relation to the aspiration of national distinction highlighted in the previous section, young people speak of *menaikkan nama negara* (raising the name of the country) so Malaysia is recognised internationally. However, it is worth noting that only one young person connected this task of raising the name of the country with the utility of enrolling in class 4-STEM. Here, as he comments on students leaving class 4-STEM (recall that initially there were 11 students), Ceney articulates how being in the class is related to the aspiration of national distinction:

> The role [is] to raise the country, like to make it a modern country, so we need to learn technology. For example, now class 4-STEM only has six students. Many go to the lower class (referring to non-STEM classes in Form 4). So we need to change: higher class (referring to 4-STEM) more [students] than lower class…Class 4-STEM offers more employment opportunities and [we] learn about technology, so we can create technology to *menaikkan nama negara*.

The way that Ceney describes the utility of enrolling in class 4-STEM represents an alignment with the state's science for development model, noting that he is in favour of having more students in class 4-STEM (thus contributing to the 60 per cent in the 60:40 policy). However, other young people do not connect their aspirations for development in Sections 5.3.1 and 5.3.2 with their tracking into class 4-STEM in the manner that Ceney has. In the course of the interviews, they do not make a direct connection between the utility of being tracked into class 4-STEM and the possibility of realising the aspirations they have articulated, even when these aspirations are shown to overlap with elements of the science for development model. I observe this disconnect as an instance of disjuncture.

Despite the above disjuncture, there are moments where the young people do highlight the utility of enrolling in class 4-STEM, either directly or indirectly tied to their individual

aspirations, rather than broader aspirations for development overlapping with government priorities. I explore these direct and indirect utilities as junctures between the young people in this study and the Malaysian state. Some young people see the value of their tracking into class 4-STEM with respect to their own immediate, individual career aspirations that require them to enrol in the subjects offered as part of the STEM package. This is exemplified by the aspirations of Wan and Chik. Wan, who obtained the best performance in PT3 in Sekolah Luar Bandar the previous year, was quite clear that her aspiration of becoming an engineer required that she stay in class 4-STEM to take the elective subjects offered there. Meanwhile, Chik left class 4-STEM and Sekolah Luar Bandar in late January 2020 in order to enrol at a technical school in the state capital. Chik also informed me that his plans of working in air traffic control require him to study the subjects as part of the STEM package which he selected in that technical school (Physics, Chemistry, Additional Mathematics, Electrical and Eletronic Engineering Studies).

Subsequently, Mila and Damia highlighted the indirect benefit of being in class 4-STEM although they do not aspire to STEM careers for themselves. Instead, they relate studying in class 4-STEM to brighter prospect in higher education. When I asked Damia—who in February 2020 transferred into Sekolah Luar Bandar from another school in the town centre—if it was important for her to remain in class 4-STEM in relation to her aspiration of becoming an English teacher, she responded:

> Damia : Important because when we take the science stream (she uses the previous terminology which has now been replaced with "STEM package"), it will make it easier for us to enter university.
>
> Aizuddin : How does it make it easier?

Damia : Because most universities take students who choose the maths…and science stream.

In the same conversation, she informs me that the guidance counsellor in her previous school also points out she may have a bright chance to become a teacher because she is taking the STEM package. This notion of broader opportunities opened up in higher education for students pursuing the STEM package is repeatedly highlighted by teachers. I recorded the following exchange with Sekolah Luar Bandar's principal, Cikgu Fahmi in my fieldnotes:

> I sit down outside of the mosque with Cikgu Fahmi and ask about his meeting with the five students from class 4-STEM that want to change to the non-STEM class. He says it seems that no one is changing after the talk he gave because he had given them time to think and if they were still keen on changing classes, then they would need to come with their parent/guardian to see him. He tells them that of course when they take the STEM class they will lose the chance to win the "best student award" because it's much harder to get better grades with the STEM subjects. They might even fail papers like Add Maths and Physics. But in his opinion the certificate for STEM subjects is still much more valuable than arts. He gives the example that those in STEM can still opt to be a journalist, but students in the arts cannot become doctors. (Fieldnotes, 8 January 2020)

The notion of broader opportunities as described by Damia and Cikgu Fahmi here point to how "science education enjoys high levels of legitimacy and receives high status, relative to other topics", further advancing the science for development model (Drori, 1998, p. 56). Additionally, in Sekolah Luar Bandar, the way teachers and students use the term *turun kelas* (Bahasa Melayu for "going down" to a class deemed of lower prestige) when switching from class 4-STEM to a non-STEM class in Form 4, also points to the higher status accorded to STEM in the school. Alongside this phenomenon of turun kelas, I take on the broader fate of class 4-STEM in relation to the science for development model in the next section.

5.3.4. The Fate of Class 4-STEM and the Science for Development Model

The tracking of young people in this study into class 4-STEM in Sekolah Luar Bandar is a school procedure that upholds the 60:40 policy, which in turn quantifies the science for development model in Malaysia. Here, I present the fate of class 4-STEM by the end of my fieldwork, which is connected to the aspirational choices the young people make as well as the translation of the science for development model.

Despite the high status and legitimacy of STEM described in the previous section, the population of class 4-STEM slowly dwindled from the initial 11 students in January 2020. By the end of January, two students (including Chik) left Sekolah Luar Bandar to enrol in a technical school in the state capital, Kuala Terengganu. One student left to enrol in a school in the town centre, a 20-minute drive from Sekolah Luar Bandar. In February, Damia transferred from that same school in the town centre to join Sekolah Luar Bandar and class 4-STEM, only to return to that school in July of the same year. From January to March 2020, four students (including Petir and Ana) switched to a non-STEM class. Even when young people demonstrate aspirations for development that may overlap with elements of the science for development model, it does not necessarily translate into a choice to remain tracked in class 4-STEM. For example, Petir and Ana turun kelas—"going down" to a non-STEM class—both not aspiring to STEM-related careers. For example, Petir reflects on being placed in class 4-STEM:

> I know it's about learning science, things like that, but the science is more in-depth, Chemistry and Additional Mathematics right?…But actually, before I found out my [PT3] results and got placed in this class, I already thought I want to join the commerce [class], that's why. Because I am interested in commerce.

Due to the various movements described above, only four of the young people remained in class 4-STEM by the time I left the field in August 2020: Wan, Mila, H4lfiey and Ceney. Their choices to remain in class 4-STEM are motivated by different reasons. As previously mentioned in Section 5.3.3, Wan aspires to become an engineer and needs the elective subjects in class 4-STEM as prerequisites for higher education. Mila, H4lfiey and Ceney all describe career aspirations that do not require such prerequisites. This means that to select courses in higher education aligned with their respective career plans, unlike Wan, they do not require qualifications tied to the elective subjects in class 4-STEM. Ceney says he can turun kelas to a non-STEM class but decides not to because he enjoys Chemistry and GKT. Mila also confirms she can pursue pathways to realise to her aspiration without being in class 4-STEM. She stays because the non-STEM elective (Accounting Principles)[16] she takes in this class may be useful for her future cake business. What about H4lfiey?

> H4lfiey told me that his sister came to school to meet Cikgu Fahmi (the principal) about his intention to turun kelas and Cikgu Fahmi says they need to write a letter [to him in order to formalise this request]. (Fieldnotes, 10 March 2020)

As described in my fieldnotes above, H4lfiey was thinking about turun kelas and had put in some effort in that direction, but eventually that letter to Cikgu Fahmi never came into being. He remained in class 4-STEM when I left the field. In relation to this dwindling number of students in class 4-STEM, Cikgu Malik, the physics teacher who has taught at Sekolah Luar Bandar since its inception observes:

[16] As mentioned in Section 5.2.4, students in class 4-STEM take Physics, Chemistry, Additional Mathematics, and a choice between Technical Graphic Communication (GKT) and Accounting Principles (PA) as electives. Mila is the only one who chose PA, which is a non-STEM elective. See Option 2 for the STEM package specified in Section 5.2.3 for a description of this combination of elective subjects.

> It's declining. If I recall in 2009 we had almost 20 students in the class. Every year there has been a downturn, until now, the Form 4 currently, only four students. One has moved (referring to Damia), only four are left.

The declining number of students in class 4-STEM must be understood within the broader regional and also even global context. Indeed, Cikgu Malik reminds me that interest in STEM on a global scale is waning, suggesting there are more consumers than creators these days. Particularly among industrialised nations, this concern on the declining interest in STEM has been reported in the literature, suggesting a threat to competitiveness and economic development (Holmes et al., 2017; Sjøberg & Schreiner, 2010; van Griethuijsen et al., 2015). Returning to the regional context, teachers in Sekolah Luar Bandar have informed me that a few secondary schools in the district have closed down classes that offer the STEM package over the years, in effect foreclosing opportunities for those who might be inclined. For instance, Cikgu Salmah, the chemistry teacher who joined Sekolah Luar Bandar at the same time as I began fieldwork, informed me about three schools (*sekolah*) in the district:

> Before this Sekolah X, but that was a while ago. Sekolah Y doesn't even have a STEM class [since it was established]. This year it is Sekolah Z, for their Form 4. They still have Form 5 [STEM]…Maybe [the decision] is from JPN or PPD (State or District Education Offices)…because it is not easy to close down STEM classes.

There are teachers in Sekolah Luar Bandar that fear their school is also heading in that direction. They are concerned about the impact of the closure of classes offering the STEM package on benefits and broader opportunities for their students as described in Section 5.3.3. On the other hand, some teachers welcome the possibility of closing the STEM class, feeling that the young people will actually be better off. This is especially if they are not academically equipped to handle the rigour of STEM subjects, evidenced historically by

examination grades of students in class 4-STEM by the end of secondary school. I recall a moment early in the school year, even before class 4-STEM was left with merely four students:

> I tell [Cikgu Halim] about one student in class 4-STEM who wants to switch to the non-STEM class. Another teacher, overhearing us, laments that he has been saying for a while that the STEM class should be closed down. He says: *Kita membunuh pelajar kita sebelum mereka terbunuh.* (We are killing off our students even before they are killed) (Fieldnotes, 5 January 2020)

This striking comment points to some teachers' belief that by enrolling in non-STEM classes, students may actually complete secondary school with better grades that offer brighter prospects for higher education. The opposite, enrolling in class 4-STEM, results in what is akin to *bunuh* (Bahasa Melayu for "killing", here referring to the extinguishing of opportunities) instead of the broadening of opportunities claimed by Cikgu Fahmi in Section 5.3.3. In fact, the broader opportunities afforded by the STEM package can be seen as *contingent* on gaining academic grades that can activate such opportunities by the end of secondary school. Reflecting on students' academic performance over the years, Cikgu Maryam, the head for science and mathematics panel in Sekolah Luar Bandar—who has also taught at the school since its inception—describes this contingency as follows:

> If their [academic] grades are okay then there are a lot of advantages, right? But if their results are a lot of G (failing grade), I don't know where that advantage is. If they pass all the subjects, it does not matter A or B, but pass all subjects, then their opportunities are very broad, compared to those that get 6As, 5As in the ordinary stream (here she uses "ordinary" to refer to the arts and humanities package). But if they get up to 4Gs, for example, then in the end they are the same as these students in the ordinary stream who get 5As. Because on our certificate, if you get a G then that [subject] is not recorded right? It looks like less [subjects than you actually took].

Therefore, the broadening of opportunities catalysed by the STEM package—and the realisation of young people's aspirations riding on the promise of such opportunities—is

contingent upon getting the right grades that will activate those opportunities. A challenge is posed when young people are tracked into class 4-STEM in the manner highlighted by Cikgu Jun in Section 5.2.4, whereby the default academic requirement (at least B in Science *and* Mathematics in PT3 examination) is severely relaxed (at least E in either Science *or* Mathematics) in order to ensure that class 4-STEM can be populated with students to remain open, hence upholding the 60:40 policy[17].

The young people's choices associated with (de)populating of class 4-STEM in Sekolah Luar Bandar reflects the multifaceted dis/junctures between their aspirations for development (including self-development) and that of the Malaysian state through the science for development model. This means that in this study, young people's articulation of aspirations for development, and the choices they make in relation to such aspirations, show instances that cohere with and also compromise the science for development model driven by the federal government. Other than leaving class 4-STEM, how else is the national aspiration compromised? Teachers inform me that historically, the majority of students taking what is now referred to as the STEM package at Sekolah Luar Bandar do not pursue higher education and careers in STEM after the SPM examination at the end of secondary school. Cikgu Jun, who is responsible for keeping track of class 4-STEM's fate in her capacity as deputy principal summarises this trend:

> …with their average grades, to enter science fields after SPM is a heavy burden. Eventually, even though they came from science classes (referring to 4-STEM) they

[17] Out of all students that took the PT3 examination at Sekolah Luar Bandar in 2019, only eight students met the minimum "relaxed" standard i.e. passed all subjects with at least a grade 'E' (equivalent to 12 per cent of the cohort). These eight students were then tracked into class 4-STEM in 2020, together with three more students on the advice of Cikgu Nor, the school's guidance counselor.

> will return to the arts. For example, the students that go into Form 6[18], they don't go into the science class, even if they came from science class (4-STEM, then 5-STEM), they will still go into arts. Maybe their abilities mean they can't handle [STEM]. So it's a shame actually if we think in terms of their post-SPM paths. But it is what it is. We can't change in terms of policy, 60:40 right? We have to follow.

Cikgu Jun's observation on ability and grades here are linked with the earlier points on relaxed academic criteria for tracking young people into class 4-STEM, as well as the contingent broadening of opportunities through STEM in relation to the right grades. Her final point about teachers' inability to "change in terms of policy" and having to "follow" the 60:40 policy speaks to the context of Malaysia's centralised education system and the lack of autonomy accorded to teachers. Whatever their views may be, teachers must serve as implementers of the federal government's development agenda through education at the school level. Contrasted with Morarji's (2016) study in the rural Indian contexts, teachers in Sekolah Luar Bandar, as demonstrated here, offer multiple instances of scepticism of their role as key agents of rural development through the realisation of the 60:40 policy at the school level.

Returning to the young people whose lives are ordered by the 60:40 policy, I ask: What does this mean for the aspirations and futures of young people remaining in class 4-STEM? This remains to be seen. One thing is clear. If the 60:40 policy is seen as a pipeline for producing human capital in STEM, thereby realising national aspirations moulded by the science for development model, then young people in Sekolah Luar Bandar historically do not "follow/flow through" this pipeline beyond secondary school. What this suggests is that even when the government shapes education and development policy in such a way that it

[18] As previously highlighted in Chapter 3 (Section 3.4.2), Form 6 is a pre-university education that bridges the end of secondary schooling and higher education, resulting in a qualification known as STPM (equivalent to the A-Levels in England).

orders young people's lives, still there is agency—however thin—among the latter in terms of deciding to flow through or leave the STEM pipeline within and beyond secondary school. Ultimately, this means that the science for development model as translated in Sekolah Luar Bandar does not mould young people's aspirations in a totalising or deterministic way. To various degrees, young people therefore negotiate their placement in class 4-STEM to suit what they believe will pave the way for fulfilling their aspirations, as they pursue the kind of lives that they value most.

5.4 Summary of Findings

In this chapter, drawing on the perspectives of young people (including from participatory activities), policymakers and experts, teachers, discourses in written documents and extensive fieldnotes, I have constructed and weaved together a set of themes to address the following research question:

> RQ1: How does the science for development model translate in the Malaysian context and what are young people's related aspirations for development in the luar bandar?

Drori's (1998) science for development model was used as a guiding lens in analysing the empirical data to identify the ways in which Malaysia's education system internalises the global science and STEM discourse in relation to its development priorities and apparatuses. Here, the science for development model is reified and translated in a cascading manner, from state apparatuses and discourses originating from the metropole, thence trickling down to the local level through education policy and procedure. Instruments such as the Rukun Negara and Wawasan 2020 driven by the federal government provide historical, public-facing anchor points for integrating science as part of the *national* aspiration and collective

project of development. Within the education context, the 60:40 policy quantifies this national aspiration, subsequently expanding the coverage of the 60 per cent component of this policy via the discursive adoption of STEM. This occurs within the contemporary context where the policy is characterised by decline, yet to be realised since its origin in 1967. Finally, a local receptacle of the science for development model takes the shape of class 4-STEM within Sekolah Luar Bandar, the principal site for studying young people's aspirations for development. The tracking of young people in this class in service of the 60:40 policy sets to scene for elucidating their aspirations for development.

In the context of the science for development model, young people in Sekolah Luar Bandar describe aspirations for development characterised by an inclination towards technological and global desires despite their emplacement in the geographic periphery. In the first theme tied to technology, they describe development as maju, prioritising the expansion of felt conveniences on the local scale—the day to day, quotidian comforts rather than abstract, "too far to imagine" national development. An affinity with the potentials of technology for driving development here aligns with the science for development model. The second theme of aspiration among young people is a desire to look outwards beyond their rural locality, benchmarking development at home with global exemplars, such as Japan. However, such outlook is tempered by the desire for a distinct national identity that will be legitimised by actors on the global stage. The positive attitudes towards modernisation reflected in this theme are also reminiscent of the goals of the science for development model. When specifically considering their tracking into class 4-STEM in Sekolah Luar Bandar (the local translation of the science for development model), a disjuncture with the Malaysian state is identified. Young people scarcely connect the abovementioned aspirations with the roles the

federal government expects them to fulfil by tracking them into class 4-STEM—to contribute to the realisation of the 60:40 policy and subsequently form the human capital in STEM for national development.

Nevertheless, alignment with government agenda is captured by young people's aspirational choices to remain in class 4-STEM. Some choices to stay or leave tie directly to young people's aspired careers; leaving class 4-STEM is associated with career plans outside of the field. Nevertheless, the (contingent) broadening of opportunity may be reason enough to stay even when aspiring to non-STEM careers. Young people's aspirational choices are nuanced and affected by teachers' procedural moves to ensure class 4-STEM remain open; this is despite the decline in the number of students over the years and their middling academic grades. The latter throw into question young people's follow/flow through the STEM pipeline represented by the 60:40 policy, and thus the science for development model as represented in Sekolah Luar Bandar. Despite being initially tracked into class 4-STEM, young people demonstrate various instances of negotiating such placement in relation to their aspirations and desired futures. Next, I turn to a broader consideration of placement, focusing on young people's day-to-day experiences living in a particular site in the Malaysian luar bandar, and their associated aspirations of development in relation to that site.

CHAPTER 6: Ambivalent Aspirations around Sekolah Luar Bandar

6.1 Introduction

The second research question (RQ2) that guides this chapter is as follows:

> RQ2: How does the national development discourse translate to the luar bandar and what are young people's related aspirations for development based on their day-to-day experiences?

This line of inquiry attends to young people's lived experiences in the community within which Sekolah Luar Bandar is located, and how such experiences are associated with their description of aspirations for development. In other words, I pay attention to how the particularities of place—and the experiences therein—colour their aspirations about the kind of lives they value. To do this, Section 6.2 provides a characterisation of the luar bandar in the national development discourse. Through reflexive thematic analysis of interviews with experts and policymakers coupled with relevant documents, I provide the macro context within which Sekolah Luar Bandar and its surrounding community are situated. This enables vertical comparison of aspirations for development (between the national and the local) in the subsequent sections. Section 6.3 then zooms in to describe the community that constitutes the principal site of this study in the Malaysian luar bandar. Against the contextual backdrop of these preceding chapters, young people's aspirations for development are then elucidated in Section 6.4. In this and the preceding section, the perspectives of young people via interviews and participatory activities are weaved with that of their teachers, experts and policymakers, information from relevant documents as well as

accounts from my fieldnotes. They are also placed in dialogue with relevant dimensions from Section 6.2. Finally, Section 6.5 summarises the findings of this chapter.

6.2 Luar Bandar in the National Development Discourse

Attention to the semantic clues in the equivalent term for "rural" in Bahasa Melayu guides the macro level characterisation in this section. Recall from Chapter 1 that the term luar bandar literally means "outside of the city". Thus in analysing the associated national development discourse, I pay particular attention to how descriptions of the luar bandar necessarily relies on the bandar (the city) as its reference point, benchmark and aspirational standard. Similar to Oyarzún's (2020) observation in Chile, here, rural in Malaysia is defined as a residual category with reference to the bandar. Thus the themes constructed here reflect the relationship and reliance of the luar bandar with and on the bandar. Guided by the literal meaning of this compound term, I consider the various ways in which luar bandar is *other* to the bandar and may be *linked* to the bandar.

6.2.1 Luar Bandar as Less Than Bandar

Placed outside of the city, characterisations of the luar bandar portray how it stacks up against the bandar. A narrative of deficit thus pervades, chiefly through the notion of the gap between the bandar and luar bandar and how it needs to be closed. What lies in this gap is described along lines such as economic development, career opportunities, education, infrastructure and poverty. In the Dasar Pembangunan Luar Bandar (Rural Development Policy) published by the Ministry of Rural Development Malaysia (2019), luar bandar is described in such terms:

> The environment of low-technology industry, low level of human resource, low level of research and development (R&D) as well as the low value-added rate causes low levels of productivity in luar bandar. This situation leads to the low growth of the industrial sector output that subsequently leads to a gap and imbalance in economic development between the bandar and luar bandar. (p. 4-4)

Descriptions in the above quote demonstrate how low levels are determined relative to that of the city, in this case with reference to industrialisation. Some "lows" are described in ways that cause other "lows" in the luar bandar. Related to this, deficit narratives also paint luar bandar as a site of poverty, associated with low income, opportunities and economic growth. The rural deficit discourse here aligns with those described in the literature that lays bare the troubling framing of rural spaces and inhabitants as lacking, problematic and backward (Reid et al, 2010; Sriprakash, 2016; Zipin et al, 2015). Further to this, in the press conference following the delivery of her New Year address of 2020, the Minister of Rural Development, Rina Mohd Harun articulated her aspiration:

> I hope starting this year, activities for the development of socio-economy and human capital of the luar bandar society are implemented holistically so that after 2030 the luar bandar society is no longer associated with poverty. (BERNAMA, 2020)

Differences in economic development compared to the bandar are also observed in Terengganu, the state where Sekolah Luar Bandar is situated. For example, Mr. Tengku turns his eye towards KL, the commercial capital of Malaysia as he compares the situation in his state:

> In Terengganu, in terms of physical changes it is not as vibrant compared to KL and others. Maybe it's the factor of economic growth. Even if shophouses are constructed, who is going to rent them? The people are not there to fill those places, they cannot afford to.

In addition to low income and poverty, "people are not there" also reflect the shrinking of population in luar bandar nationally to due intensive migration into the bandar over the years. According to the Ministry of Rural Development Malaysia (2019), the proportion of population in luar bandar will continue to decline from 29 per cent in 2010 to only 18.8 per cent projected in 2030. One of the experts I interviewed, Dr. Madeline Berma, critically observes the normative push of people from the luar bandar to bandar as being related to one of the economic functions designated to the luar bandar:

> It must become the supplier of human resource. So…it's OK for them to migrate. Why? Why do you need them to migrate?...Some of them don't want to migrate. Income must be higher here ((she indicates this hand as urban, the other as rural)). So that this one ((rural)) can go here ((urban)).

Because of the lows, lacks and deficits of the luar bandar as described above, increasing proportions of people are migrating from the luar (to the) bandar, even if they "don't want to migrate". By declaring the bandar as the standard—the site of attraction, the centre—the government thus positions and contributes to the luar bandar's diminishment over time. This is plainly stated in the aforementioned Rural Development Policy:

> Bandar is the centre of economic growth and main centre of administration, wherein many job opportunities and amenities are provided. This attracts many from the luar bandar to migrate to the bandar to search for better life opportunities such that it causes the population of the luar bandar to continue decreasing. (Ministry of Rural Development Malaysia, 2019, p. 2-1)

The decrease of the population in the luar bandar over time minoritises associated places and peoples, hardens the difference between this category and the bandar, as well as contributes to its othering. Here, attention to the material and symbolic effects of official naming—rural as luar bandar, as *outside* of the city—is reminiscent of Bourdieu's (1991) claim that

> the symbolic strategies through which agents aim to impose their vision of the divisions of the social worlds and of their position in that world can be located between two extremes: the insult…and the *official naming*, a symbolic act of imposition which has on its side all the strengths of the collective, of the consensus, of common sense, because it is performed by a delegated agent of the state. (p. 239)

Through the act of officially naming spaces outside of the normative aim as the "luar bandar", the federal government therefore reifies the symbolic and material differences that characterise such spaces as being other than the bandar. In the next section, I turn to how such othering motivates the government to develop the luar bandar such that it is in service of the bandar, and to become subsumed by the bandar.

6.2.2 Development and/in the Luar Bandar

Given my focus on aspirations for development, here I present the development priorities at the *official* national level in order to set the comparative scene for young people's own aspirations later in this chapter. Thematic analysis reveals such priorities along the lines of economic, technology and capability development.

The aforementioned Rural Development Policy is presented as the "latest effort to provide a long-term framework for development of the luar bandar towards making Malaysia a maju[19] nation that is prosperous and high-income" (Ministry of Rural Development Malaysia, 2019, p. 1-9). This policy document builds upon prior visions of development on the quest to make Malaysia a developed country. Wawasan 2020, the vision that was described in Chapter 5 in relation to science for development, also highlights the purposes that the luar bandar is meant to fulfil in the project of national development. It states:

[19] Recall how the young people also adopted this term to describe their aspiration for development in Chapter 5 (Section 5.3.1).

> Nor can we afford to neglect the luar bandar sector of our economy and society. In the years ahead, we must work for a second luar bandar development transformation, restructuring the kampung so as to be compatible with both agriculture and modern industry. Less and less farmers should produce more and more food, thus releasing manpower for an industrial society. (Mohamad, 1991)

The policy line here presents aspirations for the luar bandar to serve its dual purpose as a feeder in Malaysia. The kampung, as disorganised dwellings in the luar bandar that need "restructuring", shall feed the mouths of the populace whilst also feeding manpower—via outmigration—for industrialisation. Whilst the luar bandar is framed as other than, and needing to catch up with the bandar, a postcolonial reading of the bandar as the metropole shows that the luar bandar plays an important role in constituting and sustaining the bandar. Simply put, for all the deficit descriptions of the luar bandar in the national discourse, these places play a central role in ensuring the material survival of the bandar.

Science and technology are crucial components for realising the role ascribed to the luar bandar. The Rural Development Policy makes extensive mention of technology applications such as the use of drones in agriculture, in light of the Fourth Industrial Revolution and national food security. In the context of education, depictions of scenarios in the luar bandar in STEM subject textbooks used by young people in class 4-STEM were sparse. If any, these depictions are related to the portrayal of rural people in agricultural roles, and discussions of science and technology in relation to this role. Given the centralised nature of the education system in Malaysia (Bush & Ng, 2019) as previously highlighted in Chapter 3 (Section 3.4.1), these are textbooks published by the MOE and used by all public schools across sites in the bandar and luar bandar. In the chemistry textbook, there is a reference to chemical fertilisers for agriculture. Additionally, consider an image from the physics textbooks presented in Figure 12.



Figure 12: An image of a community in the luar bandar in the Form 4 physics textbook

Figure 12 shows a situation in a durian orchard where a family is gathering the fruit during a harvest at night. The son (left) asks the father why durian falls to the ground from the tree (typically a sign of ripeness) while the daughter in the middle asks why the moon revolves around the earth. The father (right) jokes that his children are thinking like Isaac Newton. This is a depiction of a seasonal scene in the luar bandar that I am familiar with in relation to my own family background. It demonstrates the portrayal of the agricultural role *in* and *of* the luar bandar, organised around the harvest of food for the family and as part of the supply chain to the bandar. This follows the statement outlined in the Rural Development Policy, whereby "the luar bandar sector plays the role to fulfil the demand of production, including the input of the agro industry and the food requirements of society in the bandar area" (Ministry of Rural Development Malaysia, 2019, p. 4-2).

Education plays a central role in the development of the luar bandar. The data indicates dimensions of technological and financial literacy as well as technical and vocational education and training (TVET) with an emphasis on producing entrepreneurs. STEM can be seen as complementing TVET-related capabilities to encourage entrepreneurship in the luar bandar. Professor Noraini Idris of the National STEM Movement describes an instance of such effort at a local university (Universiti Malaysia Kelantan, UMK) in the region of the study site:

> UMK is…to train entrepreneur. So we also use…UMK to work with the Kelantan schools…we have the project called 'Professors at School'…Some of the schools have successfully come out with their project, now they sell their produce, spinach, aubergine. They sell it back to the professors that encouraged them on this hydroponic [method].

Nevertheless, although education is seen to play a role in development of the luar bandar, it in itself is plagued by the challenges of development. Collectively, insights from policy documents and interviews with experts and policymakers reveal concerns of low academic attainment and student dropout, cultural incongruence, coupled with infrastructural as well as technological challenges. Commenting on this matter, Hazami Habib from ASM highlights:

> Our government uses a one size fits all [approach]. It doesn't work. If you go to Sabah [and] Sarawak (states in East Malaysia[20]), it's even more so. The schools, you travel through mud to get there, it's even more challenging…We did a study on schools in Sabah and Sarawak, the gap, my God. No wonder they look at us with anger.

[20] The urbanisation rate (process of transformation from luar bandar to bandar) in these states are lower (Sabah: 62.6 per cent, Sarawak: 57.5 per cent) compared to the state where Sekolah Luar Bandar is situated (Terengganu: 68.6 per cent) although the rates of all three states are below the national average (79.8 per cent) (Department of Statistics Malaysia, 2020)

Once again the notion of the gap between the bandar and luar bandar surfaces in the above commentary, echoing the insights in the previous section. Nevertheless, it is worth noting that the voice of the federal government in the Rural Development Policy admits that the

> strategy and action for development of the luar bandar need to take into consideration the local needs and situations, where *"There is no one size fit all solutions"*[21]. This is because luar bandar areas are not homogenous and there exists socio-cultural uniqueness as well as diversity in local resources. (Ministry of Rural Development Malaysia, 2019, p. 13-5)

Given this recognition, it seems imperative that the views of young people in a specific site of the luar bandar are seriously considered, especially if this may become a valuable resource for development policy. Thus, in the next section, I move to describe the uniqueness of Sekolah Luar Bandar and the surrounding community, as the immediate settings of young people's aspirations for development that will follow.

6.3 Sekolah Luar Bandar at the End of the Road

> The backdrop of the rolling hills [at Sekolah Luar Bandar] reminded me a bit of the boarding school of my youth, and it seemed like it would make an idyllic place for learning. (Fieldnotes, 6 November 2019)

In this section, I provide the backdrop of the young people's lives through a descriptive account of Sekolah Luar Bandar and the community it is situated in. To do this, I weave my own fieldnotes—such as my first impression of the school described above—with reflections from teachers and young people themselves, as well as demographic data collected from Sekolah Luar Bandar, the Hulu Terengganu District Office and relevant federal government ministries and departments. The setting of this scene demonstrates how

[21] In the policy document, this term is specifically quoted in English, whereas the rest are my own translation from Bahasa Melayu. Notice the mirroring of this term with the critique by Hazami Habib that preceded it.

national development manoeuvres translate into a specific site in the luar bandar, providing the particular theatre for young people's own aspirations.

6.3.1 The Remoteness of Sekolah Luar Bandar

Sekolah Luar Bandar is one of 16 secondary schools in the district of Hulu Terengganu. It serves as the secondary school for the 12 kampungs in its vicinity, with students enrolling from nearby primary schools. The kampungs are predominantly populated by the Malay-Bumiputera—all the young people and teachers in this study are from this majority group. However, there is also an indigenous *Orang Asli* population in the interior region of Terengganu (also classified as Bumiputera). None of the 16-year old young people in Sekolah Luar Bandar—the target group of this study—are from the Orang Asli community although they attend primary school in the region. The absence of Orang Asli students in upper secondary level (16 & 17 year-olds) at Sekolah Luar Bandar points to the challenge of cultural incongruence in mainstream schooling, which has been explored in the literature (see Rosnon, 2016; Md. Nor et al., 2011). This matter was also surfaced during my interview with Dr. Madeline Berma, who herself is a member of an indigenous group. In her time as the Deputy Chair of the National Education Policy Review Committee, she was vocal about compulsory schooling that did not account for the lived realities of various indigenous groups in Malaysia:

> Here it is all about "You must send them to school. You must send them to school." That's why the Orang Asli, you send them to school. But after that, what?...Why are you delaying them in the name of education, that do not bring value to them?...If the education…suit their lifestyle, meaning it can prepare them for the work in the urban setting, or work in a formal [setting], and at the same time, they can still continue with their life as a *Penan* (one of the indigenous ethnic groups) I will be very very happy.

Although the education of indigenous groups in Malaysia is beyond my expertise and not the focus of this study, it is important to highlight this field encounter here—rather than a passing mention, a footnote, or an omission—in order to resist the silencing of Orang Asli struggles in the course of focusing on the broad umbrella of luar bandar (of which there is a larger Malay population in this particular study site).

As highlighted in Section 4.7, the teachers describe Sekolah Luar Bandar as being a remote one relative to other secondary schools in the district, thus wondering why I, a researcher from the University of Oxford, chose to research such a school of all places. Sekolah Luar Bandar's remoteness is described by Cikgu Linda, who had previously taught in a more suburban part of the district, as being in "an area that is deep in the interior, and if we look, the road in front of the school leads to a dead end." As I described in my fieldnotes, the school is backdropped by rolling hills and nestled in the lush natural environment. This geographic feature will be an important component of young people's aspirations described in a later section.

6.3.2 Socioeconomic Dimensions of the Community

Agriculture is the main economic activity in the community surrounding Sekolah Luar Bandar, coupled with traditional trade and labour (*kerja kampung*). Along the river, communities may be involved with cage culture and animal husbandry (Muhamad et al., 2019). For instance, in his kampung, Ceney, observes that most people "kerja kampung, there are farmers, people who grow crops and tend to cows."

Table 5: Young people's family background and settlement

Young person	Father's occupation	Mother's occupation	Lives with	Type of settlement[22]	Distance to school (kilometres)
Ana	Not applicable (deceased)	Homemaker	Mother	Planned (palm oil)	10.4
Ceney	Self-employed (Selangor)	Homemaker (Selangor)	Grandmother	Traditional	5.1
Chik	Deputy school principal	Retired teacher	Parents	Traditional	14.6
Damia	Labourer (Perak)	Homemaker	Mother	Traditional	1.0
H4lfiey	Not applicable (deceased)	Homemaker	Mother	Organised	10.2
Mila	Factory worker	Homemaker	Parents	Planned (palm oil)	10.4
Petir	Technical trainer	Homemaker	Parents	Traditional	1.7
Wan	Traditional builder	Homemaker	Parents	Traditional	5.7

Note:

1. Mothers and fathers who are domiciled outside of the state of Terengganu are indicated with the relevant state in the parenthesis (Ceney's parents and Damia's father)
2. Distance from school is approximated using Google Maps

Table 5 provides a snapshot of the young people's family background and where they live relative to Sekolah Luar Bandar. The majority of the young people in this study live in the traditional Malay kampung settled by their ancestors near or along the river. H4lfiey resides in a kampung that is part of an organised resettlement scheme where the pattern of housing is less sprawling and organic than the traditional kampung before it. Meanwhile Ana and Mila live in a planned housing area. This type of settlement was developed in relation to the agricultural role ascribed by the federal government to the luar bandar as elaborated in

[22] These categorisations are based on the typology outlined in the *Dasar Perancangan Fizikal Desa Negara 2030* (National Countryside Physical Planning Policy 2030) by the Ministry of Housing and Local Government Malaysia (2017), information gathered from the Hulu Terengganu District Office and conversations with the young people.

Section 6.2.2. The palm oil settlement they call home was developed by FELCRA (n.d.) that is

> responsible for developing rural areas by opening up opportunities for rural communities to participate in economic activities to generate income…and achieve its mission to safeguard the economic and social interests of its Participants, whilst applying agri-technology in spearheading the National Food Security Policy (NFSP) agenda. (para 1, 4)

I have previous highlighted in Chapter 3 (Section 3.3) how the federal government's establishment of land development schemes such as FELDA and FELCRA reflects the work of the developmental state in the luar bandar. Figure 13 shows the view in front of Mila's home that she captured during the photovoice activity. She lives inside the employee quarters of the palm oil factory developed by FELCRA where her father works. Here, we see such work of the developmental state manifest in the area around Sekolah Luar Bandar to influence where Ana and Mila live.

The young people either live with their parent(s) or a relative, as in Ceney's case. As indicated in Table 5, Ceney and Damia's fathers are domiciled elsewhere for work, outside of the state of Terengganu. Ceney's parents live in the state of Selangor, where his father works, hence he lives with his grandmother. Meanwhile, Damia lives with her mother who remains in the community whilst her father works in the state of Perak. Damia and Ceney's living arrangement here points to broader trends reported in South East Asia by Rigg & Salamanca (2018), whereby rural livelihoods are defined by mobility that influence the shape and structure of the household(s)—rather than only reporting one household, family dwellings can be characterised as multi-sited.



Figure 13: View in front of Mila's home she captured as part of the photovoice activity

In reference to their parents' occupation, most live in single income households, with the exception of Chik. Nevertheless, based on my conversations with them, some of the young people have adult siblings who might also contribute to their family financially, such as Damia, H4lfiey and Petir. Based on the distance of their homes from school, I learned about their mode of transportation. Damia, who lives closest to the school, can simply walk, while Mila takes a van service that ferries her to and from school. Chik travels with his father, who is a teacher in Sekolah Luar Bandar. The rest of them travel to school by motorcycle. The location of young people's adult siblings as well as the use of motorcycles will feature as part of the analysis in Section 6.4.2.

Cikgu Jun, the deputy principal who has exclusively taught in various schools in the district of Hulu Terengganu in her 28-year career, observes the socioeconomy of the area as such:

> In terms of economy, it's average. There are not many who are too elite, maybe some are children of teachers are the most elite. Not professional careers, their mother and father, farmers, of that sort. Then in terms of socioeconomy it's low. Not rich, only average…many that struggle too, typically.

Cikgu Jun's point about family of teachers as elites in the luar bandar reflects the durability of Ong's (1987) argument through her ethnographic study of a rural community in Selangor, by now the most urbanised and industrialised state in Malaysia. More than 30 years ago, she observes teachers as those who "set local standards for aspiring *kampung* boys and girls…[who] display the accoutrements of urban lifestyle such as cars, plastic-sheathed furniture, electronic gadgets and expensive clothes." (Ong, 1987, p. 79). Another element that echoes Ong's earlier work lies in the influence of political patronage on issues of local development. Early in my fieldwork I recorded the following observation in conjunction with a ceremony called *Program Bantuan Awal Persekolahan* (School Early Assistance Programme) attended by the representative of the local Member of Parliament:

> Parents of students are invited, and the school hall is packed all the way to the back. I ask the class teacher how many of class 4-STEM students received the assistance and he mentions all of them did, except for one student…While the ceremony was ongoing, I went to the canteen with Cikgu Halim…and later Cikgu Malik joined us. Cikgu Malik says that this ceremony is political; it is for the politicians to give out money to gain mileage. Students receive RM 100[23] per person if their household income is less than RM 4000. (Fieldnotes, 20 January 2020)

From the above excerpt, it is clear that all but one of the young people in this study are from families with household incomes less than Ringgit Malaysia (RM) 4000, placing them within the Bottom 40 (B40) income bracket in Malaysia (Department of Statistics Malaysia, 2020). Scholars researching the Malaysian luar bandar have noted the above practice of financial handout as constitutive of the politics of development in rural spaces. Such is a manoeuvre

[23] At the time of writing (January 2022), Ringgit Malaysia (RM) 100 is equivalent to 17.53 GBP (www.xe.com)

largely driven by the United Malays National Organisation (UMNO), the mainstay party historically aligned with Malay concerns and often conflated with the government itself. Leveraging its access to bureaucratic levers and development resources of the government, UMNO and its offshoots have persisted in a strategy of fashioning development in the luar bandar contingent upon political fidelity of the people (Ong, 1987; Bidu & Hamil, 2018). Here, rural development penetrates Sekolah Luar Bandar as an institution of education, but also as a site for congregating voting adults—young people's parents and guardians. Doing so allows for the political work of development (and allegiance-building) through the distribution of financial resources to take place.

6.3.3 (Academic) Migration and "the Ones that are Left"

The student enrolment in Sekolah Luar Bandar over time reflects the broader population make-up of the community. Patterns of outmigration highlighted in Section 6.2.1 play out here, such that the student population in Sekolah Luar Bandar have dwindled by half from its peak 10 years ago. Cikgu Malik, who has taught at Sekolah Luar Bandar since its inception more than 15 years ago, provides the reason for this decline:

> The total number of students in our school has continued to decrease actually, because the young generation has moved to the bandar right? So the ones that are left [are] the generation of their mothers, the older folk in this kampung.

Related to this, Cikgu Halim observes that successive younger generations migrate to the bandar due to limited opportunities for employment in the area, thus reducing the birthrate in the many kampungs around Sekolah Luar Bandar. The overall decline in student population over the years also trickles into the smaller enrolment of students in class 4-

STEM, threatening its closure and compromising the 60:40 policy, as highlighted in the previous chapter (Section 5.3.4).

Another form of migration takes place specifically in the context of education, also making students in Sekolah Luar Bandar "the ones that are left", to borrow Cikgu Malik's description. Out of the 16 public secondary schools[24] in the district of Hulu Terengganu, three are considered specialised schools. Two are science focused residential schools, which means they exclusively offer STEM package of subjects at the upper secondary level, with no option for students to pursue the Arts and Humanitites package (see Chapter 5, Section 5.2.3). Both schools have "science" included in their names—each under the purview of the Ministry of Rural Development and Ministry of Education respectively. Recall that in Chapter 3 (Section 3.4.2) and Chapter 4 (Section 4.4) these specialised schools were mentioned, and I too had attended one in the state of Selangor for my secondary education. All over Malaysia, such schools regularly attract the most academically excellent students from inside and outside the districts they are located in, and are part of the concerted effort to realise the 60:40 policy (Ng, 2016). The development of these science-focused schools by the federal government is another instance of the science for development model in action, localised in the principal site of this study. The other specialised school is called a "premier school" in the town centre that attracts academically excellent students from the entire district's primary and secondary schools.

[24] During fieldwork, there was news that a new vocational college (KV) was opening up soon in the district, piquing one of the young people's interest: "Petir then brings up the KV which is opening in June close to an industrial training centre in town and his interest in doing a pastry course there." (Fieldnotes, 29 January 2020)

In our discussions related to academic challenges in Sekolah Luar Bandar, particularly the small enrolment of students in class 4-STEM, teachers highlighted the school's position in relation to the aforementioned specialised schools in the district. The three specialised schools have the first choice for admitting academically excellent students from the feeder primary schools in the district, leaving the rest to the regular secondary schools. Cikgu Fahmi, the school principal, further explains their predicament:

> There are schools that face a problem of early input. This means when the student enters from primary school they already face the problem of weak mastery in mathematics and science. During primary school at UPSR (the primary school leaving examination) they get "D" in science. For the boarding school they take in the crème, for Sekolah Luar Bandar we cannot select our students. We just take them. The ones that come to Sekolah Luar Bandar, usually the best [result] is 1A at UPSR (out of the maximum 6As) and…the achievement in mathematics and science is quite weak. So when they enter Form 1, 2, 3…not many can change to suddenly be great at mathematics because their basic was weak in primary school…So they cannot go into the science class (STEM package at upper secondary level, Form 4). That's the way it is.

Cikgu Fahmi is describing here the impact of the surrounding specialised schools on the student population in the school he leads, specifically on class 4-STEM. Compared to specialised schools in the district, Sekolah Luar Bandar is not endowed with selection and filtering abilities by the MOE. Contrasted against the smaller number of specialised secondary schools in Malaysia[25], Sekolah Luar Bandar thus reflects the default situation of the majority of public secondary schools that "cannot select [their] students…just take them". The sentiment of "the ones that are left" framing this section is more acute in the luar bandar, which demonstrates lower overall academic performance. Such performance is reported as a gap in the national SPM results at the end of secondary school compared to the

[25] According to the Ministry of Education Malaysia (2020), 85.3 per cent of secondary schools under their purview in the luar bandar are classified as regular compared to various types of specialised schools that students can apply to (science, technical, vocational, sports, arts, religious, special education). The corresponding figure in the bandar is 81.0 per cent.

bandar. Nonetheless it is important to note that this gap has been shrinking since 2012 (0.61 gap in SPM average grade between bandar and luar bandar) to the present day (0.38 gap) (Ministry of Education Malaysia, 2021).

In the above excerpt, Cikgu Fahmi also highlights the spiral nature of mathematics curriculum, which also applies to science (Bruner, 1977; Harden & Stamper, 1999). This means that acquisition of successive content at higher levels of complexity require prior foundational mastery. Thus when students arrive at Sekolah Luar Bandar with weaker proficiency in mathematics and science (as indicated by their performance in the UPSR examination), it presents challenges for teachers. In my fieldnotes, I have recorded instances when STEM subject teachers of class 4-STEM confide in me that their students are still struggling with concepts they should have mastered at the lower secondary level, in order to be able to understand what is taught in Form 4.

I return now to the notion of academic migration. Three of the young people in this study demonstrate different instances of the migration described above, although they are never linear processes. Below are their trajectories as short vignettes:

> After the UPSR examination at the end of primary school in 2016, Wan enrolled in one of the science residential schools in town owing to her performance in this examination. She left the school shortly after the academic year began in 2017 and enrolled in Sekolah Luar Bandar because she wanted to reside at home. In the PT3 examination at the end of lower secondary education (2019), she scored the highest performance in her cohort at the school. Most of the teachers I interviewed mentioned Wan as the one student out of all that remained in class 4-STEM that is academically prepared to be there. She is also the niece of Cikgu Fahmi, the school principal.

> After the UPSR examination at the end of primary school in 2016, Damia enrolled in the premier school in town owing to her performance in this examination. In 2020, Damia left the premier school to enrol in Sekolah Luar Bandar and class 4-STEM, as

mentioned in the previous chapter (Section 5.3.4). As shown in Table 5, Sekolah Luar Bandar is very close to her home, which was more convenient. However in July of the same year, she returned to the premier school in town. When asked why she left Sekolah Luar Bandar after a mere few months, she told me "I don't know…I don't think there's anywhere I can go from there."

Chik was among the 11 students initially enrolled in class 4-STEM in January 2020. By the end of the month, he left Sekolah Luar Bandar, crossing the district boundary to enrol in a technical school all the way in the state capital of Kuala Terengganu alongside another classmate. He had discussed about this possibility with his father who also teaches at Sekolah Luar Bandar. His application was successful given his performance in the PT3 examination at the end of lower secondary education in the prior year. At the technical school he also enrols in the STEM package of subjects, focusing specifically on electrical engineering.

The above vignettes demonstrate various academic migrations in and out of Sekolah Luar Bandar among young people in this study. Such migrations are tied to the pursuit of better or more specialised education opportunities outside of Sekolah Luar Bandar. Familial ties, however, influence these choices. Damia and Wan want to stay at or be close to home, and Chik consults his father who possesses knowledge about specialised educational pathways. I further explore such intimacies in the upcoming section. Next, I seek to understand young people's aspirations for development in light of their lives in Sekolah Luar Bandar and the surrounding community that I have described in detail here.

6.4 Young People's Aspirations for Development—Family, Environment and the Prospects of Migration

In this section, young people's aspirations are organised along two themes—"Commitment and contribution to family" and "Affinity and mobility in/out of the local environment". Here, I complement young people's insights from interviews with examples from the photovoice activities, my own fieldnotes, and the perspectives of teachers, experts and policymakers. Additionally, I bring the aspirations for development here in dialogue with

aspirations at the national level (Section 6.2) and contextual details of Sekolah Luar Bandar (Section 6.3) as presented before.

6.4.1 Commitment and Contribution to Family

In discussing their aspirations for development, as in the process of realising the kind of lives that are meaningful to them, young people in this study highlight the relationships that they treasure, such as with family, friends and their community. Here, I focus specifically on familial ties, which figured heavily in the data. Between references to high-income and happiness, the young people all return to a mention of supporting their family and spending time with them. For example, Ceney highlights the following when I ask what he thinks is the best way to measure development:

> Maybe the cost of living, and skyscrapers. Maybe, but not necessarily. The bit on income is true too. For example some people are happy when they are rich…But even if you are rich but don't have a family to spend time with, then what is the use? How do you become happy then?

In expressing ties to family, young people specifically mention wanting to make their mother and father proud and to be of help to them, and to "change the fate of the family" (Mila). As part of the aspiration booklet activity, Wan visualises this desire. Figure 14 shows her sketch of parents accompanying her at successive levels of academic completion at school (left) and in higher education (right) even when there is no expectation to sketch about family.

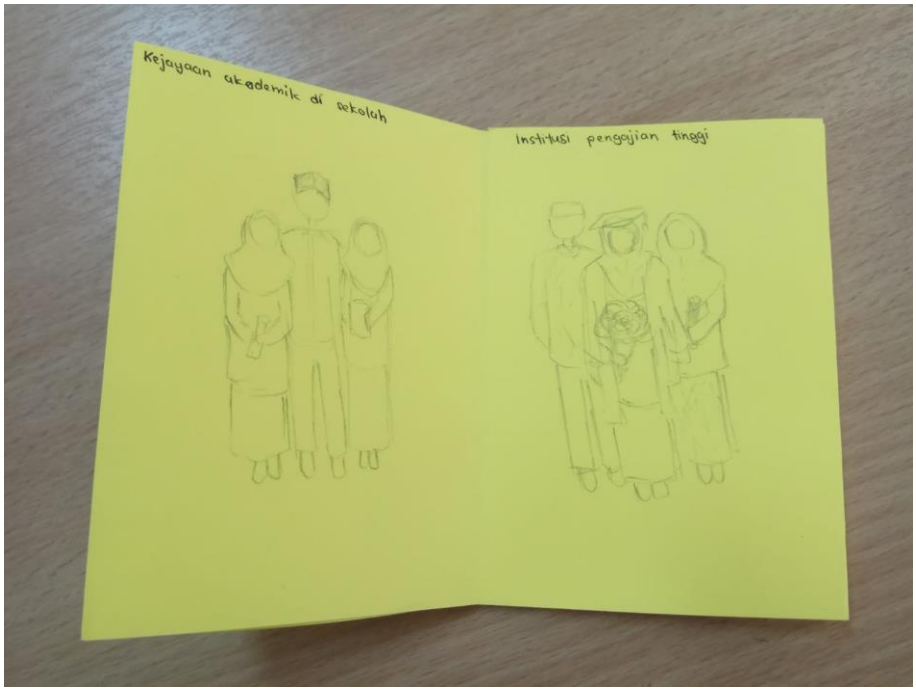

Figure 14: Wan sketches her academic aspirations that include parents accompanying her

For instance, other young people sketched their academic transcripts, or buildings to represent higher education institutions they might attend. In a similar vein, Petir echoes this notion of wanting to make his family proud:

> One thing I want is to make my parents proud. When we get to make them proud it's a big success right? We help them not just in terms of money, but we contribute our energy as a form of help is OK right? So that we always see them, and they always see us.

Thus making their family proud is intimately tied to notions of success and what they include in their aspirations for development. A sense of duty to family may also mean young people greatly want to honour their parents hopes, as is the case for Chik and Mila in terms of the pursuit of higher education. Chik, for instance, mentions that his mother hopes that he at least enters university because his older brothers were less inclined.

Young people also speak of wanting their parents to feel pleasant and live with ease (H4lfiey) and to provide them material support as part of this familial commitment. It is clear that when discussing aspirations about what is necessary for achieving lives they find meaningful, young people turn to a sense of duty to their family as a significant dimension. Such aspirations tied to family reflect the priorities in their day-to-day lives more broadly. When asked what activities they engage in after school and on weekends, young people speak of spending time with siblings, cousins and other relatives, and helping their families. Mila, H4lfiey, Damia and Wan mention playing with their siblings or members of their extended family. Below are two examples of time spent with family:

> Sometimes I play badminton with my younger sibling…watch TV and help my parents. (Mila)
>
> On weekends usually in the morning my dad invites me to go have breakfast at one of the stalls. When we return we get to work a bit [on home projects]. Now we are painting. (Petir)

Instances with family are also reflected in the photovoice activity. Here, I asked them to photograph their day-to-day experience, focusing particularly on dimensions that are meaningful to their lives. For instance, Figure 15 shows Ceney assisting his grandmother with her chilli garden and during a trip to the local market. Collectively, young people share with me photos of them spending time with siblings or other relatives, friends, pets as well as assisting family with tasks.

Further to this, spending time with family also influences young people's paths for their own futures, which will impact how they are able to realise the above aspirations tied to family. The vignette on academic migration in the previous section, where Chik was advised by his father about the technical school, is an example of this. My interviews with the young people

demonstrate multiple instances of family interaction with regards to aspirations. As an example, Damia acknowledges conversations with her aunt who is an English teacher for her plan to become one too.



Figure 15: Ceney helping out in his grandmother's chilli garden and at the local market

Meanwhile, in explaining to me her change of ambition between medical doctor during primary school to engineer in secondary school, Wan credits her older sister:

Wan	:	Since I joined secondary school, [I saw] my sister took GKT. So I liked watching her do the drawings, and I'm influenced.
Aizuddin	:	Where is your sister now?
Wan	:	Polytechnic…[in] Dungun (a district south of Hulu Terengganu)
Aizuddin	:	Studying what course?
Wan	:	Civil engineering

Influenced by watching her sister, Wan then went on to study GKT herself as one of the STEM elective subjects in class 4-STEM. Such aspirational encounters with family echo Appadurai's (2004) conceptualisation of capacity to aspire that is steeped in the process of socialisation, as aspirations "are never simply individual (as the language of wants and choices inclines us to think). They are always formed in interaction and in the thick of social life." (p. 67). As young people in this study describe their aspirations towards a life that is meaningful for them, a commitment to supporting their family and honouring parental wishes must be understood in the thick of their day-to-day interactions and intimacies in family life. Such intimacies also shape the formation of their own individual aspirations—career plans for their own futures—that can enable them to realise aforementioned commitments to their families.

Young people's aspirations for development here demonstrate a contrast against the national development priorities for the luar bandar described before in Section 6.2.2. For the most part, the national-level development aspirations are identified along the lines of agricultural role for the luar bandar, and related capability development through education, which overshadows aspirations related to family and community development. Where available, mentions of family in the corpus of data at the national level are related to level of income, the role of women and social challenges in the family institution. Below is an instance in the Rural Development Policy where family is mentioned in relation to values:

> Globalisation also impacts the values of unity and concern among the luar bandar society. This issue erodes the value of family and the result is the surfacing of *keakuan* (a focus on "me") and individualism that are becoming dominant. Directly, it also erodes community values like collaboration, *gotong-royong* (mutual aid) and volunteerism. Family values among the luar bandar society need to be preserved and defended so the community in luar bandar are able to live in an environment that is

> healthy, safe and prosperous. (Ministry of Rural Development Malaysia, 2019, p. 10-4)

In the context of young people in Sekolah Luar Bandar, globalisation has richly contributed to their aspirations for development as highlighted in the previous chapter (Section 5.3.2). They highlight globalised desires for travel and connection, emulating a country like Japan and an affinity to modern technology. Young people can look outwards to seek inspirations for lives they find meaningful, while also—as demonstrated here—maintain a commitment to family (values). The juxtaposition of the phenomenon of globalisation against practices associated with the luar bandar such as gotong-royong in the above excerpt contributes to the essentialisation and othering of the luar bandar. Why must globalisation be framed in opposition to the values grafted onto the luar bandar, while the bandar is typically described as cosmopolitan beneficiaries of globalisation (Brown et al., 2017; Farrugia, 2020)? The young people in this study teach me to resist such simple essentialisms. They can aspire in global terms whilst describing their rooted, affective ties to family, a desire to make parents proud, and time spent in the company of siblings and extended family. Their aspirations are formed *in* the interaction with family members, *for* the flourishing of their family.

The hardening of the luar/bandar boundaries shaped by national development priorities as previously described in Section 6.2.1 nevertheless has material implications on the lives of young people in the luar bandar. In the next section, I explore their aspirations related to mobility and situate them within the macro context described in Section 6.2.1, as well as the translations in the luar bandar community highlighted in Section 6.3.

6.4.2 Affinity and Mobility in/out of the Local Environment

Young people in this study describe an aspiration of maintaining the peaceful natural environment they are embedded in, whilst also being acutely aware that employment prospects mean they might need to leave the luar bandar. Referencing postcolonial theory, their ambivalence is reflected in the theme that frames this section. By this I mean the mixed, unsettled and conflicted sense of "I want to stay in the luar bandar but I might need/want to go to the bandar". As presented before in Section 6.3.1, Sekolah Luar Bandar and its surrounding community is nestled in the verdant environment of the Hulu Terengganu district. In the course of our interviews, young people repeatedly mention the nearby river as a reason for loving their kampung:

> I like it because it's not polluted yet. There is a river to bathe in. Then people also rear deer, ostrich, pony. (Ceney)
>
> In terms of the environment, it has a river…Best…best (a Malaysian expression meaning "great"). In the mornings it's chilly. Usually with my *geng-geng* (meaning group of friends) I go to the river…the river near the jetty. (Petir)

In describing the peaceful environment, images of nature are contrasted against the outcomes of development, such as higher temperatures, the busy roads as well as people's access to personal transportation like motorcycles. For example, Chik who has left Sekolah Luar Bandar, contrasts the natural environment with his new reality at the technical school in the Terengganu state capital, Kuala Terengganu:

> My hope is to maintain the area [around Sekolah Luar Bandar], because that area is beautiful right? It's chilly, has a lot of trees…It's a spacious area, a lot of hills and trees. Here at the technical [school], it's difficult in the middle (of everything), so it's warm, and my eyes hurt, [because of] the glare…It's quite a difference, the heat.

Here, Chik contrasts the natural environment of the luar bandar against the built environment of the bandar, evoking the difference in heat. Although he has left Sekolah Luar Bandar for a specialised education opportunity in the bandar, might the grass be *greener* back home? Young people's fondness for their lush natural environment points to the particularity and remoteness of their community and school, as described in Section 6.3.1.

Additionally, access to motorcycles facilitated by better transportation infrastructure, economic development and purchasing power may also be a source of ambivalence for young people in the luar bandar. Many of the young people in this study have access to motorcycles—they serve as a means for mobility to school and a literal vehicle for socialisation and leisure around the area. Access to motorcycles in this way echoes the pastime of rural youth in Laos as highlighted by Sentíes Portilla (2017) in Chapter 2. In my fieldnotes, I recorded an event associated with motorcycles held at Sekolah Luar Bandar to reflect the prevalence of their use. This happened after a spot check made by the police on students' motorcycle license, road tax and use of helmets in conjunction with the *Program Jom Ke Sekolah* (Let's Go to School Programme):

> During his speech, the *Pegawai Perhubungan Sekolah* (school liaison officer)—a role established by the Royal Malaysian Police since 1974—reminds students who are riding motorcycles to school to wear a helmet. If they don't wear helmets they cannot come into the school compound. (Fieldnotes, 17 February 2020)

In Figure 16, I present a photo taken by H4lfiey as part of the photovoice activity. Here, he shares one of his leisure activities, hanging out with friends by the river. The photo was taken from his motorcycle (partially seen in the foreground).



Figure 16: Leisure activity by the river shared by H4lfiey

Motorcycles thus enable young people to enjoy their lives among friends in the luar bandar—they constitute a significant component of the life they value. However, a number of young people also highlighted the noise pollution due to motorcycles that disrupts the peace and calm they enjoy about their kampung. H4lfiey himself, despite enjoying leisure time with friends through the use of motorcycles, encapsulates this ambivalence:

> I don't like the environment that is noisy…There are youth from other kampung wandering around here…playing with their motorcycles, it's noisy. The area also has a main road.

Motorcycles, as a symbol of development and mobility, also becomes source of ambivalence for young people in their local environment. The noise pollution they create on main roads disrupts the peaceful atmosphere associated with the natural environment, though they need it to move about—to travel to school and to meet up with friends.

Despite their attachment to the verdant natural environment, young people in this study do not simply romanticise their reality in the luar bandar. Concerns regarding mobility—beyond merely motorcycles—also figure in our conversations, especially related to employment prospects. Similarly, teachers highlight this concern in our discussion about young people's futures. When I asked young people about their employment prospects and plans, many highlight the likelihood of having to leave their kampung for opportunities elsewhere. Chik, who aspires to become an air traffic controller, must move closer to the airport, which is in the proximity of the bandar. Meanwhile, H4lfiey speculates: "If we work a bit further away from here, maybe we can get a bit more income."

Wan, who aspires to become a chemical engineer, had this to say when I asked her about employment prospects. Might she have to move away?

Wan	:	Maybe…the opportunities out there are wider.
Aizuddin	:	Wider? What about around here, if you study chemical engineering, any job opportunities near this area?
Wan	:	[To become] a teacher.
Aizuddin	:	Teacher? Other than that? What about engineer?
Wan	:	Nothing.

Recall in Section 6.2.2 how Cikgu Jun highlighted teachers and their families as socio-economic elites in the community surrounding Sekolah Luar Bandar. The limited prospects of employment in the community following higher education suggest that a career in school teaching is the idealised pathway to socio-economic mobility and a comfortable life in this particular community. Indeed, I recall Cikgu Halim mentioning to me some of his former

students who have now become teachers themselves. On the drive back to Sekolah Luar Bandar one night after dinner, he also shares with me the following:

> On a teacher's salary you can have a good life [here], not like in the bandar. It is great because as a teacher you get to know other people in the kampung and make friends; people know and respect you as a teacher. (Fieldnotes, 10 January 2020)

Young people's awareness of future prospects in the area is also shaped by their close observation of family and community members who have attempted to engage with the labour market in their vicinity. As part of the interview, I asked the young people if they had older siblings and if they were in employment, where they were based. Many of their older siblings are working outside of the state of Terengganu, such as in the case of Petir and Damia. Meanwhile, H4lfiey and Chik reported older siblings at home who were unemployed or yet to be employed. Consider my conversation with H4lfiey below when I asked if all of his older siblings are in employment:

H4lfiey : One is furthering his studies in [the state of] Perak.
Aizuddin : Are your siblings all living in this area?
H4lfiey : The ones that are living here are my mum and older sister. I have a brother who lives in KL and another one in Besut (a district north of Hulu Terengganu).
Aizuddin : Your older sister who lives here, is she working?
H4lfiey : Umm…no. My brother-in-law supports her.
Aizuddin : Your brother-in-law lives here?
H4lfiey : He lives elsewhere, and does a lot of work far away.
Aizuddin : And your mother, is she working?
H4lfiey : No.
Aizuddin : So at home there is you, your mother…
H4lfiey : One of my older brothers is here, he's not working yet.
Aizuddin : Oh, not working yet. How old is he?

H4lfiey : Around 20, 21.

H4lfiey's case represents the typical situation among young people in this study whose older siblings are either unemployed, or working and studying outside of the community. As highlighted before, some young people also have parents that were working outside of the state, such as Damia and Ceney. Within the context of intimacy with family, young people see first-hand the prospects of employment in the community, and out there.

Additionally, during my time in the field I also heard multiple variations of the same story, which is told along these lines: A family member or a friend studies diligently at school, attends university and returns to the community either unemployed or underemployed. Wan tells me that her cousin is one such case. Cikgu Maryam conveys a striking anecdote in this vein:

> I remind them "Study diligently. Get an impressive job; take courses like engineering, for example." These students tell me, "Cikgu, look at so and so, he took engineering, but is only working at Pizza [Hut]." When in fact that person is in a temporary [job], while waiting for work. Work is hard to come by right? The students [only] see that [temporary job]. But that person they are referring to, he has already gotten a job by now.

It follows here that what young people see in their immediate vicinity and temporality (the Pizza Hut example above) greatly shapes what they deem to be within the realm of possibility for them. Employment prospects are of course shaped by larger structures and development priorities, as described in Section 6.2.1. The government admits that the bandar is the centre where jobs and conveniences are concentrated. If economic development is focused *in* and *for* the bandar, then larger structural forces that compel outmigration from the luar bandar circumscribe young people's choices and create ambivalent feelings about the

value of (STEM) education in their community. For instance, Mr. Tengku's observation in the state capital of Kuala Terengganu reflects this wider predicament:

> What I see now…that creates worries among parents about STEM, [is that] there is no such labour market in this state. In Terengganu, people with engineering degrees don't have work. They have to migrate to KL. KL has a lot of jobs. When people in KL talk about STEM, "The job opportunities are aplenty." We the Terengganu people, the people of the kampung observe, "How do our children who graduate from those fields afterwards stay at the kampung with no employment?" It's totally contradictory…Parents are not too keen to allow their children to take pure science fields. Meaning to say, it's already difficult [to study these subjects], and then the job prospects cannot be seen. They already have to be away from their family [while in higher education]…This affects the number of enrolment [in STEM]. These are some of the grouses from teachers.

The above lamentation also gestures towards the declining enrolment in STEM packages, as demonstrated in the case of Sekolah Luar Bandar in Chapter 5. Young people's aspirations reflected in this section demonstrates an ambivalent scenario wherein they appreciate their environment and speak fondly of it, but possibly would need to leave it in order to secure employment.

The findings in this section reflect an enduring concern in rural education. Ley et al. (1996) argue that in instances where "rural youth migrate from their hometowns their communities are deprived of talent and vitality that contributes to the development of a desirable future for these communities" (p. 133). As described in Section 6.3.3, the community around Sekolah Luar Bandar has been shrinking due to generational and academic migration. The outflow of talent and vitality is structured in service of the bandar. If young people are to fulfil their aspirations tied to family as presented in the previous section, do they have much choice than to leave their community? Further to this, what then is left of the luar bandar community, when those who themselves are left behind by prior academic migration are also

compelled to leave? These are serious questions that warrant attention as the federal government seeks to enable development that it claims avoids a "one size fits all" approach.

6.5 Summary of Findings

In this chapter, I have attended to the following research question:

> RQ2: How does the national development discourse translate to the luar bandar and what are young people's related aspirations for development based on their day-to-day experiences?

I first sought to illuminate the notion of luar bandar at the national level in order to provide the context for situating young people's aspirations. Findings revealed that deficit discourses were dominant, contrasting the luar bandar against the bandar in terms of gaps along the dimensions of poverty and low economic productivity. The government's emphasis on development in the bandar subsequently compels migration from the luar bandar, thus resulting in the decrease of population in these areas. The federal government's reifying of difference and the othering of the luar bandar thus motivates the need to develop it so as to service the bandar. In this study, priorities of development in the luar bandar reflect the dual role assigned to it—as feeder of labour for industrialisation in the bandar and agricultural site to maintain food security. To realise this role, STEM education is utilised as a means of socialisation of agricultural roles of the luar bandar, as well as for development of people's capability by complementing TVET. Nevertheless, education itself faces challenges of development, reflected once more through the notion of gaps in academic performance, technology, infrastructure and culture. "One size fits all" approaches to development were acknowledged at the national level as inadequate in attending to the diversity and uniqueness of various sites in the luar bandar.

Sekolah Luar Bandar's remote environment and its socioeconomic landscape reflect the manifestation of the federal government's development manoeuvres in a particular site of the luar bandar. The majority of the young people in this study are from single-income households that place their families within the B40 income bracket. While most live in traditional kampung settlements, two of the young people live as part of a housing project associated with a federal agricultural development scheme to ensure national food security. The community around Sekolah Luar Bandar is not immune from the effect of outmigration. Furthermore, this effect is exacerbated by academic migration to specialised secondary schools in the district of Hulu Terengganu, creating a residual effect in the school. This means that students in Sekolah Luar Bandar are largely those left behind after specialised schools—developed by the MOE's centralised education system—have had their pick of students that perform well in national examinations.

It is against such national and local backdrops that young people in this study describe their aspirations for development. The first of these aspirations reflect their commitment and duty to their parents and other family members. There is a desire to make their parents proud and to contribute towards supporting their family via material and other means. This aspiration is congruent with young people's day-to-day lives, where they report spending a lot of time with their family, such as playing with siblings and assisting elders. Close interaction with family also influences young people's paths for their own futures, which in turn may help them realise their aspirations for (family) development. When contrasted against national discourses of development in the luar bandar, there is paucity in considerations related to the family. In instances where this is apparent, globalisation is pitted against family values in the luar bandar. Nonetheless, young people demonstrate the ability to make use of globalisation

as part of aspiring (as described in Chapter 5) while also considering familial ties as integral to aspirations for development.

Next, young people describe an aspiration that is characterised by the ambivalence of remaining in the environment that they cherish in the face of (un)employment prospects. They highlight their appreciation of the peaceful natural environment that is contrasted against the accoutrements of development. The motorcycle, for instance, creates noise pollution even as it is a vehicle for socialisation and mobility. Young people also consider mobility vis-à-vis concerns of future employment that might necessitate outmigration from the luar bandar, as reflected in the national discourse. Observing older siblings and community members in employment elsewhere, or struggling with unemployment locally further compels the young people to look outwards. In this way, they align themselves with the overwhelming structural, national development priorities that circumscribe their prospects in the luar bandar. Turning to the next chapter, I present an exploration of the agentic dimension of education and aspiration among young people in this study, to suggest how informal STEM education may become an empowering resource.

CHAPTER 7: The Building "Bricks" of Young People's Aspirations

7.1 Introduction

The empirical data and analysis presented in this chapter aim to address the third research question:

> RQ3: How can young people enact their aspirations for development in relation to STEM education and their day-to-day lives in the luar bandar?

The enactment of aspirations that is the focus here relate to young people's challenges and solutions associated with development, which they articulated through an informal STEM education project. Following Appadurai's (2004) proposition that the capacity to aspire assists people to navigate their lives, and requires practice, I investigate how a participatory education project tied to STEM education can become a site for such practice. Initially in Section 7.2, I describe the genesis and development of an informal STEM education project in the context of my ethnographic immersion in Sekolah Luar Bandar. I do this by primarily relying on extensive fieldnotes accompanied by photographs to provide a detailed account of the collaborative, participatory project with young people and their teachers.

The narrative of the participatory STEM project then sets the scene for Section 7.3, where I provide an analysis of this project as a means of enabling young people to enact their aspirations for development. I undertake reflexive thematic analysis of my fieldnotes and interview transcripts with young people, teachers, experts and policymakers. The analysis is guided by characteristics of capacity to aspire (Appadurai, 2004), Sellar & Gale's (2011) new structure of feeling as well as the Malay notion of rasa (Lim, 2003; Yaapar, 2005). I pay

attention to the value of exposure to novel encounters on young people's work of aspiring, and suggest the pertinent dimensions that are constitutive of such exposure. In Section 7.4, the findings for this chapter are then summarised. Preliminary findings from this chapter were previously published in the *Proceedings of the Yidan Prize Doctoral Conference* (Anuar, 2021).

7.2 The Building "Bricks": Participatory Informal STEM Education Project

In this section, I provide the narrative of a participatory informal STEM education project conducted in Sekolah Luar Bandar over an intensive three-week period from January to February 2020. I first present how this project came about, foregrounding the notion of kebetulan that was previously highlighted in Chapter 4 (Section 4.7.2) as an approach to research. Subsequently, I describe the conceptualisation and realisation of this informal STEM education project, guided by elements of Youth Participatory Action Research (YPAR). The narrative presented here weave together my fieldnotes as well as photographs that were captured during the course of the project.

7.2.1 Kebetulan Paves the Way for a Participatory Project

Kebetulan, which refers to the Malay notion of happenstance and coincidence that is rooted in the word betul—meaning "truth"—is an approach that I integrated into this study. At the start of the school year at Sekolah Luar Bandar in January 2020, I had been searching for potential avenues to develop rapport with the young people in this study outside of the classroom setting. On the first day of school, I sat down for a briefing with Cikgu Maryam, who had been assigned as the teacher liaison for my study, given her role as the head for science and mathematics panel at the school:

> We also chat about STEM-related competitions. She highlights that she receives letters inviting the school to participate, but usually the school declines due to challenges in student & teacher commitment. She says that students are less keen on academic related extra-curriculars, preferring sports instead. For short-term competitions such as the water rocket, where the preparation is for a few days, students can be encouraged to participate, but for longer commitments they are less keen. I tell her that I am willing to support in this regard, as I can use that platform for my own research, rather than coming up with an entirely new project…She then informs that they don't have much *pitih* (money) for activities. (Fieldnotes, 1 January 2020)

STEM-related competitions are one of the examples of informal modalities of education that is increasingly offered in Malaysia and is aligned with the approach outlined by the MOE. Based on my previous research (Anuar & Chankseliani, 2021), informal STEM education is encouraged by the MOE to increase STEM interest among young people to indirectly support the realisation of the 60:40 policy. Keeping in mind the challenges mentioned by Cikgu Maryam related to students' commitments and also the lack of financial resources, I began thinking of a potential informal STEM education project that could be undertaken together with the young people. As mentioned in Chapter 4 (Section 4.6.3) regarding participatory methods, I speculated prior to fieldwork at Sekolah Luar Bandar that there might be an opportunity to leverage existing activities, such as competitions as mentioned here by Cikgu Maryam. In the vein of kebetulan—an embrace of instances of coincidence as truth seeking that infused my research—a serendipitous opportunity for a participatory project presented itself less than two weeks later:

> Towards the end of the school day, Cikgu Maryam comes to my workspace and shares a letter from the JPN Terengganu and UMT about…a STEM career exposure event that includes a competition on innovation for secondary school students. But the competition deadline of 6 February seems tight and as part of the preparation I would also need to factor in the school break that coincided with Chinese New Year. (Fieldnotes, 12 January 2020)

The career exposure event was organised by the STEM Foundation Centre at Universiti Malaysia Terengganu (UMT, the local university in the state capital of Kuala Terengganu) headed by Dr. Laili Che Rose, who I also interviewed as part of this study. Is this another instance of kebetulan in action, gesturing towards existing and emergent entanglements of STEM opportunities and actors in the region? During the course of our interview, Dr. Laili Che Rose informed me of her motivation for organizing this event, related to her experience dealing with JPN Terengganu (State Education Department) previously:

> I am not satisfied. I always ask them, "How do you select [the schools to participate in STEM-related competitions]?" Because all of the sudden it is already the finale. "When was the quarter final?" They just select whichever schools. "How do you know you are selecting the best school?" [They reply] "From their [academic] performance". It is unfair. I say it is unfair because our adopted schools are always not included. So we organise it here in UMT…I say, "Let's include them, give them opportunity, let them feel happy"…Because to wait for JPN, they are selective of the schools. Schools that will help them win [at a higher level]. Haaa…they want to win, not provide students with [opportunities for] understanding.

Here, Dr. Laili Che Rose is framing these competitions associated with informal STEM education as opportunities for students to gain exposure, in the context where the education department at the Terengganu state has been selective of schools that were included. Sekolah Luar Bandar, as a school that does not display stellar academic performance compared to specialised schools (recall Chapter 6, Section 6.3.3) and located far away from the state capital, would be excluded from these enrichment opportunities.

Subsequently, as Cikgu Maryam asked me to consider if students' participation in this competition would be something I was interested to support, I sought the counsel of two other teachers who also taught STEM-related subjects. Cikgu Adam, the Additional Mathematics teacher, encouraged me to take on this opportunity because he viewed me as

"able to support the students more than the other teachers, since they have teaching responsibilities" (Fieldnotes, 13 January 2020). Meanwhile, the GKT teacher, Cikgu Halim relays his concern about the very short timeline for preparation leading up to the competition date of 6 February 2020. Despite concerns regarding my unfamiliarity with the school and the young people at this stage, as well as the short timeframe for preparation, I seized this particular moment proffered through kebetulan. Collaborating with the young people in this intensive project in the early days of fieldwork could assist with rapport building. I also viewed Sekolah Luar Bandar's participation in this STEM competition as a potential avenue for the young people to exercise their capacity to aspire. Subsequently, the competition presented an opportunity to contextualise STEM education in a way that was meaningful to their day-to-day lives.

On 14 January 2020, I informed Cikgu Maryam of my interest to support the school's participation in the STEM innovation competition. She suggested the names of four young people to represent Sekolah Luar Bandar (Chik, Wan, Ana and Petir), who she felt would best represent the school. However, at this time, Chik was awaiting the outcome of his application for admission into a technical school in Kuala Terengganu (recall his trajectory described in Chapters 5 and 6). Guided by the elements of YPAR, I then began conceptualising the approach to collaborate with the young people in class 4-STEM for a project that could be submitted for the STEM innovation competition, which would take place three weeks from then.

7.2.2 Collaborative Development of a STEM Participatory Project

Elements of YPAR guided the conception of an informal STEM education project, nestled in this study about young people's aspirations for development. Within the long tradition of activist-scholars guided by various critical theories, YPAR centres young peoples' role and expertise in the production of knowledge about matters that are at the forefront of their day-to-day lives (Mirra et al., 2016). Related to this, Cammarota & Fine (2008) argue that YPAR is "designed to contest and transform systems and institutions to produce greater justice—distributive justice, procedural justice, and what Iris Marion Young calls a justice of recognition, or respect." (p. 2). Therefore, YPAR as a mode of inquiry in this study pays attention to expertise of young people to identify and address concerns of development, grounded in their lived experiences in one particular community in the luar bandar. I also intended to bring in the application of STEM within an informal context—outside of the classroom experience bound by the national curriculum—to aid in addressing young people's identified development challenges.

Feel, Imagine, Do, Share (FIDS) Framework

The development of the participatory informal STEM education project in this study drew inspiration from the Feel, Imagine, Do, Share (FIDS) framework, which was developed by the global "Design for Change" movement. Based on the principles of design thinking, the four steps as part of the FIDS framework is summarised by the founder of this movement, Kiran Bir Sethi and her colleague Mohanram Gudipati as follows:

> The first step of the framework, *Feel*, enables students to observe and understand the issue from the users' perspective, taking into consideration the local environment and context. The second step, *Imagine*, offers students a structured approach to

> collaboratively developing solutions to the challenges identified in the first step. The third step, *Do*, walks students through planning and executing their solution…Finally, the fourth step, *Share*, encourages students to share the impact of their solution. (Gudipati & Sethi, 2017, p. 95)

I selected this framework as a general guide (instead of a prescription) as the elements within it are aligned with the practical and analytical dimensions of this study. Practically, *Do* and *Share* components of the FIDS framework reflect the expectations of participating in this STEM innovation competition, where the young people would develop and present an innovative product to judges and visitors. Meanwhile, *Feel* and *Imagine* are useful analytical complements. Engaging young people with the *Feel* step of the framework opens up potential insights in relation to the conceptual utility of the new structure of feeling by Sellar & Gale (2011), as well as the analogous concept of rasa in Malay epistemology (Lim, 2003; Yaapar, 2005), both of which were previously discussed in Chapter 2. Similarly, the *Imagine* step dovetails with this study's interest in young people's capacity to aspire (Appadurai, 2004). Young people's aspirations for development can be gleaned through the challenges and potential solutions proposed in the scope of this participatory project.

Project Preparation and Development

My engagement with the young people for this project relied on openings in the school timetable when a teacher was away from the class due to tasks outside of school or personal leave ("relief periods" mentioned in Chapter 4, Section 4.7.1), as well as hours after the school day ended. In the initial meeting for the project that took place on 14 January 2020 during a relief period for English, I wanted to take them outside of the classroom on a walkabout around the school. I wrote in my fieldnotes:

> I tell them [their English teacher] is away as he is marking scripts from last year's SPM examination. I then told them I would like to take them outside—"of school?" one student asks jokingly. I let them suggest where we might go. Petir suggests we can go to the shade under a tree where one of their teachers used to take them sometimes for outdoor lessons, so I ask him to lead the way. We arrive at the area parallel to the canteen towards the back of the school, we then sit under the shade…behind what they call *kandang kuda* (Bahasa Melayu for "horse stable", although this appears to be an open air agriculture shed). I then engage them in a discussion about what are some problems/conditions they would like to change in their school or kampung if they had the opportunity. It took a bit of warming up but the students then began talking. (Fieldnotes, 14 January 2020)

I recorded the following ideas the young people described during the brainstorm activity in my fieldnotes on that day (14 January 2020):

- Do something about the gate to curb student truancy
- Recycling bin in the school
- Insufficient chairs in the canteen during recess
- Herbal garden
- Curb students smoking in the toilet
- More interesting clubs, or even an afterschool club/space
- Bell/system for movement between classes
- Biomass project with cow droppings around the village
- Do something with excess material/packaging from co-op
- Do something with broken chairs—turn into brooms?
- Rearing chickens for the vocational class
- Broken locks in the toilet
- Outdoor learning space

Collectively, these ideas demonstrated young people's concerns related to matters they are interested in at school, challenges associated with infrastructure and also student behaviours. During this discussion, I also showed them an example of a project developed using the FIDS framework by a group of young people also in secondary school from the state of Sabah, in East Malaysia. The intent was to provide a tangible example and to convey my belief that they could also conceive a project of this nature:

> I tell them that they are also capable of working on a project like this, because they know best about what problems they face, and with the support of teachers and myself, they can do something. One student brings up windmill or solar as a potential project, another says this area is cloudy so solar won't work. (Fieldnotes, 14 January 2020)

Subsequently, I grouped together young people's suggestions as listed above into clusters of potential projects (students' hang-out space, recycling, agriculture) so that they could vote on the option they preferred. In the voting process, I included three criteria:

1. The project applies knowledge in STEM
2. It addresses a challenge in their daily lives
3. It is practical within the timeframe while being useful for the long-term

These criteria were influenced by the definition and characteristics of STEM education highlighted in the literature and Malaysian context presented in the previous chapters. The next day, the young people voted on the project of their choice:

> Each student could vote for 2 options (the same one if they felt strongly). Chik volunteered to come to the whiteboard to help me tally the votes. The options that were tight were the first two (students hang-out space & recycling), but eventually the recycling project won. They appeared really engaged during this voting process. (Fieldnotes, 15 January 2020)

Figure 17 shows the tally of votes, which indicated that the second project on recycling (*projek kitar semula*) received the highest number of votes based on the aforementioned voting criteria.

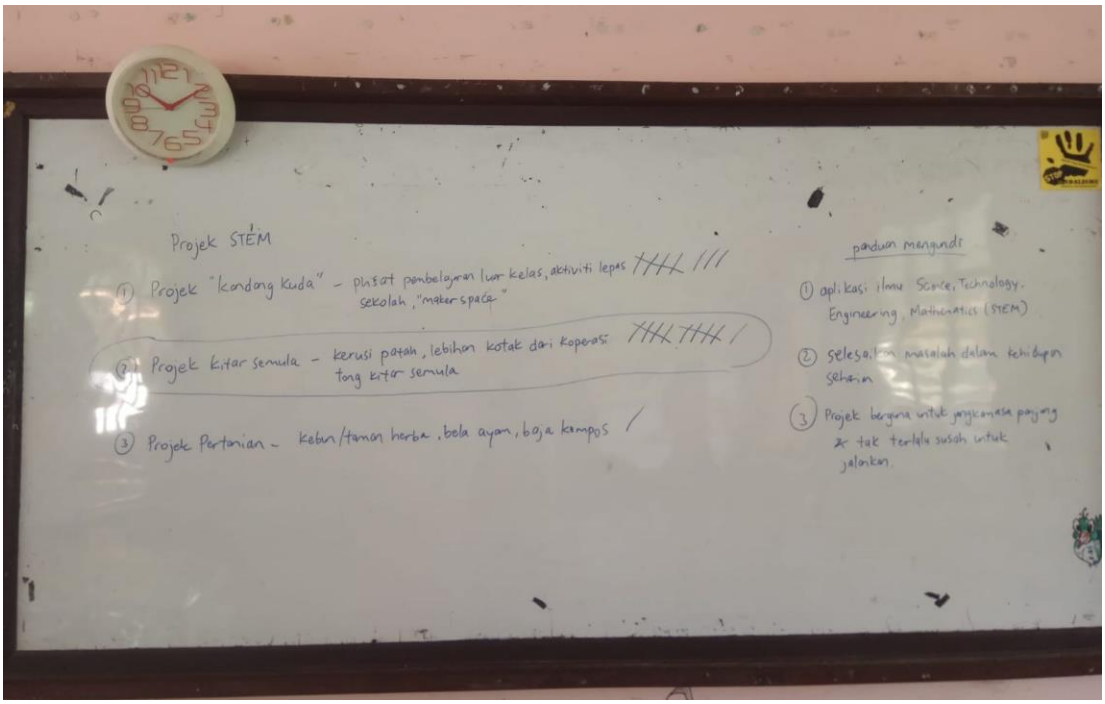

Figure 17: Tally of votes by the young people for potential STEM projects. The list of projects is on the left whilst the voting criteria are on the right.

Following the voting process, once again we left the classroom for a walkabout to identify potential items to be recycled and we decided to head back to the kandang kuda. I wanted to see through their eyes what could constitute elements of a recycling project:

> Along the way, I ask them if they had learned about recycling in their class, and they mentioned geography and science [subjects]…They show me which items can potentially be reused, mainly broken chairs and tables. I offered my phone to the students so they could capture some photos…I ask them what else can be recycled, and they mention boxes from the school cooperative, drink cartons, and bottles. (Fieldnotes, 15 January 2020)

Subsequently, Figure 18 shows a photo taken by one of the young people, Ceney, during our second visit to the kandang kuda to survey potential items for recycling. After surveying items near the kandang kuda, we walked to a different part of the school as the students had referred to a particular problem that could potentially be solved through the recycling

project, and they "tell me that students are often waiting near the back gate in the heat, so perhaps they can build a shaded seating area for the students?" (Fieldnotes, 15 January 2020). This open area was where some students would wait for transportation at the end of the school day under the hot midday sun. The young people thought about how the disposed items could potentially be reused to construct a structure like a shed to attend to this identified problem.



Figure 18: A discussion between some of the young people and myself near the *kandang kuda*, captured by Ceney.

As part of researching for this project in order to support the young people, I learned about the "ecobricks" concept. Originating from the Philippines, what has since developed into the Global Ecobrick Alliance (n.d.) is dedicated to address the environmental challenge associated with plastic consumption through the reflective practice of making ecobricks. In essence, an ecobrick entails "the manual securing of used plastic in a PET bottle (also known

as plastic sequestration) to make a reusable building block" (Global Ecobrick Alliance, n.d.). This activity seemed suited as a potential project as it involved minimal cost, given the financial challenges for enrichment activities as mentioned by Cikgu Maryam before. Additionally, the young people have also identified the abundance of single-use plastic waste in the school. Therefore, I suggested this concept to the young people to address their identified problem and shared more information about ecobricks with them as part of the preparation of this project.

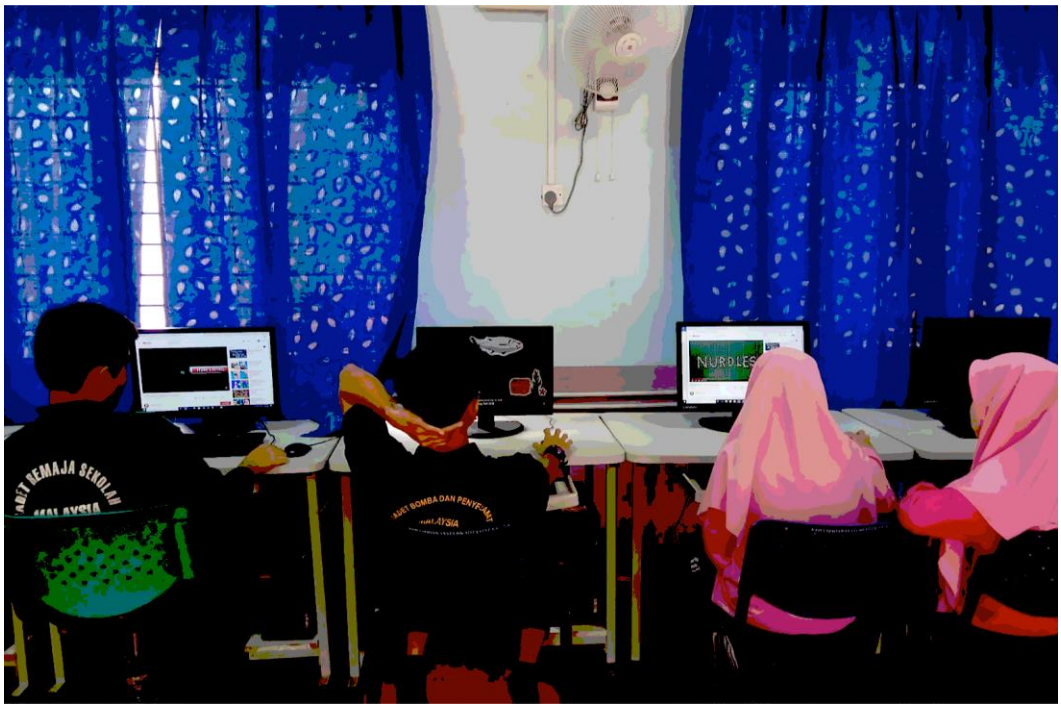

Figure 19: Some of the young people conducting desktop research for their project

Part of the development of this project also involved conducting desktop research to learn more about single-use plastic and to contextualise the problem of plastic waste in their surroundings. As this was the first time that they would participate in a competition of this

nature, I provided guidance on what information would be useful for the project and then they engaged in an internet search:

> In the computer room, I gather the students to talk about the components of the poster, and what kind of information needs to be searched on the internet to include in the poster. We briefly discuss the procedure for carrying out the project, which includes coming up with the sketch, doing a site visit, photo documentation, and also discussing the concept of "scale" in developing the prototype. Then, I guide them to search for information on the computers. I ask them to search for a combination of keywords like "*kitar semula*" (recycling) and "Terengganu"…"Sekolah", "Hulu Terengganu" so they can begin gathering facts. (Fieldnotes, 21 January 2020)

Figure 19 shows some of the young people conducting desktop research on plastic waste in Malaysia and their community, as well as learning more about single-use plastic. Around this time, Cikgu Maryam informed me that Cikgu Linda, a science subject teacher, was assigned by the school leadership to guide the young people on this project alongside me. Cikgu Linda, who had recently transferred to Sekolah Luar Bandar in 2019, previously taught at a school in the same district (Hulu Terengganu) that is much less remote, more suburban and closer in proximity to the state capital. Throughout her 15-year tenure there, she had coached many teams participating in science/STEM competitions and brought with her a wealth of experience.

After one of the meetings with the young people together with Cikgu Linda, we walked around the school to identify single-use plastic waste that could be used for making ecobricks:

> Cikgu Linda suggests we arrange the tables in a group in the middle of the class. [One student]…began explaining that we had brainstormed ideas and chose one recycling project related to broken chairs and waste from the cooperative to build a shed where the students can find shade while waiting to leave school…Cikgu Linda says it will be good for students to attend the competition and check out the ideas other teams have, for exposure. She suggests that when school reopens [after the

> break] we set up collection bins for plastic bottles and single-use plastic near the cooperative. We then pack up to go walking around the school to collect boxes and single-use plastic, first at the cooperative and then around the school hall. (Fieldnotes, 22 January 2020)

Young people collecting plastic waste (mainly food wrappings) and disposable plastic drinking bottles around the school compound are depicted in Figure 20. Our project then paused for a one-week school break that coincided with the Chinese New Year celebrations. As school resumed on 28 January 2020, Chik left Sekolah Luar Bandar to enroll in the technical school in Kuala Terengganu and Ceney replaced him as one of the school representatives (joining Petir, Ana and Wan). The young people then began making ecobricks from the collected plastic waste. This entailed cutting single-use plastic into small strips, and filling up plastic drinking bottles with these strips, densely compacting them with a packing stick made of bamboo in the process (Global Ecobricks Alliance, n.d.).



Figure 20: Young people collecting plastic waste around the school compound

In order to determine when each ecobrick was complete, it must be weighed to reach a minimum mass[26] based on the bottle volume, as this signals their durability. Once enough ecobricks were completed, 12 of them were combined to construct a small stool that they would bring to the competition to demonstrate the utility of the bricks for making furniture.



Figure 21: Young people in the process of making ecobricks, some of which are shown in the foreground

In Figure 21, the young people are shown making ecobricks, with some completed bricks in the foreground. The making of ecobricks was a slow process that demanded patience and perseverance. Cikgu Maryam, Cikgu Linda and myself all pitched in to help. This process also enabled me to develop rapport with the young people and teachers through conversations, jokes and games to while away the time. It was through the informal

[26] Per the guidelines of the Global Ecobricks Alliance (n.d.), "an ecobrick's density must be higher than 0.33 grams per millilitre." Using 600 millilitre plastic drinking bottles, the young people ensured that the weight of each ecobrick exceeded the minimum mass of 198 grams.

conversations that took place during the communal making of ecobricks that I had the opportunity to learn more about the young people's backgrounds as well as rich contextual details about the school and surrounding community.

During the preparation of this project, Cikgu Halim, the GKT subject teacher, offered to assist the young people to develop technical drawings of the shed that they could include in the project poster. I recall his generous support for the project in my fieldnotes, encouraging the young people to apply their learnings from GKT:

> He explains to the three students—H4lfiey, Ceney and Wan—that he wants them to apply what they've learned (sketching) to the STEM project. I show them the images I've just taken [of the project site] and ask them to imagine what the shed can look like. They come up with "orthographic projection" and "two point perspective drawing" based on the discussed design. (Fieldnotes, 30 January 2020)

In addition to the technical drawings, the young people also constructed a prototype of their proposed shed using recycled materials such as cardboard packaging and juice cartons to include in their project display, as depicted in Figure 22. They also developed an abstract and poster for their project, with the guidance of Cikgu Linda and myself. These activities took place during relief periods in the school day, after school, as well as on weekends leading up to the competition.

Throughout this preparation time, I engaged them in various discussions to integrate elements of STEM in the project. Below, I provide an example from my fieldnotes:

> Once all the ecobricks were completed, we measured the total mass and then I pose a mathematics question to Wan and Mila. How do they determine the total mass of the single-use plastic we have used in 12 bottles, if I provide them a single empty bottle and the laboratory balance? We discuss this. Then I explain the approach and express it in an algebraic equation. When H4lfiey and Ceney joined us, I quiz them on the same problem. (Fieldnotes, 3 February 2020)



Figure 22: Ceney and H4lfiey constructing a prototype of the shelter

In the final days before the competition, the young people had the opportunity to rehearse their presentation among themselves, with teachers and also at one of the morning assemblies in front of the whole student body. This dimension will be elaborated in more detail in Section 7.3.1 in relation to the exercise of capacity to aspire. Eventually, on 5 and 6 February 2020, four of the young people (Petir, Ceney, H4lfiey and Wan)[27] travelled to UMT in the state capital of Kuala Terengganu to participate in the STEM innovation competition. Cikgu Maryam, Cikgu Linda and myself accompanied them on this trip. The first day was dedicated for the project setup and rehearsal while the second day was for the competition itself. When we arrived at UMT for the project setup on 5 Feburary 2020, the

[27] H4lfiey replaced Ana a few days before the competition as she was not keen on representing the school, despite a conversation Cikgu Linda had with her. I discuss this hesitation in Section 7.3.2.

young people had the chance to familiarise themselves with the venue and arrange their materials for the next day:

> We are assigned the panel at the very end with plenty of space for tables…We then set up the project display, arranged the posters, materials on the table and do a full rehearsal, which went well. All the students knew their respective roles. One of the lecturers from UMT who is part of the organising committee stopped by our corner and stressed the importance of problem solving as being what the judges were looking for. (Fieldnotes, 5 February 2020)

On the competition day itself, the young people witnessed the fruits of their work displayed alongside projects by students from other schools in the state of Terengganu. Throughout the day they had the chance to present their project to judges and visitors, learn about other projects and attend career exposure events organised by the university. I share my impression of how the day unfolded below:

> As the judging commenced, beginning with other groups at the opposite end of the hallway, a lot of students and teachers from other schools visited our booth, so the students had the opportunity to practice and warm-up before the actual judging. Cikgu Maryam takes a lot of photos of the students in action to share with other teachers back at Sekolah Luar Bandar. The students demonstrated how to make ecobricks to people who visited their booth…After the judging, I asked the students how it went and they said it was okay…They then took turns to stand by the booth for the rest of the day to entertain visitors, and also visited other displays and participated in the day's activities…I also walked around to see what other schools presented—cosmetic/skincare products, drain cleaning product, fire safety gate, entrepreneurship, pest deterring system for agriculture. (Fieldnotes, 6 February 2020)

Figure 23 shows the young people presenting their project to the judges. I further discuss the young people's experience with this encounter in Section 7.3.1.



Figure 23: Young people presenting their project to the competition judges

By the end of the day, schools that participated in the competition were ushered into the main auditorium for the announcement of the results. In my fieldnotes, I recorded the following:

> Then, the award ceremony for the STEM innovation competition followed. The organisers first announced the winner for best presenter and best booth display. Then they announced the bronze and silver medal winners. Multiple schools were mentioned in each category, so we speculated every participating school would get a medal…at this point Sekolah Luar Bandar had not been mentioned. When they mentioned the gold medal winners, finally Sekolah Luar Bandar was announced as among the winners! It was a surreal moment indeed…Later as we were leaving I bid farewell to one of the organisers and he mentioned that the judges were impressed with Sekolah Luar Bandar because as a first time entry, they did very well. (Fieldnotes, 6 February 2020)

Earning a gold medal for a first time entry was an added boost of confidence to an already novel experience for the young people. Such a jubilant outcome sets the scene for reflecting on how this project serves as an educative experience and the enactment of their aspirations for development. It provides the opportunity for the young people to experience a mix of emotions, to travel outside of their normal routine and to rasa a novel encounter that pertains to questions of development in their local surroundings. In the next section, I explore these themes in more detail.

7.3 Rasa of Exposure to Novel, Challenging and Embodied Encounters

In this section, I complement the description of young people's participation in an informal STEM education project with analysis of my fieldnotes as well as interviews with experts and policymakers, teachers and the participating young people. The intent here is to suggest how the above experience enables young people to enact their aspirations for development. To do this, I think with Sellar & Gale's (2011) new structure of feeling in relation to student equity, which includes dimensions of mobility, aspiration and voice described before. In the original conceptualisation of structure of feeling, Williams (1977) highlights how this concept is characterised as

> a set, with specific internal relations, at once interlocking and in tension. Yet we are also defining a social experience which is still in process, often indeed not yet recognised as social but taken to be private, idiosyncratic, and even isolating. (p. 132)

Grounded in the empirical data, I place Sellar & Gale's (2011) new structure of feeling in dialogue with the Malay concept of rasa (Lim, 2003; Yaapar, 2005). Guided by young people's own use of the term rasa in reflecting about their participation in this informal STEM education project, I take it on as the overarching concept that reflects the tentative,

emerging nature of young people's aspirations forged through a novel experience. By engaging with instances of rasa evident through young people's collective reflections in this project, I suggest the following themes as tentative, "still in process" dimensions, to borrow Williams' (1977) phrasing, that enable them to enact their aspirations for development. Young people's participation in an informal STEM education project that attends to challenges specific to their day-to-day experiences pave the way for such dimensions to unfold.

7.3.1 Opportunities to Practice the Rasa of Aspiring

This theme suggests how the informal STEM education project and subsequent competition serve as sites for young people to practice the rasa of aspiring. Recall that in conceptualising the capacity to aspire, Appadurai (2004) argues that

> …like any complex cultural capacity, [it] thrives and survives on practice, repetition, exploration, conjecture, and refutation. Where the opportunities for such conjecture and refutation in regard to the future are limited…it follows that the capacity itself remains relatively less developed. (p. 69)

Through their participation in this informal STEM education project, young people were provided the opportunity to discuss the challenges related to development, which they have observed in their school and surrounding community. The brainstorming activity resulted in various suggestions that demonstrate the young people's sensitivity to matters deemed important in their lives which—given the permission and opportunity—they could contribute in addressing through the application of STEM education. The list of young people's suggestions during the brainstorming activity were previously included in Section 7.2.2 (Project Preparation and Development). The suggestions include addressing

infrastructural problems, agriculture and after-school projects, as well as waste recycling. Young people's keen awareness of the challenges and possibilities in their own community can facilitate their active role to take action by applying elements of science—or in this context STEM—education (Boisselle, 2016; Miller & Krajcik, 2019; Morales-Doyle & Frausto, 2021).



Figure 24: Cikgu Halim (left) and Cikgu Linda (right) coach Wan in technical drawing and abstract writing

The ideas suggested by the young people were eventually aggregated as potential projects and put to a vote, as highlighted in the previous section. The proposed project to develop a shed using ecobricks and other recycled materials points to the work of aspiration, as it represents their concern for a problem they would like to address in their school. In the course of preparing for this competition, various opportunities of practice presented themselves. As mentioned in Section 7.2.2, the young people had the opportunity to be

supported by their teachers and myself for elements of the project they were not familiar with. Figure 24 shows examples of this, whereby Cikgu Halim and Cikgu Linda are shown coaching Wan with technical drawing and developing the project abstract, respectively.

Other forms of practice also took place among peers. For example, leading up to the competition, I recorded this moment of rehearsal where one of the young people, Petir had been appointed as the presenter:

> Petir begins rehearsing his presentation. Two Form 5 students come into the workroom to observe and I ask one of them to sit on the stool made of ecobricks. We all give Petir pointers and I encourage him to write a script of what he will say based on the poster. We then suggest a few questions that could potentially be asked by the judges. Then we do another round, timed to seven minutes. (Fieldnotes, 3 February 2020)

The above instance of practice, coupled with presentations in front of teachers and one of the morning assemblies, enable the young people to gain a rasa of aspiring and how they might articulate it to others. During the competition, the young people were able to "demonstrate making ecobricks for people that came to visit their booth…[Ceney] said he got some *soalan membunuh* (killer questions) from visitors." (Fieldnotes, 6 February 2020). This is also evidence of an embodied opportunity—young people "in action" in front of the audience of the public and competition judges. Dr. Laili Che Rose, the competition organiser at UMT describes the benefit of this exposure as follows:

> For instance…we organise the innovation competition, like the one you participated in recently. So at that time, they are answering questions posed by the judges. Winning or losing is not the main concern, but actually it is there that we provide the platform, the opportunity for students to shape their skills, increasing their confidence.

Additionally, through reflections following the competition, the young people were also able to articulate the significance of this project beyond the specificity of the problem they were addressing (abundance of single use plastic waste in their school). Gesturing towards broader concerns about the environment, Petir highlights how he

> rasa the importance of this project…firstly it reduces environmental pollution. Secondly, it also enables us to create amenities using waste that could contribute to pollution. When we use this waste to make the amenities, the waste in our country will be reduced.

Beyond the national scale, his friend Ceney connects this experience further outwards, using India as an example he has encountered on the internet:

> We get to take care of the environment from pollution resulting from plastic burning. Disposal of plastic waste too, because now overseas, in New Delhi, we can see they have a garbage mountain.

Together, these reflections suggest how participation in this informal STEM education project served as a platform for the young people to voice their concerns and engage in the work of aspiring for development. These concerns were not limited to their locality, but also tied to broader questions of development out there. In this way, exercising their voice hints at their aspirations for development, articulated through a specific issue of concern in their immediate environment. The issue of plastic pollution, in this instance, points to one of the modern challenges encroaching rural communities not just in Malaysia but also globally (Mihai, 2018; Nxumalo et al., 2020). When young people voice out their concerns at the intersection of this challenge and STEM education, their situated, experiential knowledge about development ought to be taken seriously by adults, and specifically policymakers working on questions of development.

7.3.2 Mixed Emotions in the Face of a Novel Experience

Exposure to novel, embodied encounters via this project also unearthed a mixture of emotions that the young people had to confront. Most of them reported that this was the first time they were involved in a STEM education project of this nature. During the preparation stage, I recall a moment when one of the students, Ana, was hesitant to commit:

> Cikgu Linda stops by the workroom that we use to prepare for the competition and we chatted about travel arrangements. She told me that earlier, Ana spoke to her during physical education class [about her hesitation]. Cikgu Linda thinks Ana is nervous about the competition. We discuss the importance of giving the young people opportunity and exposure through activities such as this. (Fieldnotes, 3 February 2020)

Ana eventually withdrew from participating in the final line-up for the competition, and was replaced by her classmate H4lfiey. This feeling of trepidation is not unique to Ana, as other young people also reflected on feeling nervous about the competition. Although they are keen to use their voice to articulate aspirations for development, their voice is in tension with the affect of nervousness and doubt. After the competition, H4lfiey reflected how he "rasa nervous too, because we are competing with schools that are smart." Still, the opportunity to develop confidence is opened up in the process of participating in such a novel experience.

Young people's sense of doubt here is contextualised through teachers' observations about their location and associated opportunities. According to the teachers, the remote, isolated environment does not present much opportunity for challenges and competitiveness. Consider Cikgu Halim's observation of his experience with students in Sekolah Luar Bandar over his 16-year tenure there:

> Because they are from hulu (a remote, interior location). Hulu people feel they are inferior. Why did I manage to catapult our handball team to the national level? Because I wanted to challenge the perception of outsiders, "Why do you underestimate hulu people?" Hulu people, they rasa inferior when they are outside of their environment...Secondly, it's the environment. The environment itself does not provide motivation; there is no competition…It's the motivation, that's what I observe. That and their sense of shyness, inferiority…They are even ashamed to speak their own dialect.

Teachers' observations point to the value of novel experiences where young people are taken into a new environment, which may enable them to "test" their mixed emotions via a challenge or project they have engaged in. More than proving others wrong, broadening young people's self-perception can empower them to continue practicing the rasa of aspiring, as highlighted in the previous section. I analyse the mobility of young people into a new environment in greater detail in the next section.

Although participation—and success—in the STEM innovation competition was a positive experience for the young people, their emotions remain ambivalent. Consider my exchange below with Ceney after the competition:

Aizuddin	:	So if Cikgu Maryam had not nominated your name, you didn't want to participate?
Ceney	:	No, didn't want to. I'd run [he laughs]
Aizuddin	:	Eventhough I was there to support? [I laugh]
Ceney	:	Because I was scared, but after I participated and gained experience, I can participate again next year.
Aizuddin	:	Okay, now that you have experience do you rasa there is a possibility to participate again?
Ceney	:	Maybe, but I'm still scared [he laughs]
Aizuddin	:	Scared? Why are you scared?
Ceney	:	Scared, because I have to present in front of people.

Nevertheless, the possibility of future participation indicates how novel experiences such as this cannot be underestimated in pushing young people forward. Wan, who is generally very reserved and—according to Cikgu Linda—likes to keep to herself, remarked that she "gained a new experience…[she was initially] disinterested in joining the activity, but starting from this one there is a rasa to participate again." I argue that this rasa that is gained (in all its ambivalence) through the exposure to a novel experience is an important affective dimension of young people's capacity to aspire.

7.3.3 Traveling Outside of the Familiar Environment

In my conversation with teachers, they highlighted the importance of young people in Sekolah Luar Bandar being exposed to a broader set of experiences beyond their locality. There is a lot of emphasis on "seeing is believing", which is facilitated by bringing the young people into different environments than they are accustomed to. Cikgu Nor, the guidance counsellor, shares about some visits she organises to industrial training institutions. Meanwhile, Cikgu Adam provides a rich description of the need for exposure through mobility:

> We have to bring them…to see advanced technologies. Bring them into vessels, like ones with the sonar technology to detect fish, things like that. Because we are living in a kampung. For people in Kuala Lumpur I am not concerned. We live in luar bandar, so things like that will cultivate their interest. We have to bring them [for field trips] right? If we can't afford to visit Kuala Lumpur, then here in Terengganu, in [the state capital of] Kuala Terengganu there is also an abundance of technology. The [Kuala Terengganu] drawbridge, that's technology. They will say "Oh, it can be raised." Why, what is the function? It is to allow ships to pass. But the technology has to be developed for this. So they need to go there to see for themselves.

Indeed, in order to participate in this STEM innovation competition, the young people travelled for one hour to UMT, the local university situated in the state capital of Kuala

Terengganu. This experience is one that entails them "go[ing] there to see for themselves", in the words of Cikgu Adam above. Although this is not a great distance, Cikgu Linda shares with me that in her conversations with students in Sekolah Luar Bandar, "there are some that do, but not all students have the opportunity to go to [the town centre nearest to the school], what more further away than that, like Kuala Terengganu?" As such, the opportunity for the young people to travel for this competition was not something to be taken for granted.



Figure 25: Ceney and Petir explain how ecobricks are made to students from other schools

By traveling to the state capital, the young people were able to see themselves in relation to this new environment. Upon reflection, Hl4fiey mentions: "The *perasaan* (feeling, from root word rasa) of going there? Perasaan excited, to do this takes teamwork…extra effort, gather[ing] after school." Despite nervousness, finally making their way to the competition scene was a culmination of all the hard work of the prior weeks. Meanwhile, Petir speaks of the substance of this novel experience:

> In my experience joining…I rasa it is a new experience…and we can say we got to compete, we got to know the scene there, to get used to it, and I rasa it's a new [experience] for me. Maybe we can get used to other people, environment, so this is what we say a very interesting experience…

Here, he is referring to the embodied experience of being in the competition scene alongside other young people his age and becoming acquainted with this new experience. It is through traveling to a new environment that they were able to encounter other young people with similar interests. Figure 25 shows Ceney and Petir in action, demonstrating how ecobricks are made to peers from other schools visiting their display. In this shared space, they had the opportunity to exchange knowledge, to articulate why their project matters and demonstrate their work to attendees visiting their display. In short, being in this competition environment enabled the young people to enact their aspiration—enunciating a development challenge and solution identified in their own surroundings.

In addition to participating in the competition, the young people also had the opportunity to visit exhibitions by various research groups at the university. When reflecting on his participation, Ceney remarked that he "got to see what microplastic is…to visit UMT (the local university), see how they learn. That was my experience." Together with Petir, I also visited "UMT's microplastics research group to look at their display on how long plastics last

before decaying." (Fieldnotes, 6 February 2020). The experience encountering this related exhibition enabled the young people to link their project on ecobricks with a research project conducted at the university level, thus discovering another relevant connection beyond their immediate locality.

Being transplanted into a new environment, albeit temporarily, enabled the young people who participated in this STEM innovation competition to rasa a new experience. It was necessary for them to travel outside of their familiar, remote environment and enter a new one in order to embody a scenario unlike what they had encountered before. This scenario enabled dialogue and exchange with peers as well as connection of existing STEM learning with related knowledges presented at the university. Overall, the kind of informal STEM education for young people described here suggests an alignment with both ecological and interactionist senses of embodiment in science education: affordances (student-environment interfaces) and social interactions in a novel scenario that augment learning and understanding (Kersting et al., 2021). Thus, through the various interactions taking place via mobility into a novel environment, young people's emerging sense of rasa thus strengthens their capacity to aspire about a particular development challenge and solution articulated through this collaborative project.

7.4 Summary of Findings

The line of inquiry that I followed in this chapter attends to young people's aspirations for development and capacity to aspire:

> RQ3: How can young people enact their aspirations for development in relation to STEM education and their day-to-day lives in the luar bandar?

By paying attention to informal STEM education that is attuned to the concerns they have in their immediate surroundings, we collaborated on a participatory project for a competition organised by UMT, a public university in the state capital of Kuala Terengganu. The opportunity offered by a STEM innovation competition in the early days of fieldwork in Sekolah Luar Bandar was an instance of kebetulan, a serendipitous opening that embeds me in a web of relationships with young people and their teachers, thereby enriching this study. Guided by the FIDS framework (Gudipati & Sethi, 2017), young people voiced their concerns and challenges observed in their immediate environment and voted on a project they would develop for the STEM innovation competition. The selected project was the reuse of disposed materials around the school for constructing a shed for students waiting for after-school transportation. Young people collected single-use plastic waste to make ecobricks, which could be used as construction material. In the process, they also conducted desktop research, drafted technical drawings, a poster and a project abstract with the support of teachers and myself. Eventually, the young people participated in the competition at UMT in the state capital, Kuala Terengganu and earned one of the gold medals.

Through their participation in an informal STEM education project leading up to the competition, young people in this study had the opportunity to practice the work of aspiring. This entailed the space to articulate development concerns related to their immediate surroundings. In this process, their teachers and myself supported them as they situated their project within the bigger picture of environmental issues. Beyond merely positive elements, the affective dimension of doubt, fear and nervousness surrounding their involvement in this novel experience also animates their capacity to aspire. Finally, experiencing this novel encounter to enact their aspirations for development entails the need to physically travel

outside their familiar environment. Only through this form of mobility were the young people able to experience what is out there, engage with peers their age at the STEM innovation competition and subsequently reflect on their learnings in relation to such a novel experience.

I end this chapter with an anecdote from a time after fieldwork. To me, this anecdote hints at the potency of this emerging sense of rasa for the young people in this study grappling with questions of development through informal STEM education:

> On 11 January 2021, I received a WhatsApp message from Petir, one of the young people in this study. He excitedly shared with me a video he had just watched that showcased building blocks made using plastic waste (ByBlock). It reminded us both of the project we worked on almost a year prior, which had clearly left an impression on him. I would like to think of this as an example of an emerging sense of rasa that was developed through our participatory project...

In the next chapter, I consolidate the findings presented here, alongside the previous two chapters and discuss them with reference to the existing literature. I then articulate my contributions and conclude this thesis.

CHAPTER 8: Discussion and Conclusion

8.1 Introduction

The overarching line of inquiry in this study as reflected in the MRQ is "How do young people in the Malaysian luar bandar describe and enact their aspirations for development in relation to STEM education and their day-to-day experiences?" Subsequently, in this thesis I have attended to this MRQ through the following sub-questions, the findings of which have been elaborated in Chapters 5, 6 and 7 respectively:

> RQ1: How does the science for development model translate in the Malaysian context and what are young people's related aspirations for development in the luar bandar?
>
> RQ2: How does the national development discourse translate to the luar bandar and what are young people's related aspirations for development based on their day-to-day experiences?
>
> RQ3: How can young people enact their aspirations for development in relation to STEM education and their day-to-day lives in the luar bandar?

In this chapter, I first discuss the findings from the previous chapters with reference to the existing literature in order to address the MRQ. Subsequently, I highlight this study's contribution to research and practice, followed by a reflection on limitations—and openings—associated with research decisions and circumstances. Finally, I conclude this thesis by suggesting potential pathways for future research.

8.2 Addressing the Main Research Question

In this section, I summarise and discuss the findings responding to the MRQ by attending to young people's description of their aspirations for development (Section 8.2.1), the material

conditions anchoring some of their descriptions (Section 8.2.2), followed by their enactment of aspirations for development (Section 8.2.3). The first two sections on descriptions of aspirations and material conditions weave the findings from Chapters 5 and 6, whilst the final section on enactment of aspirations discusses the findings from Chapter 7.

8.2.1 Mimicry, Hybridity and Ambivalence of Aspirations

Young people in Sekolah Luar Bandar describe four main aspirations for development, as presented in Chapters 5 and 6. Guided by concepts of mimicry, hybridity and ambivalence from postcolonial theory, I discuss the aspirations in this section by situating them in the broader literature. Recall that these concepts were previously elaborated in Chapter 2 (Section 2.2.1).

One of the aspirations described by the young people through RQ1 is associating development with the word maju in Bahasa Melayu, which translates to "the march forward of progress". In their accounts of aspiring for development as maju and the associated notion of modernity, young people largely refer to infrastructure and technological development in their immediate locality, rather than larger scales such as the "national". As mentioned by one of the young people, "If it's too far to imagine, I don't have aspirations…" (Chik). Looking around their kampung, they desire local amenities that are more readily available in the bandar, such as public transportation, the utility of mobile apps as well as stable internet connection, wondering "if we do development here we won't be too excluded from others, right?" (Ceney). Here, young people's aspirations echo the translation of the science for development model at the national level in Malaysia, as expressed in the preamble of the Rukun Negara that includes the statement: "Build a

progressive society that uses modern science and technology". Indeed, the findings in this study align with a larger scale study of rural livelihoods among youth in Malaysia, which reveal unsatisfactory infrastructure and facilities in their localities (Yassin et al., 2018). At first glance, such aspirations can be seen as young people in the peripheral luar bandar expressing the desire to mimic the lifestyle of their counterparts in the bandar. When seen in this light, their aspirations echo trends identified in other rural contexts—aspiring to urban lifestyles characterised by notions of "cool" and patterns of consumption that reflect aspired standards of modernity (Pavón-Benítez et al., 2021; Pedersen & Gram, 2018; Sentíes Portilla, 2017). However, I return to this aspiration in the next section to offer an alternative explanation.

The second aspiration for development revealed through RQ1 relates to young people's awareness of development effects in other parts of the world beyond their locality and beyond Malaysia. For instance, Mila and Wan express desire to travel abroad—citing examples of modernisation like Hong Kong and Dubai—in order to gain new experiences. Young people also cite Japan as an example to be emulated, referring to notions of civic-mindedness and political stability compared to Malaysia. Nonetheless, such globalised desire for a developed Malaysia is balanced with an aspiration for a distinct national identity on the world stage, pointing to a hybrid of the global and the local. For instance, Mila wants to open a bakery abroad that sells Malaysian cakes and also those associated with orang putih (white people). These hybrid aspirations articulated by the young people are facilitated by increasing access to television and the internet, even when such access remains limited compared to the bandar due to infrastructure challenges. What is observed among young people here points to what M. Woods (2007) refers to as the "global countryside", which

include "the hybrid interaction of different strands of globalization and of local, national and global actors…the impact of globalization on rural localities is revealed not as domination or subordination but as negotiation, manipulation and hybridization" (p. 487).

The repeated mention of Japan as part of young people's aspiration is an interesting manifestation of the global countryside, especially when read against the manoeuvres of national actors, who in a period of recent history have focused on Japan as an exemplar for development through the Look East Policy. Here, young people's positive attitudes towards modernisation are aligned with the elements of the science for development model (Drori, 1998). Nevertheless, this does not necessarily mean that such hybrid aspirations should be read as an in-between phase on a linear, inevitable development trajectory from traditional to modern, but rather as contingent and in constant negotiation (Ferguson, 1999; Rigg, 2007).

Subsequently, although the Malaysian government's Rural Development Policy portrayed globalisation as a threat to values typically associated with the luar bandar (family values, gotong-royong or mutual aid), young people in this study resist such essentialisations. This is to say that they develop aspirations that at once gesture to desires associated with globalisation, as described before, while also articulating aspirations that demonstrate an attachment and commitment to family rooted in their day-to-day lives. In one of the findings of RQ2, young people describe aspirations for development that prioritise their responsibility towards family, especially their parents. Collectively, they want to be of help to family members, make their parents proud, as well as "change the fate of the family" (Mila). Young people also express their intent to honour their parents' desires to see them continue on to higher education. Aspirations in this regard are consistent with reported notions of

filial duty studied among young people in Malaysia and its neighbour Indonesia where the notion of gotong-royong is shared (Larasati et al., 2021; Naafs, 2018; Nainee et al., 2016). These aspirations must be understood in the context of the centrality of family in the day-to-day lives of young people in the luar bandar. They report spending their time after school and on the weekends assisting their family, minding and playing with siblings and being in community. Close ties and aspirations associated with the family reported by young people in this study align with the broader literature in other rural contexts (Butler & Muir, 2017; Daum, 2019; Elias et al., 2018; Larasati et al., 2021; R. Mills et al., 2021). Appreciating such familial ties enables us to illuminate "the intermediate and higher order normative contexts within which these wants are gestated and brought into view." (Appadurai, 2004, p. 68). This means that taking a more expansive view of development beyond immediate quantifiable needs—the latter being the realm of economic development—facilitates an understanding of the *ends* of development, rather than just the *means* (Appadurai, 2004; Sen, 1999).

I did not identify in the empirical data instances where an embrace of globalisation eroded or stood in tension against their aspirations tied to family, as the Malaysian government would like to claim. Despite the federal government's paternalistic concerns about communities in the luar bandar being overcome by globalisation, young people in this study show that they are not necessarily luar (outside) of globalisation as helpless folks needing guidance to navigate its terrains, so as not to be corrupted. Rather, they demonstrate a pragmatic, hybrid ability to discern which elements of globalisation can be harnessed for the work of aspiring—as evidenced in the preceding paragraphs—whilst foregrounding the centrality of family in reflecting about development. Therefore, young people in this study unsettle the

"frequent and repetitive references to [the] *kampung*, figured as sites of rurality, backwardness, underdevelopment, naïveté and tradition" (Thompson, 2004, p. 2357).

Additionally, through a postcolonial lens, young people's ambivalence was identified in their aspiration for development associated with the push and pull of the environment they are embedded in. Through another aspiration for development illuminated in RQ2, young people highlight their affinity to the lush landscape, mentioning encounter with animals, the chilly mornings and spending time with friends by the river. For example, Chik contrasts the heated environment around the technical school in the state capital of Kuala Terengganu, where he has gone on to study, compared to the idyllic landscape of Sekolah Luar Bandar. This positive association with the environment echoes the existing literature in terms of representation and romanticisation of the rural idyll (Farrugia et al., 2015; Leyshon, 2008; Pedersen & Gram, 2018; Wiborg, 2004). In the context of luar bandar, indeed the attachment to such idyllic landscapes root young people in place and would make them inclined to remain (McLaughlin et al., 2014).

Nevertheless, young people in this study also complicate the above romanticisation in terms of how they view the manifestation of development in their community. Here, the motorcycle—as a vehicle of rural youth leisure and desire (Farrugia et al., 2015; Saimon et al., 2015; Sentíes Portilla, 2017)—becomes the crucible of ambivalence for young people in the luar bandar. H4lfiey shares a photo taken from his motorcycle by the river, where he spends time with his friends. At the same time, he complains about the noisy environment around his home, where large roads enable young people to speed by on motorcycles. Although young people rely on this accoutrement of development for mobility in their community—

getting to and from school and socialising with friends—they also highlight how motorcycles can disturb the peaceful atmosphere of rural idyll described before.

In summary, the aspirations for development described by young people in the luar bandar reflect a kind of hybrid dynamism within a particular "global countryside" (M. Woods, 2007), with desires to mimic urban amenities, the negotiation of globalised influences and national as well as local concerns, the deep commitment to family, coupled with ambivalence about their local environment and use of motorcycles. Beyond the motorcycle as a literal vehicle for mobility, wider notions of mobility also capture young people's ambivalence in relation to their aspiration for development. When conceiving of development "as a process of expanding the real freedoms that people enjoy" (Sen, 1999, p. 4), the findings in this study indicate that young people's freedoms to make a living of their choosing are circumscribed by broader socioeconomic forces which reflect metropolitan priorities of development that translate into their community. It is to such *translations* related to young people's aspirations that I will turn to next.

8.2.2 Material Conditions and Aspirational Equality

In the adoption of a postcolonial critique of development in this study, I have attended to young people's aspirations along the dimensions of mimicry, hybridity and ambivalence in order to complicate static notions of rurality, or more specifically, the luar bandar in Malaysia. Nevertheless, attention to a realist analysis of the material conditions of aspiring cannot be obscured in favour of attempts at surfacing marginal narratives through deconstruction and (re)presentation of taken-for-granted categories such as rurality. Therefore, I also undertake a postcolonial analysis that brings a realist view of material

conditions together with works of deconstruction elucidated in the previous section to better understand the phenomenon under study (Crossley & Tikly, 2004). In this section, I focus on a realist analysis of the structural and material conditions that bear upon young people's lives as they describe their aspirations for development. I do this in order to present a more complex and grounded picture of the luar bandar within which the young people in this study do the work of aspiring, and the potential for realising such aspirations.

As a starting point, I return to the findings of RQ1 on aspirations for development related to the notion of maju, pointing to infrastructural and technological development like that of the bandar. Beyond mere mimicry, young people's aspirations here point to the obvious discrepancies in access to resources between the bandar and luar bandar in Malaysia (Ministry of Rural Development Malaysia, 2019). This is to say that young people's aspiration for development reflect the desire for amenities that will enable them to lead lives with fewer encumbrances right where they are—access to better internet connectivity and reliable public transportation, for instance. Yearnings from the peripheral luar bandar for a semblance of the metropolitan bandar is not so much a mindless cultural mimicry, rather, in the words of anthropologist James Ferguson (2006):

> The aspiration to modernity has been an aspiration to rise in the world in economic and political terms; to improve one's way of life, one's standing, one's place-in-the-world. Modernity has thus been a way of talking about global inequality and about material needs and how they might be met. In particular, it has indexed specific aspirations to such primary "modern" goods as improved housing, health care, and education. (p. 32)

Thus, when young people in this study describe an aspiration to become maju, to move forward, it can be interpreted as a claim to "aspirational equality" (Ferguson, 2006). Localised into the Malaysian context and put simply, why shouldn't young people in the luar

bandar aspire to standards of development taken for granted in many parts of the bandar? An aspiration of this kind is thus a claim to membership (of equals) amidst a condition marked by inequality, by the gap of the luar/bandar admitted and plainly stated by the Malaysian government, as elaborated in Chapter 6 (Section 6.2.1).

A yearning for material equality through aspiration is also reflected in young people's perception of likely outmigration for future employment prospects, revealed via RQ2. Within the broader national context where the "Bandar is the centre of economic growth…wherein many job opportunities and amenities are provided" (Ministry of Rural Development Malaysia, 2019, p. 2-1), young people in this study observe parents, older siblings and community members in employment outside of the community, or facing difficulty with employment locally. For example, both Ceney's and Damia's fathers are employed in a different state. Meanwhile, Chik and H4lfiey have older siblings who were living at home and at that point, unemployed.

In the context of these intimate, familial observations of (un)employment, the young people feel the need to migrate in search of employment elsewhere. Perhaps by migrating, they will be able to address material inequalities: "If we work a bit further away from here, maybe we can get a bit more income." (H4lfiey). Young people's aspirations in this regard have to be understood in the very real, material context of employment in Malaysia. Recall that in Chapter 6 (Section 6.2.1), I highlighted that the rate of urbanisation in Malaysia continues to climb every year, hollowing out locations in the luar bandar in the process. The acute reality of potential outmigration surfaced in this study supports the overwhelming evidence in the global literature of rural young people "learning to leave" in search of better opportunities

(Corbett, 2020; Corbett & Forsey, 2017; Crivello, 2011; Farrugia, 2016; Sugden & Punch, 2016).

Given the familial and prospective outmigration described above, the luar bandar of the young people in this study is more than a static place that is naturally being vacated. Milbourne & Kitchen (2014) highlight how contemporary insights from human geography point to the necessity of perceiving rural places as unfinished spaces of flux that are (re)made through mobility flows. In the context of luar bandar, I argue that these flows are facilitated through the federal government's policy and structural interventions, which in turn circumscribe young people's aspirations all the way in the luar bandar. Such is a reading of young people's aspiration for migration described in the previous paragraph: the federal government's positioning and priority of the bandar as the principal site of employment and development—coupled with the othering of the luar bandar in the process—drives the process of outmigration from the luar bandar.

In addition, attention to academic migration in this study also suggests how federal government policy shapes the horizons of possibility in the luar bandar. As described in Chapter 6 (Section 6.3.3), Sekolah Luar Bandar as a site of education is experiencing a reduction in its student numbers, reflective of the shrinking community it serves due to successive generational outmigration. Further to this, the 60:40 policy as a translation of the science for development model affects Sekolah Luar Bandar (and subsequently young people in this study) in two ways. First, two nearby specialised science schools—established as part of the national effort to fulfil the 60:40 policy—regularly pulls the most academically able students away from Sekolah Luar Bandar and other secondary schools in the same district.

Students in these specialised science schools then go on to higher education and migrate elsewhere for employment. Carr & Kefalas' (2009) study of rural brain drain in the United States of America highlight the paradox of small towns contributing to their own demise by dedicating their resources to the most academically able youth so that they may leave for better opportunities elsewhere. However, in the context of Sekolah Luar Bandar and the surrounding community—within a centralised education system in Malaysia—such choices are not up to the community. Instead, the setup of these specialised science schools is part of a *national* translation of the science for development model. Thus, in the luar bandar of this study, has the science for development model in fact contributed to underdevelopment, either by design or by accident?

Secondly, resulting from the above national level configuration and hierarchy of schools translated through the science for development model, the number of eligible students to be placed in class 4-STEM in Sekolah Luar Bandar is shrinking over time, as described in Chapter 5. In order to uphold the 60:40 policy at the school level, class 4-STEM must be kept "open" by tracking students into it, even when there may not be sufficient number of students who are academically prepared (based on their PT3 examination results at the lower secondary level). In this study, I have tracked the number of young people in class 4-STEM, from the initial 11 at the start of the school year in January 2020 to only four (Wan, Ceney, Mila, H4lfiey) remaining by the time I left the field in August 2020 (See Chapter 5, Section 5.3.4 for details).

I argue that young people's collective decision to remain or migrate out of class 4-STEM represents a dis/juncture of aspirations for development between the national and the local levels. Even when their aspirations for development are aligned with the elements of the

science for development model (reflected in the previous section), not all of them see themselves as partaking in the process of realising national aspirations of (science for) development by remaining tracked in class 4-STEM. However, even when they do not aspire to STEM careers, some of the young people see the utility of remaining in class 4-STEM (Damia[28] and Mila) by highlighting how it will open up more pathways in the future, whilst the teachers deemed the class to be more prestigious. The prestige associated with class 4-STEM is also reflected in the use of the phrase turun kelas ("going down") when referring to movement from this class to a non-STEM class. These perspectives reflect the broader emphasis on STEM in the 60:40 policy, pointing to the notion of "powerful knowledge" that is universalised, specialised and institutionalised by those in positions of power (Young & Muller, 2013). Furthermore, through a postcolonial reading, Burke & Wallace (2020) argue, "the link between science and technology is emphasised and equated with notions of progress and development" (p. 574). Indeed the translation of science for development in Malaysia as elucidated in this study gestures to this link, as well as bestowing a powerful status to STEM that in turn influences young people's choices.

Deciding to remain in class 4-STEM on the promise of broader opportunities is a claim to aspirational equality in the context of material disadvantage in the luar bandar. Nevertheless, I argue that the power associated with remaining in class 4-STEM is a contingent one. Only by achieving the right grades will the promises of the STEM pathway "make it easier for us to enter university" (Damia) and open more doors for the young people. As demonstrated in this study, young people are placed in class 4-STEM by the school administration despite not meeting the minimum academic criteria. This is done to ensure the class remains "open" in

[28] Although Damia left class 4-STEM and Sekolah Luar Bandar by the end of my fieldwork, she had enrolled in the STEM package of subjects (and equivalent of class 4-STEM) in the school in the town centre.

Sekolah Luar Bandar; hence the school serves its role to uphold the 60:40 policy. Subsequently, young people's prospects of realising their aspirations are once again circumscribed by broader forces orchestrated in the metropole. The situation created here by the federal government's blanket implementation of the 60:40 policy in the peripheral luar bandar is reminiscent of Vavrus' (2021) observation in the Tanzanian context. Vavrus (2021) argued that aspirations embedded in the promises of education can be thwarted by the ideology of policy at the national level, producing what Berlant (2011) calls "cruel optimism", whereby "optimism is cruel when the object/scene that ignites a sense of possibility actually makes it impossible to attain the expansive transformation for which a people risks striving" (p. 2). This means that the aspirations tethered to the power and promise of class 4-STEM—the paths it is purported to open up—can be foiled when young people tracked into the class are not academically prepared. In the context where the tracking of young people in the luar bandar is in the service of a national aspiration for development formulated in the bandar, one is therefore left to ask: Whose development is at stake here?

Overall, I have attended to the notion of aspirational equality in this section, by placing young people's aspirations in the thickness of the context in the luar bandar. Such context is made through the flow and mobility of national discourse and policies, which in turn order young people's placements, aspirations and movements. By highlighting the material conditions of inequality that may circumscribe young people's aspirations (and their realisations), I do not intend to paint a pessimistic, broken picture (Tuck, 2009). Here, I have laid bare the material effects of priority (migration from luar bandar to bandar) and policy (60:40 policy emphasising STEM) developed in the bandar on lives constructed as being

outside of it. I have done this through a meticulous focus on the day-to-day lives and aspirations of its intended beneficiaries—young people in the luar bandar—by following the manifestation of policies (Levinson et al., 2009; Stein, 2004). In doing so, I juxtapose young people's aspirations for development with the material conditions that circumscribe such horizons of aspirations to render a clear-eyed and sobering account. Attention to aspirational equality aids me in shedding light on the context within which young people's aspirations for development are described. In places like postcolonial Malaysia, where the ruling government remains calcified with minimal disruptions through successive democratic elections, "the government often speaks in the name of the state, and often conflates itself to be the state as a whole" (Embong, 2008, p. 29). To tweak Amartya Sen's (1999) terms, I therefore argue that the above material conditions—the priority of outmigration from the luar bandar and the 60:40 policy as a federal apparatus—presents an instance of development as *unfreedom*. Although these conditions were orchestrated by the federal government in the name of (national) development, I have shown how their translation in a particular site of the marginalised luar bandar can constrict young people's aspirations. From here, I move to discussing the second part of the MRQ (per the findings in Chapter 7) to gesture towards more hopeful and empowering affordances for young people's aspirations.

8.2.3 Aspirations and Informal STEM Education

The second dimension of the MRQ is related to the enactment of young people's aspirations for development in the luar bandar. To answer this question that is reflected by RQ3, I collaborated with the young people on a participatory informal STEM education project that arose through an instance of kebetulan. Early during my time in Sekolah Luar Bandar, while attempting to orient myself within the community, I was searching for a platform to develop

rapport with the young people, as well as a collaborative community development project that would put their aspirations into action. It was kebetulan—a chance opening of such a platform—when one of the teachers, Cikgu Maryam invited me to support the young people's participation in a STEM innovation competition at the local university, UMT. This informal STEM education project, which was guided by the FIDS framework (Gudipati & Sethi, 2017), prioritised young people's development-related concerns as observed in their school surroundings, and their capacity to address such concerns. To participate in the STEM innovation competition, young people considered the utility of STEM education—through the making of ecobricks—to address the problem of single-use plastic waste and the lack of shade for students waiting for after-school transportation in the afternoons. Preparation for the project, which involved desktop research on plastic waste, drafting technical drawings and constructing a prototype for a shelter, and verifying the integrity of the ecobricks (via calculations, measurement of mass) point to the application of STEM education that focus on integrated literacies to address an identified problem in their daily lives (Peters-Burton, 2014; Siekmann, 2016).

In this project, the combination of the FIDS framework (Gudipati & Sethi, 2017) with its elements of Feel, Imagine, Do and Share—grounded in design thinking—with integrated STEM education points to a fruitful convergence which has also been recently suggested in the literature (Carroll, 2015; English et al., 2020; Li et al., 2019). With overlapping concerns for real-world problems and active, hands-on participation, projects developed at the intersection of design thinking and integrated STEM education can empower young people to reflect on the development-related challenges in their community. Through informal education experiences outside of the confines of the national school curriculum, young

people can play a role in addressing their identified challenge. It is worth highlighting that participation in this project—facilitated by my presence and support as a researcher—was a novel experience for the young people in Sekolah Luar Bandar. Indeed, Cikgu Maryam's frank admission that the school does not have the financial resources to typically embark on these extracurricular activities aligns with the challenge identified amongst rural schools in terms of financial and geographical access to informal STEM education provisions (Hartman et al., 2017; Short et al., 2020).

In this study, I focused on how engaging in this participatory informal STEM education project enabled young people to exercise their capacity to aspire (Appadurai, 2004). Through an embodied experience, I argue that young people had the opportunity to practice the work of aspiring. This entailed articulating their aspirations to themselves, their teachers and subsequently the public at the STEM innovation competition in the local university. The concept of capacity to aspire (Appadurai, 2004) and structure of feeling tied to student equity (Sellar & Gale, 2011) was augmented by the Malay notion of rasa (Lim, 2003; Yaapar, 2005). Young people gained the opportunity to practice their rasa of aspiring through this project as a microcosm for identifying development challenges. Seeking to address the problem of single-use plastic waste and lack of infrastructure for students waiting after school, they engaged in the articulation of issues related to development, worked collaboratively among peers and with adults (teachers and myself) and shared their work publicly at the competition. The informal STEM education project illuminates forms of practice that strengthen young people's capacity to aspire, and converge with the observations by López-Muñoz & Ingelaere (2021); the aspirations of youth in rural Columbia were influenced by participation in group activities that promote agency.

In the course of being involved in this informal STEM education project, the ambivalent emotions encompassing hesitancy, doubt, nervousness, excitement and fear are all powerful affective components of learning that contribute to young people's work of aspiring. Emotions are central to one of the polyphonic meanings of the term rasa. Young people's reflections about this novel experience point to statements such as "rasa nervous too, because we are competing with schools that are smart" (H4lfiey) and also a forward-looking desire: "starting from this one there is a rasa to participate again" (Wan). To take such emotions seriously as part of experiential learning has been a growing concern in science education through the wider notion of aesthetics, characterised "as a set of design and art practices…[and] as responses of beauty, affect, emotion and taste to experiences and objects, regardless of the practice" (Wickman et al., 2021, p. 3). Through participation in informal STEM education projects that expose them to new experiences, the mix of emotions experienced by young people outside the formal confines of the classroom, curriculum and examinations deserve further consideration in terms of its implications for learning (Staus & Falk, 2017).

Attention to mobility that marks young people's potential futures in the luar bandar, as discussed in the previous section, takes on an educative colouration vis-à-vis their involvement in this project. Here, mobility was necessary so that the young people can be exposed to new experiences and sights, which their teachers felt was necessary to expand their imaginations of what is beyond their community in the luar bandar. To participate in the STEM innovation competition at the local university in the state capital of Kuala Terengganu, we travelled for one hour in a rented van from the luar bandar to the bandar. Once there, the young people had to address a panel of judges, demonstrate how to make

ecobricks to visitors, respond to questions and interact with peers their age. Hence, mobility to the state capital to experience the competition element of informal STEM education is a crucial component of strengthening young people's capacity to aspire. In the context where such mobility in the luar bandar is not the stuff of the everyday—thus becoming an event—it certainly has the potential to yield "new kinds of power for realizing ambition and interests, new possibilities and risks for embodied experiences of movement, as well as new ways for engaging with culture, taste and social contestation" (Elliott & Urry, 2010, p. 10).

Additionally, the embodied, problem- and project-based informal STEM learning rooted in the specificity of place entailed a process of collaboration, relating, voicing and exchange amongst the young people and other social actors. Kersting et al. (2021) argue that this kind of embodied experience is crucial for meaning making in science education. Ultimately, young people's participation in this informal STEM education project—that attends to the challenges they have voiced themselves—point to an occasion for practicing their capacity to aspire. If the capacity to aspire, as argued by Appadurai (2004) requires moments of friction, of practice, of investigation in the web of social interaction, then this project provides space for such moments. It is not clear if the young people will, in fact participate in future educational activities in a similar vein. Nevertheless, the possibility remains open. The emerging sense of rasa may perhaps be augmented by other educative moments where young people are able to voice their concerns and partake in encounters that are novel and embodied. To provide a breadth of education opportunities in this spirit for young people enables them, in the words of Amartya Sen (1999), to be "actively involved—given the opportunity—in shaping their own destiny" (p. 53), thus enacting their aspirations for development.

The young people in this study chose to develop a project addressing plastic pollution that is encroaching their community in the luar bandar. Looking beyond this locality, challenges of development and education in contemporary times are as wide-ranging as broadening inequality, the curtailing of democracy and civil society, climate change, the COVID-19 pandemic and the digital divide (UNESCO, 2021). Many of these issues fall under the banner of "wicked problems", and science education research is interested in exploring the role of out-of-school provisions given its flexible nature and dynamic ability to respond to contemporary questions, as compared to formal classroom learning confined by many factors (Dillon et al., 2021). I argue that the building "bricks" of this kind of science and STEM education call for opportunities for young people to exercise their capacity to aspire, focusing on cultivating problem solving, imaginative, and collaborative skills through a participatory spirit. The capacity to aspire should thus be developed in the thick of lived experiences in a particular place, coupled with embodied encounters that enable young people to exercise this capacity frequently and purposefully.

8.3 Contributions to Research and Practice

Emplaced in the othered context of the luar bandar in Malaysia, this study demonstrates an instance where young people described four diverse aspirations for development, encapsulated by the following themes:

1) Maju as quotidian convenience via technological advancement
2) The balance of global desires and national distinction
3) Commitment and contribution to family
4) Affinity and mobility in/out of the local environment

Collectively, such aspirations are coloured by mimicry, hybridity and ambivalence as young people negotiated the translation of the science for development model from the national scale, as well as the othering of the luar bandar as part of national development priorities. Close attention to context illuminates the material conditions circumscribing such aspirations. Instances of dis/junctures between young people's aspirations and their placement in class 4-STEM, as well as overwhelming structural forces that compel outmigration point me to the contingency of realising such aspirations. Subsequently, as a form of exposure to novel experiences, informal STEM education attuned to young people's local realities points to a pathway for strengthening their capacity to aspire vis-à-vis development concerns they have identified in the luar bandar. Attending to the Malay notion of rasa, the components of their enactment of aspirations for development were illuminated. This includes the various experience of practice, mixed emotions whilst undergoing a novel experience and embodied movement beyond their familiar environment.

In this section, I reflect on the contributions this study offers to both research and practice. In terms of research, this study contributes to an expansive and vertical view of young people's aspirations, the interplay of context and scale in studies of rurality and development, as well as the introduction of concepts from Bahasa Melayu for method and analysis. With regards to practice, I affirm the value of young people's voices in policymaking, coupled with the presentation of a tangible approach to embodied, informal STEM education associated with development. I elaborate on each of these contributions below.

8.3.1 An Expansive and "Vertical" View of Young People's Aspirations

This study has focused on development in the way Amartya Sen (1999) conceptualises it—the pursuit and expansion of life that young people find meaningful—beyond the individual to also consider community and national dimensions. In this light, young people in the luar bandar report aspirations that, while gesturing to careers and the associated mobility as prevalent in the literature (Baillergueau & Duyvendak, 2017), also include other dimensions of a life they deem worthwhile. In the luar bandar—the Malaysian manifestation of rurality—young people aspire to development that reflects globalised desires, infrastructural and technological progress, a commitment to family and ambivalence tied to mobility. Adopting this expansive view of aspiration beyond the individual also directs my attention to wider contextual forces that influence and circumscribe such aspirations, as evident through the vertical translation of the science for development model as well as the federal government priorities of outmigration from the luar bandar into the bandar.

Building on the work of Amartya Sen and Arjun Appadurai similar to Baillergueau & Duyvendak (2017), coupled with James Ferguson's (2006) notion of aspirational equality, I respond to their collective call to take on a multidimensional view of studying young people's aspirations. In doing so, I shine light on the negotiation of seemingly "individual" desires with forces at the local, national and global scales through a vertical view of their aspirations. Despite navigating material inequalities and conditioned by vertical priorities of development from the federal metropole, the aspirations of young people in the luar bandar—gesturing to equality that should be constitutive of development—resist the doom of "dreamless futures" (Baillergueau & Duyvendak, 2019).

8.3.2 The Interplay of Context and Scale in Studies of Rurality and Development

In Chapter 3, I have highlighted the centrality and shifting views of context in CIE (Bartlett & Vavrus, 2018; Piattoeva et al., 2018; Sobe & Kowalczyk, 2013). Subsequently, through a vertical analysis of aspirations at the national and local scales, I have foregrounded—via the findings and discussions—the importance of context in rendering a fuller and richer account of young people's aspirations. In so doing, this study contributes to existing work on the interplay of globalisation, scale and rural formations (Balfour et al., 2008, M. Woods, 2007). Additionally, without employing an ethnographic eye, the granularity of the vertical context of translation (60:40 policy and the construction of luar bandar from national discourse) would not have been surfaced. By foregrounding the question of "development", my approach here aligns with Corbett's (2015) call for enriching studies of rural education. He argues that scholarship in this area should expand beyond the focus and construction of cultural indigeneity (hence essentialisation), towards "committed ethnographic work that engages large questions or 'wicked problems' (Rittel and Webber 1973) that challenge policy and practice" (Corbett, 2015, p. 264).

Through a postcolonial analysis that attends to hybrid negotiation of forces translated into the luar bandar, I eschew the depiction of a pure, essentialist Malay alternative vision of (post)development in favour of complex descriptions articulated by the young people. This approach is also consistent with more nuanced accounts of postdevelopment that do not consider the "local" as pure alternatives to mainstream, hegenomic discourses of development (Escobar, 2012; McEwan, 2019; Schaffar, 2018). Additionally, on the question of scale, my attention to the translation of development manoeuvres from the federal government on rural young people's aspirations complements López-Muñoz & Ingelaere's

(2021) work on the influence of local government actions. In postcolonial contexts such as Malaysia, where the federal government is inclined to stand in for the state as a whole in articulating aspirations for development (Embong, 2008), it is necessary to present competing and contesting aspirations from the margins in all their complexities. This calls for national development actors in the metropole to be attentive as well as receptive to the voices and embodied knowledge of its intended beneficiaries in the periphery.

8.3.3 Attention to Language as Methodological and Analytical Windows

I have attempted to render careful attention to Bahasa Melayu as a resource beyond practical communication in this study. The findings elucidated in this thesis in no small part have been illuminated through thoughtful reflections on terms from Bahasa Melayu such as pembangunan, luar bandar, kebetulan, maju and rasa. More than 20 years prior to the current resurgence of the decolonial turn in academia particularly in the global North, the Malaysian sociologist S. F. Alatas (1996) referenced the work of past scholars in decolonising nations to argue the following:

> The social sciences which aspire to be more universal consist of many cultural voids. Indigenisation means filling these voids by looking at the various non-Western philosophies, cultures and historical experiences as sources of inspiration, insights, concepts and theories for the social sciences. (p. 135)

As a Malaysian conducting research at home in Bahasa Melayu among the young people, teachers, experts and policymakers and the broader context, I wanted to challenge, in some small way, the totalising and universalising application of concepts from the English language to the phenomenon under study. As part of the methodology of this study, I remained attuned and open to instances of kebetulan—serendipitous occasions that

"guided" and expanded this study in interesting directions. The opening of relief periods in the school schedule enabled moments of engagement with young people that would otherwise be sealed off due to restrictions of observing formal classroom instruction. The STEM innovation competition organised by the local university was an unexpected opening that enriched the line of inquiry for this study. Embracing unplanned moments in the research process as kebetulan—as a reaching towards truth—greatly enhanced this study beyond the initial design.

Additionally, the use of the term luar bandar directs my attention to rurality in Malaysia that constitutes its meaning by being *other* than, and in service of, the bandar. This understanding elucidated the context within which young people do their work of aspiring. I problematise not only the othering explicit in the term luar bandar, but also the heretofore taken-for-granted acceptance and plainness of such othering. While such a relational conception of rurality here is reminiscent of existing rural-urban relationships in the literature (Heley & Jones, 2012), young people's aspirations also teach me that as members of the luar bandar, they can resist othering through the hybrid characteristics of their aspirations and yearning for aspirational equality. Here, bringing in a conception of rural from Bahasa Melayu is a preliminary attempt to add to Gkartzios et al.'s (2020) invocation to pay attention to language politics and concept building in rural studies.

Another contribution of this study with regards to language is the adoption of the manifold concept of rasa as an analytical lens to understand young people's enactment of aspirations in the luar bandar. Building upon Appadurai's (2004) capacity to aspire and the structure of feeling in education by Sellar & Gale (2011), attention to rasa beyond merely feeling

elucidates the affective and embodied ways in which an informal STEM education project contributes to young people's work of aspiring. Within the context of luar bandar, attention to rasa explored via an embodied educational experience contributes to the work of "minor theory" in rural studies that seek to take seriously relations "insofar as it considers the playing out of processes which are specific to particular places and communities" (Heley & Jones, 2012, p. 215). Overall, I offer this contribution via language as a postcolonial gesture of "writing back" so as to challenge the hegemonic discourse and epistemic basis of development studies (McEwan, 2019).

8.3.4 Young People's Knowledge and Experiences for Development Policy

In the Rural Development Policy, the Malaysian government makes mention of the involvement of young people in decision-making at the grassroots level through the development of youth organisations in each locality (Ministry of Rural Development Malaysia, 2019). Young people in this study have articulated their aspirations for development that express desires at the level of individual, family, community and also the nation. From this instance in the luar bandar—notwithstanding the material inequalities identified through a vertical attention to context—indeed young people possess a capacity to aspire. The aspirations of young people in this study, and those of many others in various permutations of the luar bandar, represent valuable knowledge and lived experiences for policymaking with regards to development that impact their lives.

Collectively, young people's views should not only be taken seriously for the shaping of development policy at the local level (Jentsch, 2006; Patel, 2009). As demonstrated in this study, it is the federal government in the bandar that drives the vertical forces shaping the

contexts within which young people aspire. Thus, it follows that their aspirations in the luar bandar should also be provided a channel into the bandar, given legitimacy as forms of knowing and being, thus contributing significantly to the formulation of development policies created for their benefit. This kind of acknowledgement calls for changing the terms of recognition of young people's knowledge and experience, transcending the binary of luar/bandar so as to create genuine change (Gale & Parker, 2015). The question of popular participation in enacting development policies and provisions is reaffirmed through this study, echoing Sen's (1999) pithy insistence that it "is not just sanctimonious rubbish. Indeed, the idea of development cannot be dissociated from it." (p. 247).

8.3.5 Embodied Informal STEM Education in Rural Communities

The implementation of the participatory, informal STEM education project with the young people in this study provides a tangible example of an experience that contributes to their capacity to aspire. Paying attention to the embodied dimension of young people's experiences in the luar bandar, such as through walks around the school to identify development-related problems, the making of ecobricks, and traveling to the local university for a competition aligns with the turn of affect and embodiment in rural sociology (Farrugia et al., 2015; Rodriguez Castro; 2018). Additionally, a dual focus on design thinking and integrated STEM education that is sensitive to place, associated resources and young people's own emplaced concerns may serve as guides for teachers and informal education practitioners. Together with insights from youth participatory science (Morales-Doyle & Frausto, 2021) and close attention to the identities that young people bring to (informal) science education (Archer et al., 2021; Birmingham et al., 2017), teachers and practitioners

can utilise the elements of this project as a guide for developing their own informal STEM education projects.

Reflecting on my own embeddedness in the conception and implementation of this informal STEM education project draws my attention to the novelty of this experience for the young people in this study. By this I mean that it is through my presence as an external mentor that this informal education project came about, given teachers' restrictions associated with time and autonomy. From my fieldwork, I learned that teachers were subjected to time constraints to complete the national syllabus in preparation for the national SPM examinations at the end of secondary school, coupled with the dearth of autonomy to formulate the formal STEM subject curriculum. Cikgu Linda captures this constraint astutely:

> I would like to say again, science is fun for doing activities. But from the teacher's standpoint, we need to race to complete the syllabus. We have to choose activities, only those that we absolutely need to do, even when in our heads there are so many we want to do [laughs]…It's fun to do these activities. But our time, our time…At the school level, time is the issue.

Based on the above, informal education opportunities are deemed secondary to formal education that will determine young people's future options via national examination results. Such a scenario occurs within the context of Malaysia's highly centralised education system, as elaborated in Chapter 3. In this regard, the experience of an informal STEM education project serves "as a counterbalance to schooling, especially when formal education is centralised and controlled as it is today." (L. D. Richardson, 2001, p. 1). Across similar contexts, collaboration between teachers and other external actors via informal STEM education modalities would reduce the burden on teachers eager to provide enriching

opportunities for students to engage in hands-on, project- and problem based learning whilst balancing their responsibilities to deliver formal education tied to the national curricula.

8.4 Reflections of the Study's Limitations (and Openings)

Having discussed the findings of this study in relation to the MRQ, and outlined the resulting contributions to both research and practice, I now reflect on the limitations of this study. By considering the methodological choices I have made and the circumstances surrounding the research, I suggest here how the study contracts in certain dimensions (limitations), while it expands in others (openings). This is to say that in the course of discussing limitations, the openings created by choices and circumstances are also illuminated. I am of the view that as researchers we will never be able to gain a complete account of a phenomenon, even in the most rigorous of studies. In this regard, I think with Marginson & Mollis' (2001) stand that

> no one approach can produce all relevant "truth," that different theories and methods are associated with different truth effects and all truths are partial truths, and that we are not so rich in our understandings of comparative education that we can afford to neglect the insights of a range of approaches. (p. 605)

Indeed, the findings in this study reflect partial truths, borne out of the limitations (and openings) of this study. Recognising that the knowledge produced herein is situated and partial with reference to my positionality is also a postcolonial stance (McEwan, 2019). While something is lost, something else is gained. Below, I discuss the identified limitations in this study.

Within a CCS design, this study has mainly emphasised the vertical axis of comparison, by considering the translation of the science for development model and the development discourse of the luar bandar from the metropole into the principal site—Sekolah Luar Bandar (Bartlett & Vavrus, 2017). Young people's aspirations for development are then contrasted accordingly against the priorities gleaned at the national level. Given that data collection was confined to less than 1-year within the scope of a DPhil project, it was not possible to undertake comparative work along the horizontal (multiple schools or communities) and transversal (historical or longitudinal analysis) axes without compromising the depth of data gathered for the vertical axis. Horizontal analysis would have enabled the discovery of a broader range of aspirations for development across various contexts of the luar bandar, recognising the variegated nature of rurality. Meanwhile, a transversal focus would illuminate how the idea of development itself has evolved in the postcolonial nation's consciousness, or young people's changing aspirations and negotiations of development across a longer timeframe, or at different transition points.

However, by situating this study within Sekolah Luar Bandar in relation to national development discourses, I was able to gather rich, granular data on young people's aspirations and the attendant material conditions shaped by forces of political economy from the metropole (B. White, 2021). Furthermore, by spending significant time in the school and developing rapport with the teachers and young people, we were able to collaborate on an informal STEM education project that greatly augmented this study. Still, an acknowledgement of the possibilities opened up by emphasising the other axes paves the way for promising future directions of this research, what Bartlett & Vavrus (2017) deem to be "broadening" work as part of the CCS design.

The selection of a single school as the principal site for this study resulted in the small number of eligible young people to participate—16 year-olds who were tracked into class 4-STEM at the start of the school year. Over the course of the year, more students left class 4-STEM than those who have stayed. Whilst I was closely observing this academic migration in Sekolah Luar Bandar, even the teachers were concerned that my study would be jeopardised, given the small number of students. Of course, soliciting the views of aspirations among just eight young people does not hold much explanatory power about the breadth or typology of aspirations for development among young people in the Malaysian luar bandar, or rural spaces writ large. Furthermore, all of the participants in Sekolah Luar Bandar were of the Malay ethnic group, and their particular community cannot stand-in for the richness of various luar bandar sites in multi-ethnic Malaysia. I make no claims to generalisability here. Rather, what I have sought to demonstrate conceptually through this case study is that young people in the luar bandar have much to offer for the epistemic and material project of development. They offer such insights whilst navigating—living through—the forces from the metropole attempting to mould and other them in service of national development. Furthermore, working with this small group of young people and their teachers over time has opened up the path to listen keenly and carefully to their stories, to work closely on a collaborative project and to forge enduring relationships. Perhaps this small number of young people in a modest, "regular"[29] school in a diminishing community is in itself a metaphor of how the luar bandar is increasingly minoritised and invisibilised in the national narrative of development in Malaysia.

[29] Regular in comparison to the specialised science and premier schools that facilitated academic migration, as described in Chapter 6 (Section 6.3.3).

Subsequently, this study's design was also constrained by two circumstances beyond my control. As mentioned in Chapter 4, I had initially planned to "follow" the young people at Sekolah Luar Bandar as they engaged in STEM education both formally and informally. This meant that I would sit in and observe classroom instructions for the relevant STEM subjects. However, approval of my research pass by the Malaysian government had prohibited me from observing classroom instruction. I consider this to be a limitation in understanding the fullness of young people's engagement with STEM education, seeing as I was unable to observe the *formal* modality in action. I attempted to address this limitation via the interviews and informal conversations, asking relevant questions to the young people and their teachers. Nevertheless, this limitation also opened up space to focus on the potential of an embodied, participatory *informal* variant of STEM education that became central to this study. In the context of a centralised system where teachers are confined by the national curriculum and examinations, it appears urgent that young people are provided the enriching balance of informal education where possible.

Without a doubt, the COVID-19 pandemic itself presented limitations to this study that relied on prolonged, ethnographic and in-person engagement to achieve its aims. Elements of the initial research design had to be altered in situ as a result of the national lockdown in Malaysia beginning on 18 March 2020, followed by the revised operating procedures once schools eventually reopened on 24 June 2020. Plans to engage young people as co-researchers that would interview their teachers and family members were abandoned due to practicality, and the photovoice activity was conducted digitally. Due to the limitations of physical distancing I was unable to significantly engage with the young people and their families beyond the school hours. Hence, the participatory dimension of this study was

constrained compared to the initial design. Further to this, the process of knowledge generation at the analysis stage of this study (post-fieldwork) cannot be considered participatory, as it does not involve the participants, especially the young people, to a meaningful degree. I consider this to be a limitation, and acknowledge the call to

> embrace the aspiration to be facilitators of a genuinely collaborative research process…[to] open the much-needed space and opportunity to work as allies with communities with limited freedoms and agency and bring their contributions and analysis into the research process. (Martinez-vargas et al., 2021, p. 12)

Yet, whilst the pandemic ruptured the research unexpectedly, the ethical opening that surfaced greatly reminded me of the need to meet research participants in the fullness of their humanity, with agency and dignity embedded in the ongoing-ness of a crisis (Crivello & Favara, 2021). The pause caused by the pandemic led me to also think carefully about how best to continue research in a time of great uncertainty, and to be as minimally intrusive as possible. For example, engaging in the photovoice activity virtually meant that young people were able to condition my researcher gaze on their own terms and redistribute the power dynamics, as I was unable to physically "follow" them around (Barker & Smith, 2012). Thus, the pandemic has taught me profound ethical lessons for future research, and for life.

8.5 Looking Ahead: Future Paths of Research

In this study, young people's perspectives from a particular site in the Malaysian luar bandar offer an expansive mix of aspirations for development, associated with technological advancement, a balance of global & national desires, commitment to family and ambivalences associated with their local environment. Close contextual attention exposes material conditions that can circumscribe young people's aspirations. Nevertheless, I also

highlight the value and potential of place-based informal STEM education to strengthen young people's capacity to aspire as they reflect on questions of development. There is much work still to be done to grasp the complexity of young people's aspirations, and the conditions within which they do this hopeful, imaginative work. Future lines of research must continue to move away from "academic and policy debates to view youth primarily for their potential as future workers and consumers" and thus illuminate the "many other aspects in their present lives, including leisure, personal relationships, family and community" (Naafs & Skelton, 2018, p. 3). As young people in this study teach me, whilst they look forward, they also look around at the people and places in their lives that they value and commit to, right where they are.

The work of illuminating the many other aspects of young people's lives also calls into question the context they navigate whilst developing and enacting their aspirations. In his critique of the pervasiveness of human capital theory in policy research that relies on a defective view of rural young people's aspirations, B. White (2021) calls for more approaches "inspired by political economy which look to the constraining and oppressive structures and relationships which limit people's options." (p. 59). In this study, I have highlighted the ways in which the 60:40 policy—as a manifestation of the science for development model in Malaysia—shapes academic migration away from Sekolah Luar Bandar towards specialised science schools, and tracks the young people into class 4-STEM even when they are not academically prepared. This policy, which is enacted on a national scale as a hard, numerical target of 60 per cent STEM enrolment in the vein of "policy as numbers" (Ball et al., 2011; Lingard, 2011) has not been significantly problematised by policymakers and the general public in either its numerical target or underpinning logic since its inception in 1967. The

evidence shown here of the ways the 60:40 policy circumscribes young people's lives in the periphery motivates me to continue interrupting the "myth"—the taken for granted acceptance—of the science for development model in Malaysia through further research and dissemination (Drori, 1998).

In light of the above, I am of the view that a wider variety of studies that attend to the vertical context—the interplay between state manoeuvres via education and young people's aspirations—which I have attempted in this study, are crucial. These include different scales and technologies of government, as well as emphasis on various human and non-human actors in the policy assemblage such as teachers, family members, policy documents, and media outputs (Hamilton, 2011; Piattoeva et al., 2018). Horizontal comparison across many rural sites, perhaps within common national or regional frames, may also illuminate the breadth of young people's aspirations for development, in relation to variegated material conditions and affordances.

B. White (2021) is also of the view that compared to large-scale surveys, smaller, in-depth research via life-course and generational lenses enable more nuanced and complex accounts of rural young people's aspirations. I echo this methodological point based on the experience of undertaking this study, and the richness of empirical insights generated through attention to stories borne out of prolonged engagement—long time is of the essence. Upon reflection, without prioritising the building of rapport and relationships with young people and their teachers, this study would have been a very different one, perhaps less careful and prone to falling into the traps B. White (2021) cautioned against. To prioritise the polyphonic stories

that young people invite us to inhabit, is a call to a particular kind of knowledge practice and method, one that Tsing (2015) describes as a "rush of stories":

> Without algorithms based on self-containment, scholars and policymakers might have to learn something about the cultural and natural histories at stake. That takes time, and too much time, perhaps, for those who dream of grasping the whole in an equation. But who put them in charge? If a rush of troubled stories is the best way to tell about contaminated diversity, then it's time to make that rush part of our knowledge practices. (p. 34)

By contaminated diversity, here Tsing (2015) is speaking of the various permutations of difference that result from "transformation through encounter. Self-contained individuals are not transformed by encounter" (p. 28). Reflecting on young people and their aspirations in a specific rural place, their stories are the stuff of contaminated diversity. Their aspirations and the subsequent possibility of realising them, are never self-contained, or individual. Aspirations are (re)made in the moment of encounter and in their navigation of various social actors and discourses at different scales. Future research on young people's aspirations for development should partake in this method, in listening and contributing to such a rush of stories.

On a personal front, considering the future direction of *this* research, I am drawn to B. White's (2021) call for a life-course perspective. The work here remains unfinished, open-ended. Since I left Sekolah Luar Bandar in August 2020, some teachers have been promoted, transferred or retired, and the young people inch closer to the completion of secondary school. In December 2020, the Malaysian government launched the National Science, Technology and Innovation Policy 2021-2030 (Ministry of Science, Technology and Innovation Malaysia, 2020). The COVID-19 pandemic marches on, casting a spectre of uncertainty on prospects of education, employment and livelihoods. How might the young

people in the luar bandar—who I have come to learn a great deal from—navigate the shift into the next phase of their lives post-schooling? Would their aspirations for development and their associated enactments be transformed through more encounters, novel or otherwise?

The possibilities and futures of young people in this study—and in general—remain open and contingent. Careful attention to the fine-grained details of the contexts they negotiate remains instructive. As I have demonstrated in this study, young people in the margins have much to teach researchers and policymakers concerned with STEM education as well as the broader question of development—the expansion of opportunities, capacities, and aspirations for the good life. Young people are valid epistemic agents as they narrate their lives from the luar bandar and other sites of marginality. Ultimately, there is a great deal to be learned by listening attentively, bearing witness and contributing to their rush of stories.

> "marginality [is] much more than a site of deprivation…it is also the site of radical possibility, a space of resistance…As such, I was not speaking of a marginality one wishes to lose, to give up, or surrender as part of moving into the center, but rather as a site one stays in, clings to even, because it nourishes one's capacity to resist. It offers the possibility of radical perspectives from which to see and create, to imagine alternatives, new worlds."
>
> bell hooks

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APPENDICES

A: Semi-structured Interview Schedule (Experts and Policymakers)

Pre-pilot Schedule (English): Experts and Policymakers

Opening:

- Thank you very much for your interest and time for this interview
- Introduce myself and a bit of my research
- The purpose of this interview is to seek your insights on the science for development agenda in Malaysia and how it is cascaded as policy into education practice, as well as how you see the role of family members and teachers in relation to this.
- I will ask you a series of questions around these topics. You are not obliged to answer any question that you don't want. Feel free to let me know if this is the case.
- As mentioned in the consent form, I will be recording the interview. I will also be making some notes. I hope you are able to speak freely and as detailed as possible.
- Please feel free to clarify in case the questions are unclear, so I can explain further.
- This interview will take approximately 45 minutes to 1 hour

Theme	Questions
Introduction on development	1. Can you give me some background about your organisation? 2. Can you describe your specific role? 3. How would you define development? 4. What do you consider development to look like at the various levels (e.g. individual, community, national)? How are they interrelated? 5. What do you consider as Malaysia's national priorities for development? 6. How do you see your organisation's role in supporting these national priorities?
Science for development	7. What do you see as the role of science in development? What about in Malaysia specifically? In the rural context specifically?

	8. Which policies in Malaysia do you think are related to this science for development agenda? 9. As part of Vision 2020, our prime minister is quoted to have said the following in 1991: "There can be no fully developed Malaysia until we have finally overcome the 9 central strategic challenges that have confronted us from the moment of our birth as an independent nation…The 6th of which is the challenge of establishing a scientific and progressive society…that is innovative and forward-looking, one that is not only a consumer of technology but also a contributor of to the scientific and technological civilisation of the future" What do you make of this statement? Do you think it is still relevant today? Why? 10. How do you see the relationship between science and development of our national human resource? 11. Other than science, what other elements do you consider to be important for national development? Why?
Education and development	12. How do you see the role of education in relation to development? Particularly in the rural context? 13. One of the education policies related to science for development is the 60:40 Science/STEM and Arts stream enrolment (60:40 policy) instituted in 1970. Do you think this policy is still relevant today? 14. How do you think this 60:40 policy is related to development as described before? 15. A survey by MOE in 2017 indicates secondary students in urban areas have higher awareness of STEM and its importance compared to rural counterparts. Why do you think this is so? 16. Do you see teachers of students in rural areas as playing a role in promoting the national development agenda? How so?

	17. Do you see parents of students in rural areas as playing a role in promoting the national development agenda? How so?
Reimagining development	18. Are you aware of alternative conceptions to the current approach to development? [Provide examples] What do you make of them?

Post-pilot Schedule (English): Experts and Policymakers

Opening:

- Thank you very much for your interest and time for this interview
- Introduce myself and a bit of my research
- The purpose of this interview is to seek your insights on the science for development agenda in Malaysia and how it is related to STEM education
- I will ask you a series of questions around these topics. You are not obliged to answer any question that you don't want. Feel free to let me know if this is the case.
- As mentioned in the consent form, I will be recording the interview. I will also be making some notes. I hope you are able to speak freely and as detailed as possible.
- Please feel free to clarify in case the questions are unclear, so I can explain further.
- This interview will take approximately 45 minutes to 1 hour

Theme	**Questions**
Introduction on development	1. Are you affiliated to any organisation? If so, can you give me some background about your organisation? 2. Malaysia wants to be a developed country. What do you think it means for Malaysia to be developed? 3. Malaysia's urbanisation rate is currently around 75% and projected to increase. What do you think of this?
Science for development	4. Do you think science is important for national development? How does it contribute? 5. [Show prompt card] As part of Vision 2020, our prime minister said the following in 1991: "There can be no fully developed Malaysia until we have finally overcome the 9 central strategic challenges that have confronted us from the moment of our birth as an independent nation…The 6th of which is the challenge of establishing a scientific and progressive society…that is innovative and forward-looking, one that is not only a consumer of technology but also a contributor of to the scientific and

	technological civilisation of the future” Do you think this statement is still relevant today now that we have the Shared Prosperity Vision 2030? Can you elaborate?
Education and development	6. In your opinion, how does education contribute to societal and national development? 7. One of the education policies related to science for development is the 60:40 Science and Arts stream enrolment (60:40 policy) instituted in 1970. What do you think is the basis for this policy? 8. Do you think this 60:40 policy is still relevant today? 9. How would you describe ‘STEM education’? 10. Do you think it is important to increase STEM interest among students in rural areas compared to urban areas? 11. Do you see teachers/parents in rural areas playing a role in raising STEM interest? How so? 12. How do you think students from rural areas can contribute to societal and national development? 13. Can STEM education help them to contribute to societal and national development? How?
Alternative development	14. What do you think it means by development ‘dalam acuan kita sendiri’? 15. The mainstream approach to development often emphasises economic development. Are you aware of alternative ideas about development? I am going to show you some examples. [Show prompt card] **Buen Vivir**: A concept originating from indigenous population in Latin America. It is based on the belief that true well-being (“the good life”) is only possible as part of a community. The good of the community is placed above that of the individual. Furthermore, this is community in an expanded sense; it includes

	Nature, plants, animals, and the Earth. Nature itself must be cared for and respected as a valuable part of the community. The land cannot be owned; it should be honored and protected. – Pachamama Alliance **Ubuntu**: A traditional African concept. It can be roughly translated as "humanity towards others." *Ubuntu* embodies all those virtues that maintain harmony and the spirit of sharing among the members of a society. It implies an appreciation of traditional beliefs, and a constant awareness that an individual's actions today are a reflection on the past, and will have far-reaching consequences for the future. – New World Encyclopedia What do you think about these concepts? Do you think similar concepts can be found in Malaysia?

Post-pilot Schedule (Bahasa Melayu): Experts and Policymakers

Pembukaan:

- Terima kasih atas kesudian dan masa tuan/puan untuk temu bual ini
- Perkenalkan diri dan kajian saya
- Tujuan temu bual ini adalah untuk mendapatkan pandangan dan wawasan tuan/puan tentang agenda pembangunan menerusi sains dan bagaimana ia berkaitan dengan pendidikan STEM
- Saya akan bertanya beberapa soalan berkenaan topik ini. Tuan/Puan tidak wajib menjawab sebarang soalan yang tidak diingini. Tuan/puan hanya perlu maklumkan saya, kita boleh ke soalan seterusnya.
- Seperti yang dinyatakan dalam borang kebenaran, saya akan membuat rakaman audio dalam temu bual ini. Saya harap tuan/puan dapat bercakap secara jelas dan terperinci.
- Jika ada sebarang soalan yang kurang jelas, boleh maklumkan saya untuk saya beri penerangan lebih lanjut.
- Temu bual ini akan mengambil masa 45 minit hingga 1 jam

Tema	**Soalan**
Pengenalan tentang pembangunan	1. Adakah tuan/puan mewakili atau terlibat dengan sebarang organisasi? Jika ya, boleh berikan sedikit latar belakang organisasi ini? 2. Malaysia mempunyai aspirasi untuk menjadi negara membangun. Pada pendapat tuan/puan, apakah maksudnya untuk menjadi negara membangun? 3. Kadar urbanisasi Malaysia ialah 75% dan dijangka terus meningkat. Apa pendapat tuan/puan tentang hal ini?
Sains untuk pembangunan	4. Adakah tuan/puan fikir sains penting untuk pembangunan? Apakah sumbangannya? 5. [Tunjuk kad dorongan] Dalam Wawasan 2020, Perdana Menteri kita menyatakan pada tahun 1991: “Tidak akan wujud Malaysia yang maju sepenuhnya sehingga kita akhirnya dapat mengatasi sembilan cabaran strategik yang kita hadapi sejak kelahiran kita sebagai sebuah negara merdeka...Yang ke-enam ialah cabaran mewujudkan masyarakat yang saintifik

	dan progresif serta melahirkan masyarakat yang berpandangan jauh, yang bukan sahaja menjadi pengguna teknologi tetapi juga menjadi penyumbang kepada tamadun saintifik dan teknologi masa depan." Adakah tuan/puan rasa pernyataan ini masih relevan pada hari ini dengan adanya Wawasan Kemakmuran Bersama 2030? Boleh jelaskan?
Pendidikan dan pembangunan	6. Pada pendapat tuan/puan, bagaimanakah pendidikan menyumbang kepada pembangunan masyarakat dan negara? 7. Salah satu polisi pendidikan berkaitan dengan sains untuk pembangunan ialah polisi 60:40 sains dan sastera yang dilaksanakan sejak tahun 1970. Pada pendapat tuan/puan, apakah tujuan polisi ini diperkenalkan? 8. Adakah tuan/puan rasa polisi 60:40 ini masih relevan pada hari ini? 9. Bagaimana tuan/puan boleh terangkan maksud 'pendidikan STEM'? 10. Adakah tuan/puan berpendapat yang penting untuk meningkatkan minat STEM di kalangan pelajar luar bandar berbanding bandar? 11. Adakah tuan/puan melihat guru-guru/ibu bapa di luar bandar memainkan peranan untuk meningkatkan minat STEM? Bagaimanakah mereka memainkan peranan ini? 12. Bagaimanakah pelajar di luar bandar boleh menyumbang kepada pembangunan masyarakat dan negara? 13. Bolehkah pendidikan STEM membantu mereka menyumbang kepada pembangunan masyarakat dan negara?
Pembangunan alternatif	14. Apakah yang tuan/puan fikir tentang maksud pembangunan 'dalam acuan kita sendiri'? 15. Pendekatan pembangunan arus perdana selalunya menekankan pembangunan ekonomi. Adakah

	tuan/puan tahu tentang idea-idea alternatif tentang pembangunan? Saya akan menunjukkan beberapa contoh. [Tunjuk kad dorongan] **Buen Vivir**: Konsep berasal dari golongan orang asli di Amerika Latin. Ia berdasarkan kepercayaan yang kesejahteraan sebenar ("the good life") hanya boleh tercapai dalam kehidupan berkomuniti. Kebajikan komuniti lebih dipentingkan dari kebajikan individu. Maksud komuniti ialah konteks yang lebih luas, termasuk alam semula jadi, flora, fauna dan bumi. Alam semula jadi mesti dipelihara dan dihormati sebagai sebahagian penting komuniti. Tanah tidak boleh dimiliki, ia harus diberi penghormatan dan dilindungi – Pachamama Alliance **Ubuntu**: Konsep tradisional Afrika. Ia boleh diterjemahkan secara kasar sebagai "kemanusiaan terhadap orang lain". *Ubuntu* merangkumi semua sifat baik yang mengekalkan keharmonian dan semangat perkongsian dalam masyarakat. Ia menekankan penghargaan terhadap kepercayaan tradisional, dan kesedaran yang berpanjangan bahawa tindak tanduk seseorang individu pada hari ini adalah cerminan masa lalu, dan mempunyai kesan meluas untuk masa depan – New World Encyclopedia Apa pendapat tuan/puan tentang konsep-konsep ini? Adakah tuan/puan fikir ada konsep yang serupa di Malaysia?

B: Semi-structured Interview Schedule (Young people)

Interview Schedule (Bahasa Melayu): Young People

Pembukaan:

- Sekarang kita akan berbincang tentang aspirasi kamu. Ini bermakna harapan, impian dan cita-cita berkaitan masa depan yang kamu bayangkan dan idamkan. Aspirasi boleh berkaitan diri sendiri, masyarakat sekeliling dan juga Malaysia. Kita juga akan berbincang tentang minat dan kegunaan mempelajari subjek-subjek STEM, dan pengalaman seharian kamu tinggal di sini.
- Saya akan bertanya kamu beberapa soalan tentang topik-topik ini. Kamu tidak perlu jawab mana-mana soalan yang kamu tidak mahu. Kamu hanya perlu maklumkan kepada saya, kita boleh terus ke soalan yang lain.
- Seperti yang dimaklumkan, saya akan merakam temu bual ini secara audio. Saya juga akan mengambil nota. Saya harap kamu boleh jawab dengan terperinci.
- Jika soalan tidak jelas, kamu boleh maklumkan saya. Nanti saya akan terangkan dengan lebih lanjut.
- Perbincangan ini akan mengambil masa 30 hingga 45 minit.

Tema	**Soalan**
Pertandingan inovasi STEM (refleksi) ***terutamanya untuk peserta, tapi yang lain membantu juga boleh**	1. Boleh ceritakan pengalaman kamu menyertai pertandingan ini? Apa yang kamu belajar daripada pengalaman ini? Probes: a. Apakah aplikasi ilmu STEM dalam projek ini? b. Projek berkaitan plastik, alam sekitar. Apa kepentingan projek ini? c. Adakah kamu berminat menyertai projek seperti ini pada masa depan?
Pengenalan tentang pembangunan	2. Adakah kamu pernah dengar perkataan ‘pembangunan’? Apa yang kamu faham bila sebut perkataan ini?
Aspirasi untuk pembangunan	3. Sekarang kamu sudah masuk tingkatan 4. Apakah harapan, impian dan cita-cita kamu? a. diri sendiri (ada perubahan tak dari kecil?) b. keluarga c. kampung kamu d. negeri atau negara

	4. Boleh ceritakan apa yang kamu tahu tentang aspirasi negara? (cth: Wawasan 2020, Wawasan Kemakmuran Bersama 2030). 5. Apa peranan orang muda macam kamu untuk mencapai aspirasi ini?
Pendidikan STEM	6. Adakah kamu rasa belajar di sekolah penting untuk membantu kamu merealisasikan harapan, impian dan cita-cita kamu? Bagaimana? 7. Boleh kongsi dengan saya keputusan PT3? Gred untuk Matematik dan Sains? 8. Adakah kamu sendiri memilih untuk masuk kelas 4-STEM (Pakej STEM)? 9. Mengapa kamu memilih untuk keluar dari kelas 4-STEM? (Jika berkaitan) 10. Adakah kamu rasa belajar subjek STEM berguna untuk merealisasikan harapan, impian dan cita-cita yang kamu sebutkan tadi? Bagaimana? 11. Adakah cikgu-cikgu kamu membantu kamu untuk berfikir dengan lebih lanjut tentang harapan, impian dan cita-cita kamu? Bagaimana? Probes: Boleh fikirkan contoh aktiviti/perbincangan yang melibatkan penjanaan imaginasi/idea, perancangan masa depan, penyelesaian masalah?
Budaya dan aspirasi	12. Latar belakang keluarga. Tinggal di mana, bilangan adik beradik, pekerjaan ibu bapa. 13. Adakah kamu ada abang/kakak? Boleh ceritakan serba sedikit tentang mereka? Adakah mereka belajar juga atau bekerja? 14. Boleh ceritakan apa yang biasa kamu lakukan selepas sekolah dan pada hujung minggu? 15. Apa yang kamu suka/tidak suka tentang kampung

	kamu? 16. Bila kamu fikirkan tentang harapan, impian dan cita-cita kamu, adakah kamu rasa kamu akan tinggal di sini atau perlu berpindah untuk realisasikannya? 17. Adakah kamu pernah berbincang dengan ibu bapa/penjaga dan ahli keluarga yang lain tentang harapan, impian dan cita-cita kamu? Apakah pendapat/bantuan yang diberikan oleh mereka? Probes: Boleh fikirkan contoh aktiviti/perbincangan yang melibatkan penjanaan imaginasi/idea, perancangan masa depan, penyelesaian masalah?

Interview Schedule (English Translation): Young People

Opening:

- Now we are going to talk about your aspirations. This means hopes, dreams and ambitions related to the future that you imagine and want to see. Aspirations can be for yourself, your community and also for Malaysia. We will also discuss what you like and find useful in studying STEM subjects, and your day-to-day experience living in this area.
- I will ask you some questions about these topics. You don't have to answer any question that you don't want. Feel free to let me know if this is the case, we can move to the next question.
- As mentioned before, I will be recording the interview. I will also be making some notes. I hope you are able to speak freely and as detailed as possible.
- Please feel free to let me know in case the questions are unclear, so I can explain them better.
- This discussion will take approximately 30 to 45 minutes.

Theme	**Questions**
STEM innovation competition (reflection) ***especially for participants, but can also apply for others that assisted**	1. Can you share about your experience joining this competition? What did you learn from this experience? Probes: a. What is the application of STEM knowledge in this project? b. This project is about plastic, and the environment. What is the importance of this project? c. Would you be interested to participate in competitions such as this in the future?
Introduction on development	2. Have you heard of the term 'development'? What do you understand about it?
Aspirations for development	3. Now you are in Form 4. What are your hopes, dreams and ambitions? a. yourself (any change from when you were younger?) b. your family c. your village d. State or country 4. Can you share what you know about the country's

	aspiration? (e.g. Vision 2020, Shared Prosperity Vision 2030). 5. What is the role of young people like you in fulfilling this aspiration?
STEM education	6. Do you think learning in school is important to help you fulfil your hopes, dreams or ambitions? How so? 7. Can you share with me your PT3 results? What were your grades for Mathematics and Science? 8. Did you choose to join class 4-STEM (STEM package)? 9. Why did you choose to leave class 4-STEM? (if applicable) 10. Do you think studying the STEM subjects will be useful to help you fulfil your hopes, dreams or ambitions? How so? 11. Have your teachers helped you to think further about how to fulfil your hopes, dreams or ambitions? How so? Probes: Can you think of examples of activities/discussions that involve generation of imagination/ideas, planning for the future and problem solving?
Culture and aspirations	12. Family background. Where do you live, how many siblings do you have, what do your parents do for work. 13. Do you have any older siblings? Can you tell me about what they do? Are they studying or working? 14. Can you share what you usually do after school and on weekends? 15. What do you like or dislike about your village? 16. When you think about your hopes, dreams or ambitions, do you think you would like to stay here or

	move away to achieve them? 17. Have you talked with your parents and other family members about your hopes, dreams or ambitions? What do they think about it? Probes: Can you think of examples of activities/discussions that involve generation of imagination/ideas, planning for the future and problem solving?

C: Semi-structured Interview Schedule (Teachers)

Interview schedule (Bahasa Melayu): Teachers

Pembukaan:

- Sekarang kita akan berbincang tentang pendidikan STEM di Sekolah Luar Bandar
- Saya akan bertanya kamu beberapa soalan tentang topik ini. Kamu tidak perlu jawab mana-mana soalan yang kamu tidak mahu. Kamu hanya perlu maklumkan kepada saya, kita boleh terus ke soalan yang lain.
- Seperti yang dimaklumkan, saya akan merakam temu bual ini secara audio. Saya juga akan mengambil nota. Saya harap kamu boleh jawab dengan terperinci.
- Jika soalan tidak jelas, kamu boleh maklumkan saya. Nanti saya akan terangkan dengan lebih lanjut.
- Perbincangan ini akan mengambil masa 30 hingga 45 minit.

Tema	**Soalan**
Pengalaman mengajar (untuk semua)	1. Boleh cikgu ceritakan pengalaman cikgu mengajar? Probes: a. Ajar subjek apa? b. Dah berapa tahun mengajar di Sekolah Luar Bandar?
Aliran Sains/Pakej STEM (untuk semua, fokus lebih pada Pengetua & PKP)	2. Pada pendapat cikgu, kenapa diwujudkan aliran sains/pakej STEM di peringkat menengah atas di sekolah-sekolah di Malaysia? Probe: Dasar 60:40 Adakah ada kaitan dengan wawasan negara? 3. Adakah ada manfaat/kepentingan pelajar memilih aliran sains/pakej STEM berbanding yang lain? 4. Boleh cikgu ceritakan proses pelajar disalurkan ke aliran sains/sastera semasa tingkatan 4? (untuk pengetua/PKP/kaunselor, luangkan lebih masa) 5. Sekarang kita bincangkan situasi aliran sains/pakej

	STEM di Sekolah Luar Bandar. Apakah cabaran berkaitan aliran sains/pakej STEM di sini? Probes: a. Bilangan kelas/pelajar yg ambil aliran sains pada tahun-tahun lalu (ada maklumat ini?) b. Sekolah di Hulu Terengganu 'tutup kelas' sains c. Untuk Pengetua/PKP: Bagaimanakah perbincangan dengan PPD/JPN berkaitan isu ini? Pernah sertai Jerayawara STEM? d. Pelajar terbaik sekolah biasanya bukan kelas sains, 'turun kelas' 6. Bila cikgu mula dengar tentang konsep STEM? Apa yg cikgu faham tentang konsep ini?
Untuk guru matapelajaran STEM: • **Matematik** • **Matematik Tambahan** • **Sains** • **Fizik** • **Kimia** • **Grafik Komunikasi Tekninal**	7. Pada pendapat cikgu, apa manfaat pelajar belajar subjek cikgu? 8. Apa yang cikgu rasa pelajar suka tentang subjek cikgu? Ada bab tertentu ke? 9. Apakah cabaran-cabaran pelajar dengan subjek cikgu? Probe: Pelajar kurang semangat, bergantung pada guru, takut matematik, sistem berasaskan peperiksaan 10. Adakah cikgu rasa kandungan matapelajaran cikgu relevan dengan kehidupan seharian pelajar? 11. Sejak konsep STEM popular di Malaysia, cikgu rasa ada perubahan tak pada cara cikgu mengajar? Ada latihan berbeza yg diberikan oleh KPM? Probe: Semasa saya interview Dr. Ihsan, Pengarah Pusat STEM Negara, dia kata guru ada latihan IBSE/IBME. 12. Apa pandangan cikgu tentang keputusan pelajar dalam subjek cikgu & hubungkait dengan aspirasi/masa depan mereka? Probe: Analisa keputusan SPM subjek STEM biasanya kurang memuaskan berbanding subjek lain

	13. Bagaimana pengalaman cikgu mengajar subjek cikgu semasa musim PKP? Bagaimana penerimaan pelajar?
Untuk kaunselor	14. Semasa pelajar di tingkatan 3, adakah mereka diberikan taklimat untuk memilih aliran menengah atas? 15. Boleh cikgu ceritakan tentang ujian/pendedahan pelajar terhadap kerjaya di sekolah ini? Probe: Semasa di tingkatan 3 Inventori Minat Kerjaya (IMK), 'my future map'? 16. Biasanya, untuk pelajar-pelajar yang memilih aliran sains di Sekolah Luar Bandar, apakah laluan pendidikan/kerjaya mereka selepas itu? 17. Adakah sebarang aktiviti untuk menaikkan semangat/aspirasi pelajar? Apa cabarannya? 18. Adakah pelajar mempunyai banyak peluang di sekolah ini untuk mengembangkan aspirasi mereka?

Interview Schedule (English Translation): Teachers

Opening:

- Now we are going to discuss about STEM education at Sekolah Luar Bandar
- I will ask you some questions about these topics. You don't have to answer any question that you don't want. Feel free to let me know if this is the case, we can move to the next question.
- As mentioned before, I will be recording the interview. I will also be making some notes. I hope you are able to speak freely and as detailed as possible.
- Please feel free to let me know in case the questions are unclear, so I can explain them better.
- This discussion will take approximately 30 to 45 minutes.

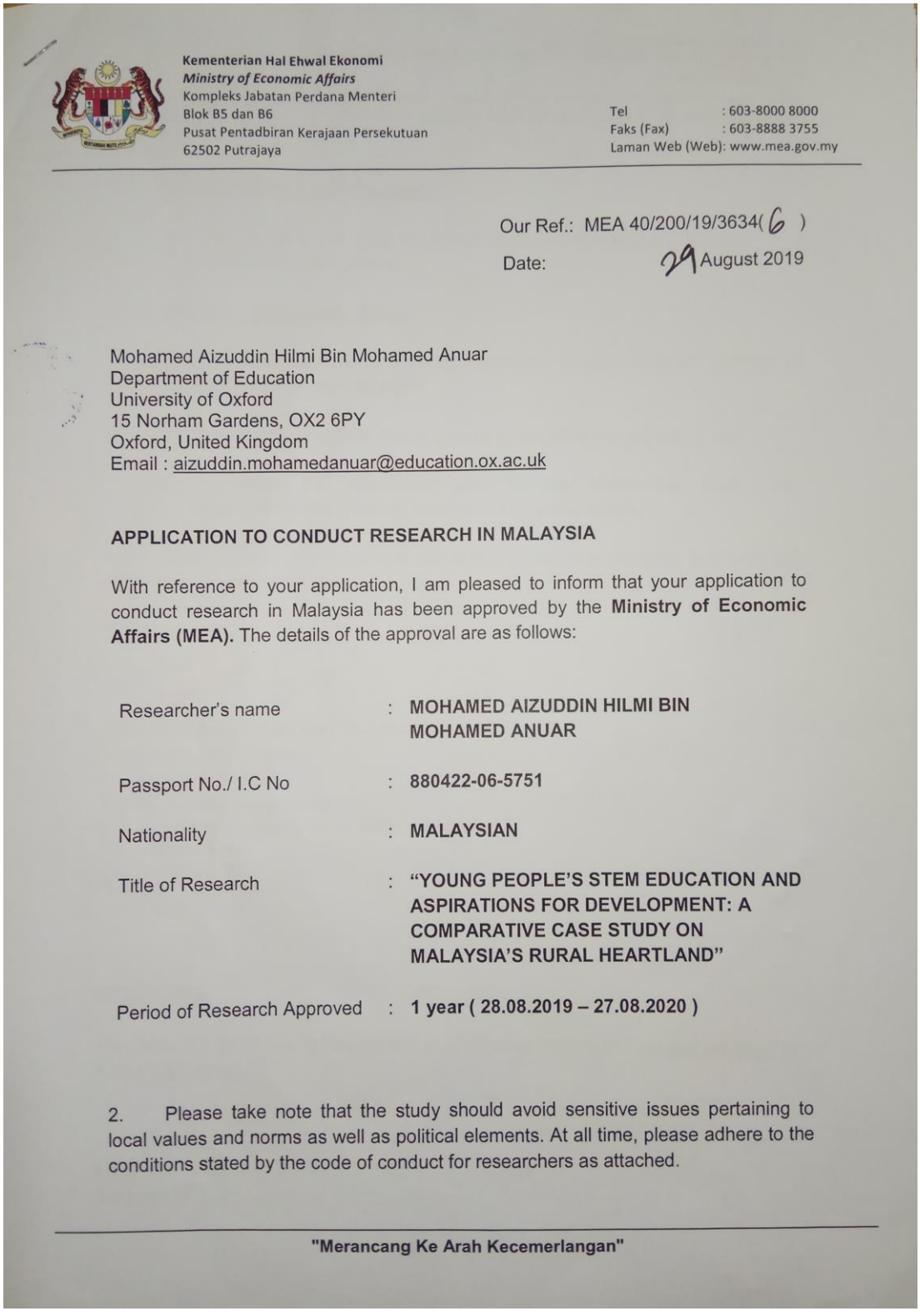
Theme	**Question**
Teaching experience (for all)	1. Can you share about your teaching experience? Probes: a. What subject(s) do you teach? b. How many years have you taught at Sekolah Luar Bandar?
Science Stream/STEM package (for all, focus more for Principal and Deputy Principal)	2. In your opinion, why were the science stream/STEM package created at the upper secondary level in Malaysian schools? Probes: 60:40 policy Is there a relation with national aspirations? 3. Is there a benefit/importance for students choosing science stream/STEM package compared to others? 4. Can you share the process of students being tracked into science/arts stream in Form 4? (Spend more time on this for Principal/Deputy Principal/Guidance Counsellor) 5. Now we will discuss the situation of science stream/STEM package at Sekolah Luar Bandar. What are the challenges related to science stream/STEM package here?

	Probes: a. The number of classes/students taking the science stream in previous years (do you have this information?) b. Schools in Hulu Terengganu district 'closing' science classes c. For Principal/Deputy Principal: How are the discussions with District/State Education Office on this. Have you ever joined STEM roadshow? d. Best students in the school usually not in science class, "going down" to other class. 6. When did you first hear about the concept of STEM? What do you understand about this?
STEM subject teachers: • **Mathematics** • **Additional Mathematics** • **Science** • **Physics** • **Chemistry** • **Technical Graphic Communication**	7. In your opinion, what are the benefits for students learning your subject? 8. What do you think students enjoy about your subject? Are there specific topics? 9. What are the challenges that students face in your subject? Probe: Students are not motivated, rely on teachers, averse to mathematics, examination oriented system 10. Do you think the content of your subject relevant to students' daily lives? 11. Since the concept of STEM is popular in Malaysia, do you think there has been a change in how you teach? Has there been a different form of training offered by the MOE? Probe: When I interviewed Dr. Ihsan, Director of the National STEM Centre, he says teachers are provided training in IBSE/IBME. 12. What is your opinion about students' academic results in your subject, and the relationship with their aspirations/future? Probe: Analysis of SPM results show that STEM subjects are usually

	less satisfactory compared to other subjects 13. How was your experience teaching during the lockdown period? How was the receptivity from students?
Guidance counsellor	14. When students were in Form 3, did they receive a briefing on selecting streams in the upper secondary level? 15. Can you share about instruments/exposure related to careers at this school? Probe: In Form 3 there is the Career Interest Inventory, 'my future map'? 16. Usually, students that choose the science stream in Sekolah Luar Bandar, what are their education/careers paths after school? 17. Are there activities to raise the motivation/aspiration of students? What are the challenges associated with this? 18. Do students have a lot of opportunities at this school to expand their aspirations?

D: Approval of Research Pass from Malaysian Government

Approval Letter from Ministry of Economic Affairs



Kementerian Hal Ehwal Ekonomi
Ministry of Economic Affairs
Kompleks Jabatan Perdana Menteri
Blok B5 dan B6
Pusat Pentadbiran Kerajaan Persekutuan
62502 Putrajaya

Tel : 603-8000 8000
Faks (Fax) : 603-8888 3755
Laman Web (Web): www.mea.gov.my

Our Ref.: MEA 40/200/19/3634(6)
Date: 29 August 2019

Mohamed Aizuddin Hilmi Bin Mohamed Anuar
Department of Education
University of Oxford
15 Norham Gardens, OX2 6PY
Oxford, United Kingdom
Email : aizuddin.mohamedanuar@education.ox.ac.uk

APPLICATION TO CONDUCT RESEARCH IN MALAYSIA

With reference to your application, I am pleased to inform that your application to conduct research in Malaysia has been approved by the **Ministry of Economic Affairs (MEA).** The details of the approval are as follows:

Researcher's name	:	**MOHAMED AIZUDDIN HILMI BIN MOHAMED ANUAR**
Passport No./ I.C No	:	**880422-06-5751**
Nationality	:	**MALAYSIAN**
Title of Research	:	**"YOUNG PEOPLE'S STEM EDUCATION AND ASPIRATIONS FOR DEVELOPMENT: A COMPARATIVE CASE STUDY ON MALAYSIA'S RURAL HEARTLAND"**
Period of Research Approved	:	**1 year (28.08.2019 – 27.08.2020)**

2. Please take note that the study should avoid sensitive issues pertaining to local values and norms as well as political elements. At all time, please adhere to the conditions stated by the code of conduct for researchers as attached.

"Merancang Ke Arah Kecemerlangan"

3. The issuance of the research pass is also subject to your agreement on the following:

i. **Ministry of Education Malaysia**

a) Observations and video recordings of student teaching and learning activities are not allowed.

ii. **Ministry of Economic Affairs**

a) To ensure submission of a brief summary of your research findings on completion of your research;

b) To submit three (3) copies of your final dissertation/publication; and

c) To return the researcher pass to the Researcher Pass Unit, Macroeconomics Division, Ministry of Economic Affairs.

4. Thank you for your interest in conducting research in Malaysia and wish you all the best in your future research endeavour.

Yours sincerely,

(MUHAMMAD JAWAD BIN TAJUDDIN)
Macroeconomics Division
for Secretary General
Ministry of Economic Affairs
Email : jawad.tajuddin@mea.gov.my/oridb@mea.gov.my
Tel : 03 88723254
Fax : 03 88883798

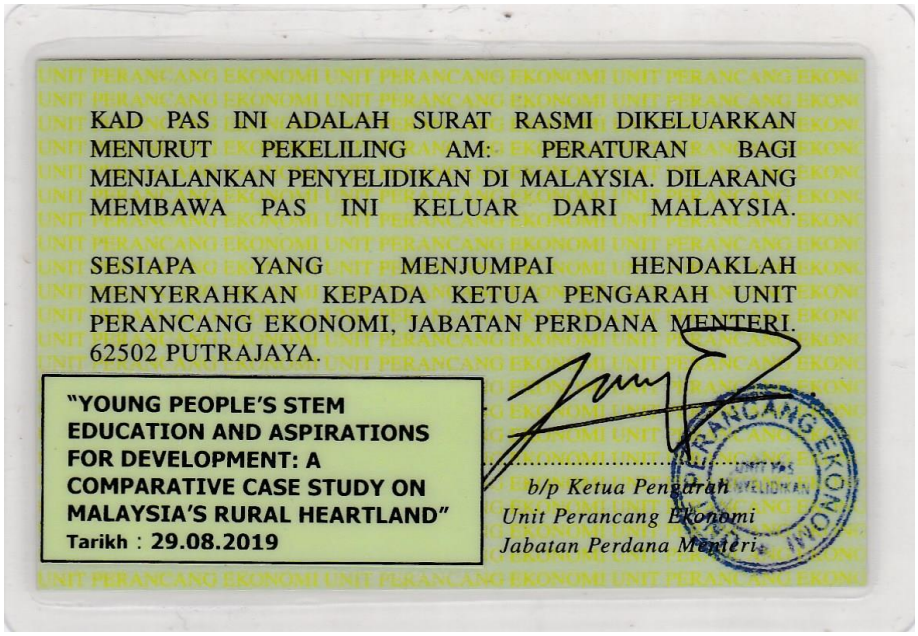
ATTENTION

This letter is only to inform you the status of your application and **cannot be used as a research pass.**

c.c.:
(for record)

Research Pass Issued as Part of Approval





E: CUREC and Fieldwork Risk Assessment Approvals

CUREC Approval (Prior to Fieldwork): 30 April 2019

RE: CUREC on behalf of Aizuddin Mohamed Anuar



Joshua McGrane
Tue 30/04, 17:14
Aizuddin Mohamed Anuar; Education Research Office; Maia Chankseliani

Reply

Inbox

Flag for follow up. Start by 30 April 2019. Due by 30 April 2019.

Dear Aizuddin,

Title: "Young people's STEM education and aspirations for development: A comparative case study in Malaysia's rural heartland"

The above application (reference number ED-C1A-19-190) has been considered on behalf of the Departmental Research Ethics Committee (DREC) in accordance with the procedures laid down by the University for ethical approval of all research involving human participants.

I am pleased to inform you that, on the basis of the information provided to DREC, the proposed research has been judged as meeting appropriate ethical standards, and accordingly, approval has been granted. However, I do highly recommend that you and your supervisors thoroughly proofread your attachments before distributing them, as several of them contain grammatical errors.

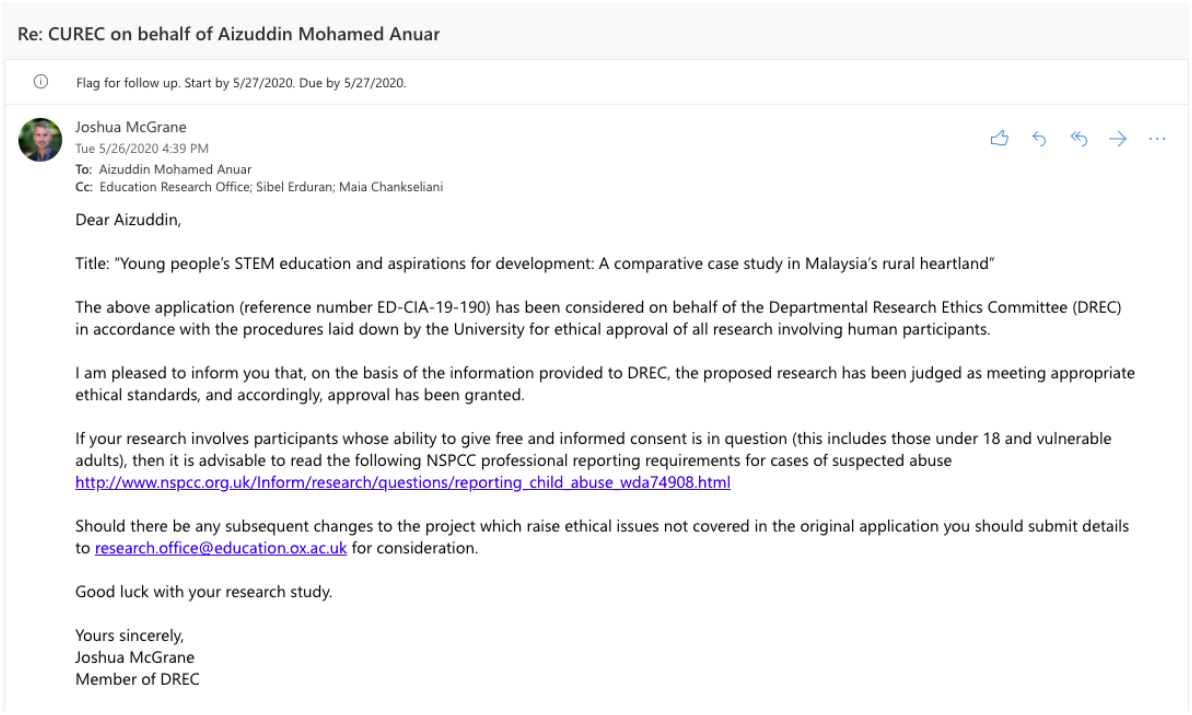
If your research involves participants whose ability to give free and informed consent is in question (this includes those under 18 and vulnerable adults), then it is advisable to read the following NSPCC professional reporting requirements for cases of suspected abuse http://www.nspcc.org.uk/Inform/research/questions/reporting_child_abuse_wda74908.html

Should there be any subsequent changes to the project which raise ethical issues not covered in the original application you should submit details to research.office@education.ox.ac.uk for consideration.

Good luck with your research study.

Yours sincerely,
Joshua McGrane
Member of DREC

CUREC Approval (During Fieldwork): 30 April 2019
Note: Additional approval for variation associated with lockdown & remote research due to COVID-19 pandemic



Re: CUREC on behalf of Aizuddin Mohamed Anuar

Flag for follow up. Start by 5/27/2020. Due by 5/27/2020.

Joshua McGrane
Tue 5/26/2020 4:39 PM
To: Aizuddin Mohamed Anuar
Cc: Education Research Office; Sibel Erduran; Maia Chankseliani

Dear Aizuddin,

Title: "Young people's STEM education and aspirations for development: A comparative case study in Malaysia's rural heartland"

The above application (reference number ED-CIA-19-190) has been considered on behalf of the Departmental Research Ethics Committee (DREC) in accordance with the procedures laid down by the University for ethical approval of all research involving human participants.

I am pleased to inform you that, on the basis of the information provided to DREC, the proposed research has been judged as meeting appropriate ethical standards, and accordingly, approval has been granted.

If your research involves participants whose ability to give free and informed consent is in question (this includes those under 18 and vulnerable adults), then it is advisable to read the following NSPCC professional reporting requirements for cases of suspected abuse
http://www.nspcc.org.uk/Inform/research/questions/reporting_child_abuse_wda74908.html

Should there be any subsequent changes to the project which raise ethical issues not covered in the original application you should submit details to research.office@education.ox.ac.uk for consideration.

Good luck with your research study.

Yours sincerely,
Joshua McGrane
Member of DREC

List of Ethical Concerns and Mitigations (variations associated with lockdown & remote research due to COVID-19 pandemic highlighted in red)

14. Title and very brief and simple lay description of research (about 150 words), plus description (about 200 words) of the nature of participants.
a) Title, brief description of research (150 words) in lay language. When describing the research, please include your methodology, how you are applying professional guidelines, and the use to which results/data will be put. **Please also declare any conflicts of interest here.**
Young people's STEM education and aspirations for development: A comparative case study in Malaysia's rural heartland The aim of this research is to understand how rural young people in Malaysia form and describe development-related aspirations. These aspirations will be contrasted against the state's development agenda cascaded via education and socialisation. The methodology will be a comparative case study including elite interviews, analysis of policy and media documents and artefacts from the case study sites, participant observation and interviews with young people, teachers and family members. A participatory component involves young people a) taking photographs of their lived environments/spaces b) participating in focus groups to develop questions c) carrying out interviews with teachers and family members. Ethical guidelines from education, visual and participatory research will be referenced in discussing potential ethnical issues. Data will be anonymised and used for completion of a DPhil thesis and subsequent academic publications. Due to the current pandemic associated with COVID-19, I am not able to physically access my fieldwork site. As such, two participatory component proposed above (b) & (c) are not possible at the present time. Therefore, interviews with teachers and students are now proposed to be conducted via phone/online. Additionally, data collection through Whatsapp with students are also proposed. A Whatsapp group for research purposes will be set up separately from that containing informal exchanges in order to demarcate which data will be collected for research.

15. What are the ethical issues connected with your research and what steps have you taken to address them? Please do not answer 'none'. The committee needs to see evidence that you have identified potential ethical issues with respect to your research and have taken steps to address them. These issues could relate to: • your own physical and psychological safety as a researcher (please see the University's and Social Science Division's Safety in Fieldwork guidance • participant burdens and/or risks, and • data protection/ confidentiality (please also see section 18). For more guidance on ethical issues, please see http://researchsupport.admin.ox.ac.uk/governance/ethics/resources
• Due to the current extraordinary circumstance, conducting interviews with teachers, many of whom are bearing care responsibilities at home, might be distracting or seen as an additional burden. Therefore, I will reach out to them to check if they are comfortable to be interviewed in the current situation, and seek their advice on the best time to conduct the interview over the phone. In some instances, these interviews might also carry therapeutic value i.e. teachers feel connected to their professional identity/work. Similarly, a careful approach will be undertaken with students to determine their willingness to be interviewed over the phone during this time. • Collection of data through over Whatsapp might raise privacy concerns. I will inform

student participants explicitly and seek their consent about using relevant elements of our conversation for research purposes. Information they provide for this purpose will also be anonymised accordingly.

- There are potential risks to my safety in relation to being in a rural community for an extended period (4-6 months) that could affect the course of my study. However, the community I am researching is not particularly impoverished or disadvantaged. There are roads, stable electricity and access to town with facilities (15 mins by car). I will conduct a pre-fieldwork visit to get acquainted with the area (medical facility, police station) and also seek as much information about the site beforehand through the school principal and teachers. I will also maintain correspondence with my family and supervisors throughout the fieldwork.
- There might be challenges in maintaining confidentiality of the elite interviewees, particularly when they are high-level officials with very specific positions. As part of the consent, I will offer the option to name them if they are comfortable. Otherwise, every effort will be taken to maintain anonymity and de-identify them (e.g. developing composite/aggregate portraits) so as to avoid legal implications or harm to their professional reputation.
- Given that a large component of the research will happen in a school setting, students might feel obligated or pressured to participate when the teachers and school leaders have consented to participate. I will make it clear to students that their consent is separate from their teachers', and there will be no repercussions should they decide not to participate in the study.
- Classroom observations may inevitably include students that do not consent to participate in the study, as the observations occur within the day-to-day STEM subject classrooms. Students will be provided the option to consent to this component only without committing to other parts of the study. Nevertheless, if they do not consent, every effort will be taken to exclude any observational data related to them in the study.
- Students could potentially be distracted from their studies or be more preoccupied with thinking about their futures (more than usual) by participating in this study. I will ensure that the in-class observations are as non-intrusive as possible, and the interviews and participatory components will be conducted after school hours. None of the questions asked will be related to sensitive topics, though there is always a small possibility that students could respond in distress. The advice of the school counsellor will be sought on how to best manage such responses in the school setting. Overall, the study will be framed as an opportunity for students to learn more about themselves and their families, and they will gain research skills and training in the participatory process.
- Other students of the same age who are not participating in this study (due to non-consent or not meeting recruitment criteria e.g. not studying the STEM stream) may be excluded from this study's potential benefits. Although this study is not an intervention, I will provide a guide/template for the participatory element of this study to the school counsellor so students can access them if they are interested to learn the research skills. I will also discuss with the school principal on how students can benefit from my experience as a gesture of reciprocity during my time with the school (e.g. being a teaching assistant for a general subject such as English).
- In the course of responding to the interview, teachers might encounter conflicting obligations to the Ministry of Education (MOE) as their employer (to champion STEM education), and also by their views on students' aspirations based on day-to-day interactions; these might not necessarily overlap. I will advise the teachers that their responses will be anonymised and not shared with the MOE. They should also not feel obligated to divulge anything they are uncomfortable with, and can revoke their consent at any point should they wish to.

- A potential issue with analysis of documents and artefacts is related to privacy and confidentiality. Though the majority of the documents I intend to analyse will be found in the public domain, there might be instances where personal documents or artefacts will be useful. In such cases, consent from the owner of the documents/artefacts will be sought prior to inclusion, with steps taken to subsequently anonymise them.
- There are also ethical issues related to the participatory components of the study. For example, when students take pictures of their day-to-day lived environment as prompts for the interview, there will be issues related to privacy, confidentiality and consent. Students will be briefed of these potential issues beforehand, and where applicable, to seek direct/parental permission for individuals included in their photographs. Should the students capture any distressing images, the school's standard reporting protocol for safeguarding and welfare will be adhered to.
- In instances where I take photos of students, teachers and family members engaged in STEM education or day-to-day activities, I will also seek consent for any photos that identify them directly, and also reiterate how I will use the photos as part of data for writing up the thesis.
- There are potential issues related to power imbalance and tokenism in participatory research. In this study, students will be provided options to decide the extent of their involvement in the participatory activities, where they will co-design parts of the study, determine the salient questions to be asked, learn new skills and have the opportunity to reflect on the experience at the end. Every effort will be made to hear the concerns of students and privilege their voices and agency in this participatory phase.
- For the focus group during the participatory phase, there might be concerns of confidentiality due to what is shared in a group setting that can be leaked outside of the group. As part of the briefing before the start of focus group, I will advise participants to respect what others are sharing within the group and avoid disclosing such information to people outside of the group. I will also reiterate that students should not feel obliged to share anything they are uncomfortable with, particularly in a group setting that includes their peers.
- Strict standards of data protection and confidentiality will be maintained in this study, and the steps are elaborated per item no. 18.

Fieldwork Risk Assessment Approval

Declaration

When complete, please email this form to travel@education.ox.ac.uk.

Student Declaration

☒I have completed the risk assessment relevant to my fieldwork

☒The information given on this form is correct to the best of my knowledge and I will ensure that it is updated as necessary (referring to the FCO website)

☒I have familiarised myself with current university Health & Safety Policies (and university statement of safety organisation)

☒I have agreed with my supervisor a regular check-in time and contact method by which we will keep in touch.

☒I am aware that it is departmental policy that I must check in with my supervisor at least once per month.

Signed _____ **Date:** 11/7/2019

Supervisor Declaration

☒I have read this risk assessment form and discussed it with the student

☒I have completed the supervisor check list with comments as appropriate

☒I have agreed with my student a regular check-in time and contact method by which we will keep in touch.

☒I am aware that it is departmental policy that I must check in with my student at least once per month.

M. Chanksiani

Signed **Date:** 11.07.2019

DGS / HoD Approval

(HoD Approval required when region/area to be visited is deemed 'inadvisable' by the FCO)

Signed _____ **Date:** 22/7/19

F: Invitation, Participant Information Sheet and Consent Form (Experts and Policymakers)

Recruitment Email (English): Experts and Policymakers

Email Title:
Invitation to participate in an interview for "Young people's STEM education and aspirations for development: A comparative case study in Malaysia's rural heartland"

Greetings,

My name is Aizuddin, and I am a doctoral research (DPhil) student at University of Oxford, supervised by Dr. Maia Chankseliani (Associate Professor of Comparative and International Education) and Professor Sibel Erduran (Professor of Science Education). In my research project "Young people's STEM education and aspirations for development: A comparative case study of Malaysia's rural heartland" I will explore how rural young people in Malaysia form and describe development-related aspirations through STEM education, contrasted against the national development agenda.

Aim

One of the aims of this study is to understand how is the 'science for development' agenda in Malaysia at the national level is cascaded into the rural school setting. This involves seeking the views of key policy makers and actors related to 'science for development', across fields such as development, rural affairs, science and technology, education and STEM education specifically.

Interview

As part of this study, I would be grateful if you would be willing to be interviewed regarding your views on the role of science and technology in development (including rural development), education as well as STEM education specifically. If you are agreeable, would you be able to advise a 1-hr time slot & date at your convenience?

Participant Information Sheet

Attached is an information sheet to provide more details on the study. Please do not hesitate to contact me if any additional information is needed.

I would also be grateful if you are able to forward this interview invitation to other colleagues in your network that are can provide insightful views related to 'science for development' as mentioned above.

I thank you very much for your time and kind consideration and I look forward to your response.

Best wishes,

Aizuddin Mohamed Anuar
DPhil in Education student
aizuddin.mohamedanuar@education.ox.ac.uk

Recruitment Email (Bahasa Melayu): Experts and Policymakers

Tajuk emel:
Jemputan menyertai temubual untuk kajian "Young people's STEM education and aspirations for development: A comparative case study in Malaysia's rural heartland"

Salam sejahtera,

Nama saya Aizuddin, pelajar doktor falsafah (DPhil) di University of Oxford, diselia oleh Dr. Maia Chankseliani (Associate Professor of Comparative and International Education) and Professor Sibel Erduran (Professor of Science Education). Dalam kajian saya "Pendidikan STEM golongan muda dan aspirasi untuk pembangunan: Kajian kes perbandingan tentang kawasan luar bandar di Malaysia", saya akan menerokai bagaimana golongan muda luar bandar membentuk dan menggambarkan aspirasi mereka berkaitan pembangunan menerusi pendidikan STEM, berbanding aspirasi pembangunan nasional.

Matlamat

Salah satu matlamat kajian ini ialah untuk memahami bagaimana agenda 'sains untuk pembangunan' di Malaysia diturunkan dari peringkat kebangsaan ke peringkat sekolah luar bandar. Ini melibatkan proses mengumpul pandangan penggubal polisi dan pihak-pihak berkepentingan berkaitan 'sains untuk pembangunan', dalam bidang pembangunan, hal ehwal luar bandar, sains dan teknologi, pendidikan secara amnya serta pendidikan STEM khususnya.

Temubual

Saya amat berharap agar tuan/puan sudi meluangkan masa untuk sesi temu bual berkaitan pandangan peranan sains dan teknologi, serta pendidikan STEM dalam pembangunan (termasuk pembangunan luar bandar).Jika tuan/puan bersetuju, saya mohon maklumkan waktu (1 jam) dan tarikh yang sesuai?

Risalah maklumat

Saya lampirkan risalah maklumat dengan butiran lebih lanjut tentang kajian ini. Jika ada sebarang maklumat lanjut yang diperlukan, boleh hubungi saya.

Saya juga amat menghargai bantuan tuan/puan untuk memanjangkan jemputan ini kepada kenalan-kenalan yang boleh memberikan pandangan pakar berkaitan 'sains untuk pembangunan' seperti yang dijelaskan di atas.

Pertimbangan pihak tuan/puan berkaitan jemputan ini saya dahului dengan ucapan terima kasih.

Yang benar,

Aizuddin Mohamed Anuar
Pelajar DPhil Pendidikan
aizuddin.mohamedanuar@education.ox.ac.uk

University of Oxford
Department of Education
15 Norham Gardens, Oxford OX2 6PY
Tel: +44 (0)1865 274024 Fax: +44 (0)1865 274024
Director: Prof. Jo-Anne Baird



Aizuddin Mohamed Anuar
DPhil in Education student
aizuddin.mohamedanuar@education.ox.ac.uk

Young people's STEM education and aspirations for development: A comparative case study of Malaysia's rural heartland

ADULT PARTICIPANT INFORMATION SHEET

CUREC Approval Reference: [ED-CIA-19-190]

What is the purpose of this research?
The aim of this research is to understand how rural young people in Malaysia form and describe development-related aspirations through STEM education, contrasted against the national development agenda. In the course of this research, the way in which the 'science for development agenda' is cascaded from policy into practice will first be traced, before exploring how young people describe development-related aspirations in relation to their STEM education, rural identity and socialisation with teachers and family members.

Why have I been invited to take part?
You have been invited because you have been identified or recommended as a key policy maker or actor related to 'science for development', across fields that include but not limited to development, rural affairs, science and technology, education and STEM education specifically. Your insights will be useful in the tracing of policy into practice associated with 'science for development'.

Do I have to take part?
Your participation is voluntary. You can ask questions about the study before deciding whether or not to participate. If you do agree to participate, you may withdraw yourself and any data provided so far from the study at any time, without giving a reason and without penalty, by advising the researcher of this decision.

What do I need to do if I take part in the research?
If you agree to participate, you will be contacted for an interview with the researcher. A consent form will be issued prior to the interview for you to complete. The interview will be audio-recorded and will take between 45 to 60 minutes.

Are there any potential risks in taking part?
There are no potential risks (physical or emotional) associated with your participation in this study. Your identity as well as that of your organisation will be concealed and anonymised. As a participant you have every right to ask questions or raise any concerns during any stage of the research process. You can reschedule or cancel the interview if necessary

Are there any benefits in taking part?
There are no direct benefits to your participation. However, your input will greatly contribute to a holistic picture of how rural young people form and describe their development-related aspirations.

What happens to the data provided?
Your responses will be anonymised and all research data will be stored confidentially on an encrypted and password protected drive that is only accessible to the researcher as his supervisors Dr. Maia Chankseliani and Prof. Sibel Erduran. The data will be used in the first instance as part of the researcher's completion of a thesis for the DPhil in Education at the University of Oxford. Subsequently, it may potentially be used for academic presentations or publications.

Will the research be published?
The University of Oxford is committed to the dissemination of its research for the benefit of society and the economy and, in support of this commitment, has established an online archive of research materials. This archive includes digital copies of student theses successfully submitted as part of a University of Oxford postgraduate degree programme. Holding the archive online gives easy access for researchers to the full text of freely available theses, thereby increasing the likely impact and use of that research.

The research will be written up as a thesis. On successful submission of the thesis, it will be deposited both in print and online in the University archives, to facilitate its use in future research. The thesis will be openly accessible. Subsequently, the research findings may also be used in academic publications.

Who is organising and funding the research?
This research is organised under the Department of Education, University of Oxford as part of the DPhil in Education. The research is funded by the Clarendon Fund at the University of Oxford, which has awarded a full DPhil scholarship to the researcher.

Who has reviewed this study?
This study has been reviewed by, and received ethics clearance through, the University of Oxford Central University Research Ethics Committee [ED-CIA-19-190]

Who do I contact if I have a concern about the study or I wish to complain?

If you have questions about any aspect of this study, please reach out to the following individuals, who will do their best to answer your query:

Researcher
Aizuddin Mohamed Anuar: aizuddin.mohamedanuar@education.ox.ac.uk

OR

Research supervisors
Dr. Maia Chankseliani: maia.chankseliani@education.ox.ac.uk
Prof. Sibel Erduran: sibel.erduran@education.ox.ac.uk

Should you have any concern, the researchers should acknowledge this within 10 working days and give you an indication of how they intend to deal with it.

If you remain unsatisfied or wish to make a formal complaint, please contact the relevant chair of the Research Ethics Committee at the University of Oxford who will seek to resolve the matter in a reasonably expeditious manner: Chair, Social Sciences & Humanities Inter-Divisional Research Ethics Committee; Email: ethics@socsci.ox.ac.uk; Address: Research Services, University of Oxford, Wellington Square, Oxford OX1 2JD

University of Oxford
Department of Education
15 Norham Gardens, Oxford OX2 6PY
Tel: +44 (0)1865 274024 Fax: +44 (0)1865 274024
Director: Prof. Jo-Anne Baird

Aizuddin Mohamed Anuar
Pelajar DPhil Pendidikan
aizuddin.mohamedanuar@education.ox.ac.uk

Pendidikan STEM golongan muda dan aspirasi untuk pembangunan: Kajian kes perbandingan tentang kawasan luar bandar di Malaysia

RISALAH MAKLUMAT DEWASA

Kelulusan CUREC: [ED-CIA-19-190]

Apakah matlamat kajian ini?
Matlamat kajian ini adalah untuk memahami bagaimana golongan muda di luar bandar membentuk dan menggambarkan aspirasi berkaitan pembangunan menerusi pendidikan STEM, berbanding aspirasi pembangunan nasional. Dalam kajian ini, pertamanya, cara agenda 'sains untuk pembangunan' diturunkan daripada polisi kepada amalan pendidikan akan diterokai. Ini akan diikuti oleh penerokaan cara golongan muda menggambarkan aspirasi berkaitan pembangunan berhubungkait dengan pendidikan STEM, identiti luar bandar serta pergaulan dengan guru-guru dan ahli keluarga mereka.

Mengapakah saya telah dijemput untuk menyertai kajian ini?
Anda telah dijemput kerana anda telah dikenalpasti atau dicadangkan sebagai penggubal polisi atau pihak berkepentingan dan berkepakaran berkaitan 'sains untuk pembangunan', dalam bidang seperti pembangunan, hal ehwal luar bandar, sains dan teknologi, pendidikan secara amnya serta pendidikan STEM khususnya. Pandangan anda amat bernilai untuk menerokai bagaimana agenda 'sains untuk pembangunan' diturunkan daripada polisi kepada amalan pendidikan.

Adakah saya wajib mengambil bahagian?
Penyertaan anda adalah secara sukarela. Anda boleh bertanya soalan berkenaan kajian ini sebelum membuat keputusan untuk menyertai atau tidak. Jika anda bersetuju untuk menyertai kajian ini, anda boleh berhenti pada bila-bila masa tanpa memberikan sebarang alasan dan tanpa penalti. Hanya maklumkan penyelidik tentang keputusan ini dan data serta maklumat anda tidak akan digunakan.

Apa yang perlu saya lakukan jika saya menyertai kajian ini?
Jika anda bersetuju untuk menyertai kajian ini, anda akan dihubungi oleh penyelidik untuk sesi temu bual. Borang kebenaran akan diberikan sebelum temu bual untuk dilengkapkan. Temu bual akan dirakam secara audio dan akan mengambil masa 45 hingga 60 minit.

Adakah terdapat sebarang risiko menyertai kajian ini?

Tiada risiko (fizikal atau emosi) berkaitan penyertaan anda dalam kajian ini. Identiti anda dan organisasi anda akan dirahsiakan. Anda berhak untuk bertanya soalan dan membuat sebarang aduan sepanjang kajian ini. Anda boleh mengatur semula atau membatalkan temu bual jika perlu.

Adakah penyelidikan ini akan diterbitkan?
University of Oxford komited untuk menyebarkan hasil penyelidikan buat manfaat masyarakat dan ekonomi. Bagi menyokong komitmen ini, ia telah menubuhkan arkib atas talian yang mengandungi salinan tesis digital para pelajar yang telah berjaya menamatkan program peringkat pasca-siswazah di University of Oxford. Dengan adanya arkib atas talian ini, para penyelidik dapat mengakses teks penuh tesis-tesis tersebut, seterusnya meningkatkan peluang aplikasi dan impak penyelidikan.

Hasil penyelidikan ini akan ditulis sebagai sebuah tesis. Setelah tesis berjaya dihantar, ia akan dimasukkan ke dalam arkib universiti secara cetakan dan juga atas talian, untuk memudahkan aplikasi penyelidikan di masa hadapan. Tesis ini boleh diakses oleh pihak awam. Seterusnya, dapatan kajian juga mungkin diterbitkan sebagai artikel jurnal akademik.

Siapakah yang mengelolai dan membiayai kajian ini?
Kajian DPhil Pendidikan ini dikelolai Jabatan Pendidikan di University of Oxford. Ia dibiayai oleh Clarendon Fund di University of Oxford, yang memberikan biasiswa penuh kepada penyelidik untuk pengajian DPhil.

Siapakah yang telah menyemak kajian ini?
Kajian ini telah disemak dan menerima kelulusan etika menerusi University of Oxford Central University Research Ethics Committee (Rujukan Kelulusan Etika: ED-CIA-19-190).

Siapakah yang boleh saya hubungi sekiranya saya mempunyai soalan berkaitan kajian ini, atau saya ingin membuat aduan?
Jika anda mempunyai soalan berkaitan mana-mana aspek kajian ini, sila hubungi individu di bawah yang akan berusaha sebaiknya untuk menjawab persoalan anda:

Penyelidik
Aizuddin Mohamed Anuar: aizuddin.mohamedanuar@education.ox.ac.uk

ATAU

Penyelia penyelidik
Dr. Maia Chankseliani: maia.chankseliani@education.ox.ac.uk
Prof. Sibel Erduran: sibel.erduran@education.ox.ac.uk

Jika anda mempunyai sebarang pertanyaan, penyelidik seharusnya mengambil maklum akan perkara ini dalam tempoh 10 hari bekerja dan memberikan petunjuk berkaitan cara pertanyaan ini akan dijawab.

Jika anda masih tidak berpuas hati dan ingin membuat aduan secara formal, sila hubungi pengerusi Jawatankuasa Etika Penyelidikan di University of Oxford yang akan menyelesaikan isu ini secepat yang mungkin: Chair, Social Sciences & Humanities Inter-Divisional Research Ethics Committee; E-mel: ethics@socsci.ox.ac.uk; Alamat: Research Services, University of Oxford, Wellington Square, Oxford OX1 2JD

Consent Form (English): Experts and Policymakers

University of Oxford
Department of Education
15 Norham Gardens, Oxford OX2 6PY
Tel: +44 (0)1865 274024 Fax: +44 (0)1865 274024
Director: Prof. Jo-Anne Baird



Aizuddin Mohamed Anuar
DPhil in Education student
aizuddin.mohamedanuar@education.ox.ac.uk

Young people's STEM education and aspirations for development: A comparative case study of Malaysia's rural heartland

PARTICIPANT CONSENT FORM

CUREC Approval Reference: [ED-CIA-19-190]

The aim of this research is to understand how rural young people in Malaysia form and describe development-related aspirations through STEM education, contrasted against the national development agenda. In the course of this research, the way in which the 'science for development agenda' is cascaded from policy into practice will first be traced, before exploring how young people describe development-related aspirations in relation to their STEM education, rural identity and socialisation with teachers and family members.

		Please initial each box
1	I confirm that I have read and understand the Participant Information Sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	
2	I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, and without any adverse consequences.	
3	I understand that research data collected during the study may be looked at by designated individuals from the University of Oxford where it is relevant to my taking part in this study. I give permission for these individuals to access my data.	
4	I understand that this project has been reviewed by, and received ethics clearance through, the University of Oxford Central University Research Ethics Committee.	
5	I understand who will have access to personal data provided, how the data will be stored and what will happen to the data at the end of the project.	
6	I understand how this research will be written up and published.	
7	I understand how to raise a concern or make a complaint.	
8	I consent to being audio recorded.	

9	I understand how audio recordings will be used in research outputs.	☐
10	I give permission to be quoted directly in the research publication against my name.	☐
11	I agree to take part in the study.	☐

_____	dd / mm / yyyy	_____
Name of Participant	Date	Signature
_____	dd / mm / yyyy	_____
Name of Researcher	Date	Signature

Consent Form (Bahasa Melayu): Experts and Policymakers

University of Oxford
Department of Education
15 Norham Gardens, Oxford OX2 6PY
Tel: +44 (0)1865 274024 Fax: +44 (0)1865 274024
Director: Prof. Jo-Anne Baird

Aizuddin Mohamed Anuar
Pelajar DPhil Pendidikan
aizuddin.mohamedanuar@education.ox.ac.uk

Pendidikan STEM golongan muda dan aspirasi untuk pembangunan: Kajian kes perbandingan tentang kawasan luar bandar di Malaysia

BORANG KEBENARAN PESERTA

Kelulusan CUREC: [ED-CIA-19-190]

Matlamat kajian ini adalah untuk memahami bagaimana anak muda luar bandar membentuk dan menggambarkan aspirasi mereka berkaitan pembangunan menerusi pendidikan STEM, berbanding aspirasi pembangunan nasional. Dalam kajian ini, pertamanya, cara agenda 'sains untuk pembangunan' diturunkan daripada polisi kepada amalan pendidikan akan diterokai. Ini akan diikuti oleh penerokaan cara golongan muda menggambarkan aspirasi berkaitan pembangunan berhubungkait dengan pendidikan STEM, identiti luar bandar serta pergaulan dengan guru-guru dan ahli keluarga mereka.

Sila tandakan

1	Saya sahkan bahawa saya telah membaca dan memahami Risalah Maklumat Peserta untuk kajian ini. Saya telah diberikan peluang untuk menghadam maklumat tersebut, bertanya soalan dan berpuas hati dengan jawapan yang diberikan.	☐
2	Saya faham bahawa penyertaan saya ialah secara sukarela dan saya bebas untuk menarik diri pada bila-bila masa, tanpa memberikan sebarang alasan, dan tanpa sebarang kesan negatif.	☐
3	Saya faham data kajian ini boleh diakses individu yang relevan di University of Oxford. Saya berikan kebenaran saya kepada individu-individu ini untuk mengakses data saya.	☐
4	Saya faham projek ini telah dinilai dan mendapat kelulusan etika daripada the University of Oxford Central University Research Ethics Committee.	☐
5	Saya faham siapa yang mempunyai akses kepada data peribadi yang diberikan, bagaimana data ini disimpan dan apa yang akan terjadi kepada data ini di akhir projek.	☐
6	Saya faham bagaimana kajian ini akan ditulis dan diterbitkan.	☐
7	Saya faham bagaimana untuk menyatakan kebimbangan dan untuk membuat sebarang aduan.	☐

8	Saya berikan kebenaran untuk direkod secara audio.	☐
9	Saya faham bagaimana rakaman audio akan digunakan dalam hasil kajian.	☐
10	Saya berikan kebenaran untuk kata-kata saya dipetik bersama nama saya dalam penerbitan kajian ini.	☐
11	Saya bersetuju untuk menyertai kajian ini.	☐

_____	dd / mm / yyyy	_____
Name Peserta	Tarikh	Tandatangan
_____	dd / mm / yyyy	_____
Name Penyelidik	Tarikh	Tandatangan

G: Participant Information Sheet and Consent Form (Young People)

Participant Information Sheet (Bahasa Melayu): Young People and Parents

University of Oxford
Department of Education
15 Norham Gardens, Oxford OX2 6PY
Tel: +44 (0)1865 274024 Fax: +44 (0)1865 274024
Director: Prof. Jo-Anne Baird

Aizuddin Mohamed Anuar
Pelajar DPhil Pendidikan
aizuddin.mohamedanuar@education.ox.ac.uk

Pendidikan STEM dan aspirasi untuk pembangunan: Kajian kes perbandingan tentang kawasan luar bandar di Malaysia

RISALAH MAKLUMAT PESERTA (PELAJAR & IBU BAPA/PENJAGA)

Kelulusan CUREC: [ED-CIA-19-190]

Saya ingin bertanya jika kamu dan ahli keluarga kamu berminat untuk menyertai kajian ini.

Sebelum membuat keputusan untuk menyertai atau tidak, penting untuk kamu memahami kajian ini dan bagaimana kamu akan terlibat. Sila baca dengan teliti dan rujuk kepada saya jika ada sebarang soalan.

Apakah tujuan kajian ini?
Kajian ini dijalankan untuk memahami bagaimana kamu berfikir dan menggambarkan harapan, impian dan cita-cita berkaitan masa depan yang kamu bayangkan dan idamkan. Ini boleh berkaitan dengan diri sendiri, masyarakat sekeliling dan juga negara. Kita juga akan berbincang tentang minat dan kegunaan mempelajari subjek-subjek STEM. Saya juga ingin berbincang tentang topik yang sama dengan cikgu-cikgu serta ahli keluarga kamu.

Kenapa saya dijemput untuk menyertai kajian ini?
Kamu dijemput kerana kamu pelajar tingkatan 4 yang pernah atau sedang berada di kelas pakej STEM di sekolah kamu.

Adakah saya wajib mengambil bahagian?
Tidak. Ia bergantung sepenuhnya kepada kamu. Kamu juga boleh mengubah fikiran semasa kajian dijalankan.

Apa yang perlu saya lakukan jika saya ingin menyertai kajian ini?
Dalam kajian ini, saya ingin berbincang dengan kamu tentang bagaimana kamu menggambarkan harapan, impian dan cita-cita berkaitan masa depan dan pembangunan. Saya akan merakam perbincangan kita secara audio supaya saya boleh mendengar semula dan mencatat maklumat. Kita juga akan menjalankan aktiviti luar kelas seperti fotografi dan projek STEM. Kita akan berbincang dengan lebih lanjut tentang aktiviti luar kelas ini semasa temu bual kita. Saya juga akan menangkap gambar kamu semasa akitiviti berkaitan STEM dan dalam kehidupan seharian, serta melihat dokumen atau objek yang berkaitan dengan harapan, impian dan cita-cita kamu.

Seterusnya, jika kamu berminat, kamu boleh membantu saya untuk menemu bual cikgu-cikgu dan ahli keluarga seperti ibu bapa atau abang/kakak kamu. Kita akan berbincang bersama-sama soalan yang boleh ditanyakan kepada mereka. Soalan-soalan ini akan berkaitan bagaimana

cikgu-cikgu dan ahli keluarga kamu berpendapat subjek-subjek STEM, latar belakang kamu serta pengalaman tinggal di sini mempengaruhi pemikiran kamu tentang harapan, impian dan cita-cita kamu.

Jika kamu bersetuju untuk mengambil bahagian, diharap agar ibu bapa/penjaga kamu boleh melengkapkan borang kebenaran di bawah. Jika perlu, saya juga boleh menerangkan dengan lebih lanjut kepada mereka tentang kajian ini, serta penglibatan kamu dan juga ahli keluarga.

Adakah ada apa-apa yang perlu saya bimbangi jika saya mengambil bahagian?
Tidak. Kita tidak akan berbincang tentang perkara yang rumit atau memberikan tekanan. Jika kamu berasa bimbang tentang apa-apa perkara semasa menyertai kajian ini, boleh maklumkan saya dan kita akan berbincang dengan ibu bapa/penjaga kamu. Kamu juga boleh menarik diri pada bila-bila masa. Tiada sebarang paksaan dalam kajian ini.

Adakah menyertai kajian ini akan membantu saya?
Ia akan membantu kamu untuk berfikir dan merenungi harapan, impian dan cita-cita kamu, serta bagaimana kamu boleh merealisasikannya. Kamu juga akan belajar kemahiran baru seperti menjalankan temu bual serta mengumpul data kajian.

Apa akan terjadi pada maklumat yang kamu kumpul?
Nama kamu akan dirahsiakan dalam kajian ini, jadi tiada siapa tahu kamu mengambil bahagian kecuali saya dan dua orang penyelia saya. Saya akan simpan semua maklumat yang dikumpulkan dengan selamat. Saya akan menggunakan maklumat ini untuk menulis tesis PhD saya di University of Oxford, dan juga untuk pembentangan, laporan atau penerbitan akan datang. Jika saya ingin menggunakan gambar yang ada wajah kamu di penerbitan atau platform lain selain tesis, saya akan memohon kebenaran ibu bapa kamu. Berdasarkan peraturan universiti saya, maklumat tanpa nama yang saya kumpul akan disimpan selama 3 tahun setelah selesai PhD saya.

Siapa yang mengelolai dan membiayai kajian ini?
Kajian PhD ini dikelolai Jabatan Pendidikan di University of Oxford. Ia dibiayai oleh Clarendon Fund di University of Oxford, yang memberikan saya biasiswa untuk pengajian PhD saya.

Siapa yang telah menyemak kajian ini?
Kajian ini telah disemak dan mendapat kelulusan etika melalui Central University Research Ethics Committee (CUREC) di University of Oxford (Nombor rujukan: ED-CIA-19-190).

Siapa yang boleh saya hubungi jika saya ada sebarang aduan tentang kajian ini?
Jika kamu ada sebarang soalan berkaitan kajian ini, sila maklumkan kepada saya. Kamu juga boleh berbincang dengan ibu bapa/penjaga kamu dan kemudian kita boleh berbincang bersama-sama.

University of Oxford
Department of Education
15 Norham Gardens, Oxford OX2 6PY
Tel: +44 (0)1865 274024 Fax: +44 (0)1865 274024
Director: Prof. Jo-Anne Baird



Aizuddin Mohamed Anuar
Pelajar DPhil Pendidikan
aizuddin.mohamedanuar@education.ox.ac.uk

Young people's STEM education and aspirations for development: A comparative case study in Malaysia's rural heartland

PARTICIPANT INFORMATION SHEET (YOUNG PEOPLE & PARENTS/GUARDIANS)

CUREC Approval Reference: [ED-CIA-19-190]

I would like to ask if you and your family members would be interested to take part in this study.

Before deciding if you would like to join, it is important that you understand what this study is about and how you will be involved. Please read this sheet carefully and feel free to ask me any questions.

What is this study about?
This study is done to understand how you think and talk about your hopes, dreams and ambitions related to the future that you imagine and want to see. This can be for yourself, your community and also for Malaysia. We will also discuss what you like and find useful in studying STEM subjects. I would also like to talk to your teachers and family members about similar topics.

Why have I been invited to take part?
You have been invited because you are in Form 4 and also studying in the STEM stream at your school.

Do I have to take part?
No, you don't. It's entirely up to you if you want to take part. You can always change your mind during the study.

What do I need to do if I take part?
In this study, I will observe and take notes about what you are learning in STEM subject classes for half the school year from January to May. A few more things will happen during this period. I also want to interview you about your hopes, dreams and ambitions related to the future that you imagine and would like to see, as well as your past dreams and ambitions. I will record this interview using a voice recorder so I can listen to it later and write everything down. You will also take some pictures of your important day-to-day experience and surroundings. We will talk more about these pictures during the interview. I might also take photos of you engaging in STEM activities and in your day-to-day experience and look at documents or objects related to your hopes, dreams and ambitions.

Then, if you want, you can also help me interview teachers and family members like your parents and older siblings after school. We will discuss and come up with these questions together. These questions will be about how your teachers think STEM subjects help you think about your hopes, dreams and ambitions, and also how your family members think living in this area, and your background help you think about these same concepts.

If you are happy to take part, one of your parents/guardians will sign a form to let me know. I will also explain to them about this study, your involvement and also their involvement.

Is there anything to be worried about if I take part?
No. We will not discuss anything stressful or complicated. If you are worried about anything while taking part in this study, do let me know and we can discuss it with your parents too. You can also quit anytime you want. It is entirely up to you.

Will taking part in this study help me?
It will help to think and reflect about your hopes, dreams and ambitions, and also how you might plan to make them a reality. You will also learn new skills such as interviewing and collecting research data.

What happens to the information you collect?
Your responses will be anonymised, so no one knows that you were part of this study except for me and also my two professors. I will keep all the information I collect safely. I will use the information to write a thesis for my PhD at the University of Oxford, and also presentations, reports or books later on. If I decide to use photos that can directly identify you in places other than for the thesis, I will ask permission from your parents/guardians. Based on my university rules, the anonymised information I collect will be stored for 3 years after I finish my PhD.

Who is organising and funding the study?
This research is organised under the Department of Education, University of Oxford as part of my PhD. It is paid for by the Clarendon Fund at the University of Oxford, which has awarded me a scholarship so I can do my PhD.

Who has reviewed this study?
This study has been reviewed by, and received ethics clearance through, the University of Oxford Central University Research Ethics Committee (Reference number: ED-CIA-19-190).

Who do I contact if I have a concern about the study?
If you have questions about any aspect of this study, please let me know. You can also discuss it with your parents/guardians and then we can talk about it together.

Consent Form (Bahasa Melayu): Young People and Parents

Pendidikan STEM dan aspirasi untuk pembangunan: Kajian kes perbandingan tentang kawasan luar bandar di Malaysia

BORANG KEBENARAN IBU BAPA/PENJAGA

Kelulusan CUREC: [ED-CIA-19-190]

- Sekolah anak tuan/puan telah bersetuju untuk menyertai kajian yang dijalankan oleh University of Oxford tentang bagaimana golongan muda luar bandar di Malaysia membentuk dan menggambarkan aspirasi berkaitan pembangunan menerusi pendidikan STEM.
- Jika tuan/puan bersetuju untuk anak mengambil bahagian, sila isi borang di bawah dan kembalikan kepada penyelidik secepat mungkin.
- **Untuk mengetahui dengan lebih lanjut tentang kajian ini, sila baca risalah maklumat pelajar yang dilampirkan bersama.**

- -

Nama anak: _____

Saya telah membaca dan memahami perincian kajian di atas, dan telah berpeluang untuk bertanya soalan dan berbincang tentang kajian ini dengan penyelidik. Saya faham bahawa projek ini telah menerima kelulusan etika daripada University of Oxford, dan saya faham siapa yang mempunyai akses kepada data, bagaimana ia akan disimpan dan apa yang akan terjadi kepada data di akhir kajian ini. Saya faham bahawa penyertaan adalah secara sukarela dan saya serta anak saya bebas untuk menarik balik kebenaran pada bila-bila masa, tanpa memberikan sebarang alasan atau kesan kepada pendidikan anak saya. Saya faham bagaimana untuk menyatakan sebarang kebimbangan atau aduan.

Saya setuju untuk anak saya berkongsi sebarang hasil berkaitan kajian ini	Ya	☐	Tidak	☐
Saya setuju untuk temubual bersama anak saya dirakam secara audio	Ya	☐	Tidak	☐
Saya setuju untuk gambar anak saya ditangkap dalam kajian ini	Ya	☐	Tidak	☐
Saya faham bagaimana rakaman audio/gambar akan digunakan dalam hasil kajian ini	Ya	☐	Tidak	☐

Saya memberikan kebenaran kepada anak saya untuk menyertai kajian di atas

_____	dd / mm / yyyy	_____
Nama Ibu bapa/penjaga	Tarikh	Tandatangan
Aizuddin Mohamed Anuar	dd / mm / yyyy	_____
Nama Penyelidik	Tarikh	Tandatangan

Consent Form (English Translation): Young People and Parents

Young people's STEM education and aspirations for development: A comparative case study of Malaysia's rural heartland

PARENT/GUARDIAN CONSENT FORM

CUREC Approval Reference: [ED-CIA-19-190]

- Your child's school has agreed to take part in a study run by University of Oxford looking at how rural young people in Malaysia form and describe development-related aspirations through STEM education.
- If your child takes part, a researcher would come and visit them at school, observe them in classrooms, interview them, and engage them in some activities after school.
- If you are happy for your child to take part, please fill in the form below and return it to your child's class teacher as soon as possible.
- **To find out more about the study, please read the attached student information sheet.**

- - - -

H: Participant Information Sheet and Consent Form (Teachers)

Participant Information Sheet (Bahasa Melayu): Teachers

University of Oxford
Department of Education
15 Norham Gardens, Oxford OX2 6PY
Tel: +44 (0)1865 274024 Fax: +44 (0)1865 274024
Director: Prof. Jo-Anne Baird

Aizuddin Mohamed Anuar
Pelajar DPhil Pendidikan
aizuddin.mohamedanuar@education.ox.ac.uk

Pendidikan STEM golongan muda dan aspirasi untuk pembangunan: Kajian kes perbandingan tentang kawasan luar bandar di Malaysia

RISALAH MAKLUMAT PESERTA

Kelulusan CUREC: [ED-CIA-19-190]

Apakah matlamat kajian ini?
Matlamat kajian ini adalah untuk memahami bagaimana golongan muda di luar bandar membentuk dan menggambarkan aspirasi berkaitan pembangunan menerusi pendidikan STEM, berbanding aspirasi pembangunan nasional. Dalam kajian ini, pertamanya, cara agenda 'sains untuk pembangunan' diturunkan daripada polisi kepada amalan pendidikan akan diterokai. Ini akan diikuti oleh penerokaan cara golongan muda menggambarkan aspirasi berkaitan pembangunan berhubungkait dengan pendidikan STEM, budaya luar bandar serta pergaulan dengan guru-guru dan ahli keluarga mereka.

Mengapakah saya telah dijemput untuk menyertai kajian ini?
Anda telah dijemput sebagai anggota kumpulan pentadbiran sekolah, guru yang mengajar subjek berkaitan STEM di sekolah ini, atau sebagai guru bimbingan dan kaunseling yang berinteraksi dengan pelajar dalam kajian ini berkaitan laluan pendidikan dan kerjaya. Pandangan anda amat bernilai untuk memahami bagaimana pendidikan amnya, dan pendidikan STEM khususnya, mempengaruhi pembentukan aspirasi golongan muda berkaitan pembangunan.

Adakah saya wajib mengambil bahagian?
Penyertaan anda adalah secara sukarela. Anda boleh bertanya soalan berkenaan kajian ini sebelum membuat keputusan untuk menyertai atau tidak. Jika anda bersetuju untuk menyertai kajian ini, anda boleh berhenti pada bila-bila masa tanpa memberikan sebarang alasan dan tanpa penalti. Hanya maklumkan penyelidik tentang keputusan ini dan data serta maklumat anda tidak akan digunakan.

Apa yang perlu saya lakukan jika saya menyertai kajian ini?
Jika anda bersetuju untuk menyertai kajian ini, anda akan ditemu bual oleh penyelidik. Borang kebenaran akan diberikan sebelum temu bual untuk dilengkapkan. Temu bual akan dirakam secara audio dan akan mengambil masa 45 hingga 60 minit.

Adakah terdapat sebarang risiko menyertai kajian ini?
Tiada risiko (fizikal atau emosi) berkaitan penyertaan anda dalam kajian ini. Identiti anda dan organisasi anda akan dirahsiakan. Anda berhak untuk bertanya soalan dan membuat sebarang aduan sepanjang kajian ini. Anda boleh mengatur semula atau membatalkan temu bual jika perlu.

Adakah penyelidikan ini akan diterbitkan?
University of Oxford komited untuk menyebarkan hasil penyelidikan buat manfaat masyarakat dan ekonomi. Bagi menyokong komitmen ini, ia telah menubuhkan arkib atas talian yang mengandungi salinan tesis digital para pelajar yang telah berjaya menamatkan program peringkat pasca-siswazah di University of Oxford. Dengan adanya arkib atas talian ini, para penyelidik dapat mengakses teks penuh tesis-tesis tersebut, seterusnya meningkatkan peluang aplikasi dan impak penyelidikan.

Hasil penyelidikan ini akan ditulis sebagai sebuah tesis. Setelah tesis berjaya dihantar, ia akan dimasukkan ke dalam arkib universiti secara cetakan dan juga atas talian, untuk memudahkan aplikasi penyelidikan di masa hadapan. Tesis ini boleh diakses oleh pihak awam. Seterusnya, dapatan kajian juga mungkin diterbitkan sebagai artikel jurnal akademik.

Siapakah yang mengelolai dan membiayai kajian ini?
Kajian DPhil Pendidikan ini dikelolai Jabatan Pendidikan di University of Oxford. Ia dibiayai oleh Clarendon Fund di University of Oxford, yang memberikan biasiswa penuh kepada penyelidik untuk pengajian DPhil.

Siapakah yang telah menyemak kajian ini?
Kajian ini telah disemak dan menerima kelulusan etika menerusi University of Oxford Central University Research Ethics Committee (Rujukan Kelulusan Etika: ED-CIA-19-190).

Siapakah yang boleh saya hubungi sekiranya saya mempunyai soalan berkaitan kajian ini, atau saya ingin membuat aduan?
Jika anda mempunyai soalan berkaitan mana-mana aspek kajian ini, sila hubungi individu di bawah yang akan berusaha sebaiknya untuk menjawab persoalan anda:

Penyelidik
Aizuddin Mohamed Anuar: aizuddin.mohamedanuar@education.ox.ac.uk

ATAU

Penyelia penyelidik
Dr. Maia Chankseliani: maia.chankseliani@education.ox.ac.uk
Prof. Sibel Erduran: sibel.erduran@education.ox.ac.uk

Jika anda mempunyai sebarang pertanyaan, penyelidik seharusnya mengambil maklum akan perkara ini dalam tempoh 10 hari bekerja dan memberikan petunjuk berkaitan cara pertanyaan ini akan dijawab.

Jika anda masih tidak berpuas hati dan ingin membuat aduan secara formal, sila hubungi pengerusi Jawatankuasa Etika Penyelidikan di University of Oxford yang akan menyelesaikan isu ini secepat yang mungkin: Chair, Social Sciences & Humanities Inter-Divisional Research Ethics

Committee; E-mel: ethics@socsci.ox.ac.uk; Alamat: Research Services, University of Oxford, Wellington Square, Oxford OX1 2JD

University of Oxford
Department of Education
15 Norham Gardens, Oxford OX2 6PY
Tel: +44 (0)1865 274024 Fax: +44 (0)1865 274024
Director: Prof. Jo-Anne Baird



Aizuddin Mohamed Anuar
Pelajar DPhil Pendidikan
aizuddin.mohamedanuar@education.ox.ac.uk

Young people's STEM education and aspirations for development: A comparative case study of Malaysia's rural heartland

PARTICIPANT INFORMATION SHEET

CUREC Approval Reference: [ED-CIA-19-190]

What is the purpose of this research?
The aim of this research is to understand how rural young people in Malaysia form and describe development-related aspirations through STEM education, contrasted against the national development agenda. In the course of this research, the way in which the 'science for development agenda' is cascaded from policy into practice will first be traced, before exploring how young people describe development-related aspirations in relation to their STEM education, rural identity and socialisation with teachers and family members.

Why have I been invited to take part?
You have been invited because you are part of the school leadership team, teach STEM-related subjects in school to the young people who have agreed to participate in this study, or you are the school counsellor that works closely with the young people in advising about potential education and career pathways. Your insights will be useful in identifying how education generally, and STEM education specifically influences the formation of young people's development-related aspirations.

Do I have to take part?
Your participation is voluntary. You can ask questions about the study before deciding whether or not to participate. If you do agree to participate, you may withdraw yourself and any data provided so far from the study at any time, without giving a reason and without penalty, by advising the researcher of this decision.

What do I need to do if I take part in the research?
If you agree to participate, you will engage in interview(s) with the researcher as well as the young people in this study, who will co-design and jointly carry out the interviews. A consent form will be issued prior to the interview for you to complete. Each interview will be audio-recorded and will take between 45 to 60 minutes.

Are there any potential risks in taking part?
There are no potential risks (physical or emotional) associated with your participation in this study. Your identity as well as that of your organisation will be concealed and anonymised. As a participant you have every right to ask questions or raise any concerns during any stage of the research process. You can reschedule or cancel the interview if necessary.

Will the research be published?

The University of Oxford is committed to the dissemination of its research for the benefit of society and the economy and, in support of this commitment, has established an online archive of research materials. This archive includes digital copies of student theses successfully submitted as part of a University of Oxford postgraduate degree programme. Holding the archive online gives easy access for researchers to the full text of freely available theses, thereby increasing the likely impact and use of that research.

The research will be written up as a thesis. On successful submission of the thesis, it will be deposited both in print and online in the University archives, to facilitate its use in future research. The thesis will be openly accessible. Subsequently, the research findings may also be used in academic publications.

Who is organising and funding the research?
This research is organised under the Department of Education, University of Oxford as part of the DPhil in Education. The research is funded by the Clarendon Fund at the University of Oxford, which has awarded a full DPhil scholarship to the researcher.

Who has reviewed this study?
This study has been reviewed by, and received ethics clearance through, the University of Oxford Central University Research Ethics Committee [ED-CIA-19-190]

Who do I contact if I have a concern about the study or I wish to complain?

If you have questions about any aspect of this study, please reach out to the following individuals, who will do their best to answer your query:

Researcher
Aizuddin Mohamed Anuar: aizuddin.mohamedanuar@education.ox.ac.uk

OR

Research supervisors
Dr. Maia Chankseliani: maia.chankseliani@education.ox.ac.uk
Prof. Sibel Erduran: sibel.erduran@education.ox.ac.uk

Should you have any concern, the researchers should acknowledge this within 10 working days and give you an indication of how they intend to deal with it.

If you remain unsatisfied or wish to make a formal complaint, please contact the relevant chair of the Research Ethics Committee at the University of Oxford who will seek to resolve the matter in a reasonably expeditious manner: Chair, Social Sciences & Humanities Inter-Divisional Research Ethics Committee; Email: ethics@socsci.ox.ac.uk; Address: Research Services, University of Oxford, Wellington Square, Oxford OX1 2JD

Consent Form (Bahasa Melayu): Teachers

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Pendidikan STEM golongan muda dan aspirasi untuk pembangunan: Kajian kes perbandingan tentang kawasan luar bandar di Malaysia

BORANG KEBENARAN PESERTA

Kelulusan CUREC: [ED-CIA-19-190]

Matlamat kajian ini adalah untuk memahami bagaimana anak muda luar bandar membentuk dan menggambarkan aspirasi mereka berkaitan pembangunan menerusi pendidikan STEM, berbanding aspirasi pembangunan nasional. Dalam kajian ini, pertamanya, cara agenda 'sains untuk pembangunan' diturunkan daripada polisi kepada amalan pendidikan akan diterokai. Ini akan diikuti oleh penerokaan cara golongan muda menggambarkan aspirasi berkaitan pembangunan berhubungkait dengan pendidikan STEM, identiti luar bandar serta pergaulan dengan guru-guru dan ahli keluarga mereka.

Sila tandakan

1	Saya sahkan bahawa saya telah membaca dan memahami Risalah Maklumat Peserta untuk kajian ini. Saya telah diberikan peluang untuk menghadam maklumat tersebut, bertanya soalan dan berpuas hati dengan jawapan yang diberikan.	☐
2	Saya faham bahawa penyertaan saya ialah secara sukarela dan saya bebas untuk menarik diri pada bila-bila masa, tanpa memberikan sebarang alasan, dan tanpa sebarang kesan negatif.	☐
3	Saya faham data kajian ini boleh diakses individu yang relevan di University of Oxford. Saya berikan kebenaran saya kepada individu-individu ini untuk mengakses data saya.	☐
4	Saya faham projek ini telah dinilai dan mendapat kelulusan etika daripada the University of Oxford Central University Research Ethics Committee.	☐
5	Saya faham siapa yang mempunyai akses kepada data peribadi yang diberikan, bagaimana data ini disimpan dan apa yang akan terjadi kepada data ini di akhir projek.	☐
6	Saya faham bagaimana kajian ini akan ditulis dan diterbitkan.	☐
7	Saya faham bagaimana untuk menyatakan kebimbangan dan untuk membuat sebarang aduan.	☐

8	Saya berikan kebenaran untuk direkod secara audio.	☐
9	Saya faham bagaimana rakaman audio akan digunakan dalam hasil kajian.	☐
10	Saya bersetuju untuk menyertai kajian ini.	☐

_____	dd / mm / yyyy	_____
Name Peserta	Tarikh	Tandatangan
Aizuddin Mohamed Anuar	dd / mm / yyyy	_____
Name Penyelidik	Tarikh	Tandatangan

Consent Form (English Translation): Teachers

University of Oxford
Department of Education
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Young people's STEM education and aspirations for development: A comparative case study of Malaysia's rural heartland

PARTICIPANT CONSENT FORM

CUREC Approval Reference: [ED-CIA-19-190]

The aim of this research is to understand how rural young people in Malaysia form and describe development-related aspirations through STEM education, contrasted against the national development agenda. In the course of this research, the way in which the 'science for development agenda' is cascaded from policy into practice will first be traced, before exploring how young people describe development-related aspirations in relation to their STEM education, rural identity and socialisation with teachers and family members.

		Please initial each box
1	I confirm that I have read and understand the Participant Information Sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	☐
2	I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, and without any adverse consequences.	☐
3	I understand that research data collected during the study may be looked at by designated individuals from the University of Oxford where it is relevant to my taking part in this study. I give permission for these individuals to access my data.	☐
4	I understand that this project has been reviewed by, and received ethics clearance through, the University of Oxford Central University Research Ethics Committee.	☐
5	I understand who will have access to personal data provided, how the data will be stored and what will happen to the data at the end of the project.	☐
6	I understand how this research will be written up and published.	☐
7	I understand how to raise a concern or make a complaint.	☐
8	I consent to being audio recorded.	☐

9	I understand how audio recordings will be used in research outputs.	☐
10	I agree to take part in the study.	☐

_____	dd / mm / yyyy	_____
Name of Participant	Date	Signature
Aizuddin Mohamed Anuar	dd / mm / yyyy	_____
Name of Researcher	Date	Signature

I: List of Documents Collected and Included in the Analysis

No.	Title	Publication year	Type	Source
1.	Malaysia Education Blueprint 2013-2025 (Preschool to Post-Secondary education)	2013	Policy document	Public domain
2.	*Buku Penerangan Kurikulum Standard Sekolah Menengah* (Guidebook for the Secondary School Standard Curriculum)	2016	Manual	Public domain
3.	*Pelaksanaan Kurikulum Standard Sekolah Menengah (Menengah Atas) dan Pelaksanaan Pakej Mata Pelajaran Mulai Tahun 2020* (Implementation of the Secondary School Standard Curriculum (Upper Secondary) and Implementation of the Subject Packages Beginning 2020)	2019	Governement circular	Public domain
4.	*Kriteria Kemasukan Murid Tingkatan 4 Aliran Sains Mulai Tahun 2015 Berdasarkan Pentaksiran Berasaskan Sekolah Peringkat Menengah Rendah* (Criteria for Form 4 Entry into Science Stream Beginning 2015 Based on Lower Secondary School Based Assessment)	2015	Government circular	Public domain
5.	*Dasar Pembangunan Luar Bandar* (Rural Development Policy)	2019	Policy document	Public Domain
6.	*Ke Arah Pengukuhan Pendidikan STEM di Malaysia* (Towards Strengthening STEM Education in Malaysia)	No information	Brochure	Kuala Lumpur Science and Engineering Festival (KLSEF)
7.	*Inisiatif Pengukuhan Pendidikan STEM* (Initiative to Strengthen STEM education)	No information	Poster	Dr. Ihsan Ismail (one of the policymakers interviewed)
8.	STEM subject textbooks (Additional Mathematics, Physics, Chemistry, Technical Graphic Communication)	2016-2019	Textbook	Sekolah Luar Bandar
9.	Various media clippings related to STEM education, luar bandar and development (n=25)	2019-2020	Media articles	Public domain

No.	Title	Publication year	Type	Source
10.	Aspiration timeline and booklet	2020	Personal artefacts	Young people at Sekolah Luar Bandar

J: Reflexive Memo During Data Analysis (Excerpts)

3/12/2020

Laziness and lethargy as a code—need to rethink this, just because they sleep a lot for example, does that indicate laziness? Need to avoid perpetuating stereotypes--myth of the lazy native, read up.

Remember to think about how these interviews themselves are avenues of strengthening capacity to aspire. Example of these, how to code these?

Think about how to portray demographic information, and also PT3 results.

STEM education refers to what in the context of this study?

Think of development in the broadest sense, could what is seen as backward, underdeveloped (infra-wise) also be a facet of development?

27/1/2021

Today I'm back to coding student transcripts after so long. I have the list of codes (from the previous round of coding) and am mainly referring to them as I look through the 3 remaining transcripts (Chik, Mila, Petir). Will this bias my thinking? I also have the research question on standby, and have been generating new codes too.

Remind myself to comb through previous transcripts and see if new codes apply (this is an iterative process)

2/2/2021

Coded students' images and also photos of their booklets. Highlights:

One of H4lfiey's photos from the booklet says 'Welcome to Universal' (did he mean university?)---but this is interesting as a commentary on universal/particular--development as universalising (thru modernity). Sounds like a heading/subheading.

Petir shared a PUBG screenshot to represent his *kampung*. He was joking, but perhaps a metaphor for how the *kampung* is fast evolving, a commentary on place/lessness.

Various examples of encounters with animals & nature, friends that can be used to talk about centrality of place and web of relations in aspirations/lived experiences.

Remember to also (upload and) code photos of the students I took as well. STEM competition, classroom activities, etc.