The role of non-state providers in informal Science, Technology, Engineering and Mathematics (STEM) education: A Malaysian perspective

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Abstract

The role of non-state providers in the provision of education has been expanding globally. However, there is a dearth of literature on the role of non-state providers in informal education, especially when delivered alongside formal education in schools predominantly under government purview. Using a mixed methods design with surveys and interviews involving 32 non-state providers of informal STEM education in Malaysia, this study provides new empirical material to understand the role of non-state providers in informal STEM education. Non-state providers play a complementary role to the government's provision of formal STEM education through the informal variant, motivated by concerns of posterity and national development. At the same time, instances of political competition and bureaucratic barriers are at odds with the government's aspirations for partnership with non-state providers in order to raise students' interest in STEM.

Keywords

non-state providers, partnership, informal education, STEM, Malaysia

Introduction

The rising prominence of non-governmental organisations (NGOs) in the provision of alternative education since the 1980s in partnership with international aid agencies, as well as the growth of the for-profit private education sector since the 1990s have been enabled by the international neoliberal agenda of promoting the role of markets and limiting the role of the state (Carney, 2009; Rose, 2010). Therefore, the increasing presence of non-state providers in the education sector - traditionally seen as a public domain under the purview of governments - is normally tied to the discourses of development aid and marketization of education. Relative to the state, non-state providers have been similarly and widely identified as "business and civil society actors" (Koppenjan & Klijn, 2004), "private and voluntary sector" (Brinkerhoff & Brinkerhoff, 2011), "business and philanthropy actors" (Ball & Junemann, 2012), "commercial,

traditional, faith-based, or non-governmental organisations" (Batley & Rose, 2011), as well as "market and voluntary associational sectors" (Najam, 2000). In light of this, "government is understood to be located alongside business and civil society actors in a complex game of public policy formation, decision-making and implementation" (Koppenjan & Klijn, 2004, p. 25). As will be subsequently demonstrated, there exists extensive research on the involvement of non-state providers in private and public-private formal education, as well as non-formal education such as low-fee private schooling and private tutoring. Yet, we know very little on the role of non-state providers in the provision of informal education, especially coupled with formal education in schools predominantly administered by the government.

This study seeks to understand the role of non-state providers in administering informal Science, Technology, Engineering and Mathematics (STEM) education targeting Malaysian school students. The specific focus on STEM is motivated by Malaysia's recent adoption of this term to replace Science and Technology (S&T), as well as the country's contemporary emphasis on increasing students' interest in this domain through the use of informal education and partnership with the private sector. In the context of this study, informal education follows the definition of the International Standard Classification of Education (ISCED), which differs from non-formal education on one-hand and random learning on the other (UNESCO Institute of Statistics, 2011). Non-formal education refers to provisions of education that are meant to serve as alternative or add-on to the formal provision. These may include "education for out-of-school children, as well as programmes on life skills, work skills…training in a workplace" (UNESCO Institute of Statistics, 2011, p. 12). Informal education - the focus of this study - refers specifically to enrichment activities such as field trips, competitions, workshops, after-school activities outside of the remit of formal education; in contrast to non-formal education, informal education cannot be considered as alternative to former education (UNESCO Institute of Statistics, 2011). Our adoption of the term informal education is similar to Banarjee's (2017) use associated with "STEM enrichment and enhancement activities…designed and run by agencies other than schools to support classroom teaching" (p. 204).

Drawing on the findings emerging from an empirical study of various non-state providers of informal STEM education for Malaysian students, this article aims to deepen the understanding of the role of non-state providers in the provision of informal STEM education in three ways. First, the nature of the role of non-state providers in the provision of informal education depends on the alignment between the goals and means of these providers with that of the state via its governmental arm, the Ministry of Education (MOE). This role will be explicated in the context where the MOE is the dominant administrator of formal education. Secondly, insights into the motivation of non-state providers provide a greater appreciation of their roles in relation to the state when administering informal education. Finally, when the MOE frames the involvement of non-state providers in administering informal education as a form of partnership to fulfil a broader agenda, the latter's perception of the challenges inherent in the relationship is crucial to be surfaced. In doing so, the MOE's aspirational notion of

partnership can be contrasted against the reality on the ground from the perspective of non-state providers.

The article begins by providing an overview of the existing literature on the role of non-state providers in education internationally as well as on informal STEM education, to demonstrate the gap that this study intends to fill. Subsequently, we describe the Malaysian setting and informal STEM education context within which the empirical study is situated. The methodological approach is outlined next. This is followed by four thematic sections of the findings and associated discussions. These focus on the role of non-state providers, as well as their motivation and challenges in partnering with the MOE to realize the STEM education agenda. The paper concludes with suggestions for future areas of research to deepen the understanding of non-state providers' role in administering informal education as a complement to government-administered formal education.

Literature overview

Non-state providers in education

The role of non-state providers in education has been expanding globally. Literature often links this expansion with the so-called New Public Management (NPM) and the Global Education Industry (GEI). NPM refers to the "marketisation, or the application of business management theories and practices in public service administration" (Tolofari, 2005, p. 75). Indeed, Nikos (2001) and Tolofari (2005) observed that NPM reforms in the public sector administration including education have permeated many parts of the world, advancing the value of markets, economics and efficiency. Therefore, it is not surprising that the GEI has gained ascendance off the back of NPM; it is an overarching industry characterised by Verger et al. (2016) as an

> increasingly globalized economic sector in which a broad range of educational services and goods are produced, exchanged and consumed, often on a for-profit basis. The GEI is constituted by its own sets of processes, systems of rules, and social forces, which interact in the production, offer and demand of educational services and goods. (p. 4)

The GEI thus provides the context within which to situate the literature regarding the involvement of non-state providers in education. In this paper, we acknowledge the term "non-state providers" as is utilized by development-related actors in order to make the case for its pervasive influence on contemporary education management and administration discourse, which extends beyond the academic sphere. In a joint report published by the Asian Development Bank (ADB) and United Nations Children's Fund (UNICEF), non-state providers in education is defined as "a range of for-profit as well as non-profit actors engaged in the provisions and/or financing of education services, including entrepreneurs, faith-based and community-based organizations, NGOs and philanthropic associations" (LaRocque & Lee, 2011, p. 1). We consciously adopt this

definition in this paper and situate our contribution in relation to the associated discourses that follow.

Characteristic of the extensive literature in the domain of non-state providers of formal and non-formal education is the challenge of drawing distinct boundaries between various non-state providers, as well as between the state and the non-state sector in the provision of formal and non-formal education. To demonstrate this, Steer et al. (2015) highlight the various permutations of school types, ranging from non-state schools, to non-state funded, non-state contracted, non-state managed and market contracted schools, all of which are formed through the combination of diverse arrangements in ownership, contracting and financing. For example, studies conducted in this sphere include that of low-cost or low-fee private schools (Härmä & Rose, 2012; Heyneman & Stern, 2014). Adding to this complexity is the role of the non-state providers in the private tutoring sector as a form of non-formal education and its increasing legitimisation alongside formal education (Mori & Baker, 2010). The literature on non-state providers in education has so far focused on formal and non-formal modes of education. With the exception of Kaptzon & Yemini's (2018) recent case study of STEM programmes delivered by an NGO within Israeli public schools in competition with the state, there is a dearth of research into the nature of non-state providers' involvement in informal education. Therefore, our study intends to expand the scholarship at this intersection with the state as the dominant provider of formal education through the MOE, focusing specifically on the perspectives of various non-state providers of informal STEM education in the Malaysian context.

Informal STEM education

Informal STEM education cover activities such as field trips, science camps, hands-on workshops, fairs, competitions, work experience, and career talks (Horwarth & Scott, 2014). These informal learning activities—also known as STEM enrichment and enhancement activities—are often purposefully designed by private entities, charitable organisations and higher education institutions, aiming to spark interest in STEM subjects, make STEM accessible, as well as dispel myths and stereotypes associated with STEM education and careers (Banarjee, 2017). In the literature, a wide range of studies explores the use of science museums (Pedretti, 2002), field centres (Dillon et al., 2006), field trips (DeWitt & Storksdieck, 2008) and science competitions (Miller et al., 2017; Sahin et al., 2015) as modalities of informal learning in STEM. Collectively, these studies 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.

Despite these positives, two concerns relating to informal learning opportunities in STEM have been highlighted in the literature. First is related to the challenge of measuring the efficacy of informal STEM education provisions, tied to the diverse range of modalities (Bell, 2014) as well as ecological difference related to the "very nature of the brief, voluntary, and emergent learning experiences that are the hallmark of informal

environments" (Allen & Peterman, 2019, p. 19). In this regard, Morris et al. (2019) developed the "STEMwhere app" that students could use while engaging in informal STEM education, attempting to track goal setting, engagement, interest and identity. Meanwhile, Yao & Mohr-Schroeder (2019) suggest a conscious bridging of formal classroom learning and informal STEM approaches within the curriculum that would ensure alignment and complementarity.

The second concern is related to the question of who has access to informal learning opportunities in STEM. Studies in the U.K. and U.S. reveal patterns of inequality surrounding participation in such enrichment opportunities, which tend to favour more privileged, educated and higher-income families (Bell et al., 2009; Castell et al., 2014; DeWitt & Archer, 2017). However, a review by Hsu & Fang (2019) pointed to recent examples where STEM programmes in informal learning settings were consciously targeting students from underpresented backgrounds (low socioeconomic status) in the lead up to college and future careers in STEM. As informal STEM education opportunities expand in both reach and orientation, it is crucial to ensure concerns regarding evaluation as well as access and representation continue to be addressed.

Despite the breadth of topics covered within informal STEM education, all the studies surveyed above do not explicitly address the nature of interaction between the state and non-state actors in the delivery of such provision (beyond a mention of 'partnerships' where applicable). By offering new empirical material with Malaysia as the case study, we seek to address this gap in the literature.

The Malaysian STEM education context

Science and Technology (S&T) - recently supplanted by the nomenclature STEM - has been part of Malaysia's nation-building agenda following independence. The state's efforts have been anchored by the implementation of a target of 60% S&T stream enrolment against 40 per cent arts stream in secondary school (hereafter, 60:40 policy) since 1970 as part of the National Education Policy (Zainudin et al., 2015). The MOE began adopting the term STEM in reference to the 60:40 policy in the Malaysia Education Blueprint 2013-2025 (Preschool to Post Secondary Education) (hereafter, Education Blueprint). In recent years, as part of the Education Blueprint, the MOE explicitly highlighted their intention to adopt "an informal approach to strengthening interest in STEM education and careers by organising mobile Science fairs and centralised Science camps."(Ministry of Education Malaysia, 2013, p. 4-9). The involvement of non-state providers in education as part of Public-Private Partnerships (PPP) has also been identified as a target area under 'Shift 9: Partner with parents, community and private sector at scale' (Ministry of Education Malaysia, 2013). In relation to this target, the first author of this study participated in the PPP Strategy Lab organized by the MOE in 2016 to develop a strategic action plan for PPP in Malaysian education, covering aspects of product innovation, strategic alliance and outreach, governance and standard operating procedures as well as human capital (Ministry of Education Malaysia, 2017).

A review of literature on STEM education research in Malaysia pointed to a broad overview of out-of-school learning by Tuan Soh & Mohd Meerah (2013). Their overview of informal STEM education, as well as a more recent review by Wan Husin et al. (2017) mainly describe the government's own efforts, indicating the absence of scholarship on non-state providers' involvement, despite our observation of their increased visibility within this domain in both mainstream and social media in Malaysia. We therefore situate this empirical study in the context of the Malaysian MOE's overarching agenda of prioritising STEM education in a largely government administered public education system, as well as the MOE's appetite for partnerships with non-state providers to realize such agenda. Globally, the findings of this study build on the existing literature on PPP in education that heretofore mainly caters for formal and non-formal modes of education.

Research design, participants, data analytic framework, and assumptions

The findings reported in this article are part of a larger study that also sought to map the landscape and characteristics of informal STEM education in Malaysia. The study adopted a sequential, embedded mixed-methods design, combining an online survey and semi-structured interview. In the first part, the survey contained questions related to the background of the participating providers and the characteristics of informal STEM education, such as the mode of offerings, objectives, target audience and geographical coverage. The second part of the survey included questions on the providers' perception of their role and motivation to deliver informal STEM education, as well as incentives from the government to support them in this endeavour. At the end of the survey, participants were given the option to participate in interviews in order to provide more in-depth insights. The survey was thus followed by semi-structured interviews with some interested participants to lend more depth to the understanding of non-state providers' role and motivations.

Sample

We used a combination of purposive and snowball sampling to identify the online survey participants: representatives of Malaysian organisations that self-identify as a non-state provider, implement informal STEM education and target Malaysian school students as their audience. The following methods were used for identifying our sample: direct contact by email; the public Facebook group *Pendidikan STEM di Malaysia – Pendidikan Menerusi Penerokaan* (STEM Education in Malaysia – Education Through Exploration); various government organisations; and via the first author's own professional network in government, private and the non-profit sectors. The data collection lasted for 13 weeks (between March and June 2018) and resulted into 32 responses. The distribution of the 32 non-state providers that responded to the survey is shown in Table 1.

Table 1: Participants of the study, by type

Non-state providers by type [abbreviation used in the paper]	Number of participants
Private provider of STEM educational activities [PP]	16
Non-Government Organisation/Charity/Foundation [NGO]	11
Private employer (STEM educational activities not the core business activity) [PE]	2
Private STEM Discovery Centre/Museum [PSDC]	1
Private university [PU]	1
Professional/Discipline-related Association [PDA]	1
TOTAL	32

Although 21 out of the 32 participants expressed interest to be interviewed to provide more in-depth insights beyond the survey, only six interviews were conducted due to time constraints and scheduling conflicts within the data collection period. Four semi-structured interviews were conducted online via Skype. The interview questions delved deeper into the role, motivation and incentives for delivering informal STEM education and supporting the government's agenda of raising students' interest in STEM. Interviews lasted from 60 minutes to 90 minutes. The option of a more structured, asynchronous email interview utilising the same sequence of questions in semi-structured interview was offered to respondents to circumvent scheduling conflicts. Two asynchronous email interview responses were also recorded through this option, yielding a total of six interviews by the end of data collection period.

To ensure confidentiality of each non-state provider, where quoted in this paper, they are denoted by the type of organisation. For example, NGO-1 and NGO-2 refer to two non-state providers that are both NGOs, where the numbers differentiate the two providers. The full list of abbreviations for this purpose and the distribution of the 32 surveyed providers by type are included in Table 1. More contextual details on each participant are included in the Appendix, alongside samples of relevant survey items and interview questions.

Data analytic approach and assumptions

The data analytic approach centred around Najam's (2000) conceptual framework of 4Cs that maps the relationship between Non-Government Organisations (NGO) and the government with four potential outcomes:

1. Cooperation: seeking similar ends with similar means
2. Confrontation: seeking dissimilar ends with dissimilar means
3. Complementarity: seeking similar ends but preferring dissimilar means
4. Co-optation: preferring similar means but for dissimilar ends (p. 383)

The adoption of this framework is driven by its fit with the dimensions of interest in this study. The nature of the relationship between non-state providers and the state can be understood through the congruence or divergence between the ends (the government's goal of raising interest in STEM as previously discussed) and means (administration of informal STEM education by non-state providers, the focus of this study). Two assumptions warrant elaboration in relation to the adoption of this framework in our study. Najam (2000) developed this framework specifically as a typology of relationships between the government and NGOs - describing the latter as "a synonym for that broad spectrum of organizations that is variously referred to as the nonprofit, voluntary, independent, charitable, people's, philanthropic, associational, or third sector" (p. 376). First, we assume that in our analysis, this typology can be expanded beyond NGOs as a generic framework applicable for other non-state providers such as for-profit corporations and private providers of informal education. Particularly in the context of Malaysia, as we will demonstrate, all actors outside the government domain are subjected to the same regulations and procedures for involvement in education by the MOE as the gatekeeper for the state's centrally administered, hierarchical education system. Secondly, we acknowledge the nuance in the definition and use of terminologies "state" and "government". The relationship between the two is captured as part of the Montevideo Convention on the Rights and Duties of States, wherein government is a component of the state, alongside "a permanent population, a defined territory…and capacity to enter into relations with the other states" (Robinson, 2013, p. 559). As such, we adopt and operationalize this framework recognising the government as a *subset of,* and an *actor for* the state that is placed on the same analytical plane as the corresponding actors known as non-state providers analysed in this study. This follows our earlier depiction of the MOE (an arm of the government) acting on behalf of the state in administering Malaysia's education system for the majority of the population and furthering the agenda of raising students' interest in STEM.

In addition to the role of non-state providers, the study also examines their motivation for partnering with the state in instances when they choose to do so. We follow the schema proposed by Alford & O'Flynn (2012) for understanding motivation, which encompasses material self-interest, intrinsic motivation, sociality and purposive values. In the context of this study, material self-interest is tied to non-state providers being motivated by rewards from the state, or attempts to avoid penalties for any non-conformance. Intrinsic motivation can be seen as valuing the delivery of informal STEM education provisions for its own sake, while sociality refers to non-state providers' need or pressure to maintain favourable perception among counterparts by partaking in the delivery of such provision. Lastly, purposive values is tied to the belief that delivery of informal STEM education will fulfil broader goals for collective benefit beyond self-benefit or legitimisation. This schema is chosen particularly because it concerns the relationship between the state and external providers in a manner where the former can influence the latter's behaviour by acting as a motivator (Alford & O'Flynn, 2012). As such, we also consider the incentives offered by the government that may bear on the motivation of the non-state providers.

Data gathered in this study were subjected to a combination of inductive and deductive coding and subsequent thematic analysis (Braun & Clarke, 2006; Kuckartz, 2014), guided by a coding scheme based on the 4Cs framework and the schema for motivation. Close reading and systematic analysis of the data took place, paying particular attention to the ways non-state providers described the associated roles and motivations for administering informal STEM education in order to generate the relevant themes that depict their relationship with the government (as a proxy for the state). Given the specificity of the context and subject matter, we do not intend to generalize the findings of this study to all non-state providers in education. Instead, the findings point to the initial development of knowledge on the role of non-state providers in administering informal education, positioned as complementing formal education largely administered for the state by the MOE.

Findings and discussion

Complementarity and cooperation with the MOE to realize shared agenda

The majority of the non-state providers in this study can be described as fulfilling a complementary role to the MOE in raising STEM interest among Malaysian students. Though they share similar goals with the MOE, these non-state providers highlight their approach of informal education as distinct from the formal education offered in schools. One private employer (PE-1) providing laboratory testing services highlight how they "bring real-science to the classroom as part of democratising science. A different pedagogical approach [compared] to teaching and learning in our educational system." Meanwhile, another private employer in the engineering industry depicts the hands-on nature of their offering during a STEM fair, which satisfies a particular demand among students that remain unfulfilled by the MOE:

> [We] opened a booth, the activities revolve around…how to make a straw and two strips of paper fly…Most of the kids flock to our booth. Why? These kids, they hunger for tactile feedback, they want to be able to manage something, handle something, and then see it work. (PE-2)

The above observation is consistent with Ng's (2016) finding on the lack of science experiments in Malaysian schools due to preoccupation with examinations, inadequate laboratory infrastructure as well as the lack of professional support in schools. Non-state providers' predominantly complementary role in raising STEM interest among Malaysian students represents a parallel with the complementary nature of informal learning in STEM education. In this regard, Bell et al. (2009) argue that "the goals of schools and informal, non-school settings are both overlapping and complementary" (p. 295), whereby informal learning supports the development of motivation, interest and learner identity in STEM through interaction with natural and designed environments. Therefore, the role of non-state providers in this study not only reflects an alignment of the non-state providers' organisational goals with that of the state (to raise students' interest in STEM), but also an alignment between the spirit of the strategy employed (informal education

complementing formal education) and the characteristic of the role itself (non-state providers complementing the government's efforts).

Meanwhile, two providers describe instances where they cooperate and collaborate with the MOE on joint-efforts to address the declining STEM interest among Malaysian students. Interestingly, an NGO that implements a number of joint programmes with the MOE highlights the necessity to maintain a subdued stance so as not to jeopardize the collaboration. When asked on the extent of influence they have in partnerships with the MOE, NGO-1 prefers "the word 'to recommend' or 'to collaborate' in implementing programmes…we are not in the position to actually roll out new programmes for the schools. We want to be sure that we are working closely with MOE'.

This response hints at a power imbalance between both parties in a collaboration, where one is careful not to offend the other, reflected by NGO-1's careful choice of words. Coston (1998) would not consider this to be a form of collaboration due to the absence of power symmetry, though Najam (2000) does not consider power symmetry a prerequisite - only that there be no overt threat - for cooperation or collaboration to take place, hence using both terms interchangeably. Nevertheless, NGO-1's apprehension in describing the relationship with the MOE highlights the potential of political competition, whereby the government may perceive the NGO to be a threat to their power and legitimacy in delivering public service on behalf of the state (Coston, 1998). Indeed, the potential of political competition is further reflected in the MOE's overt gatekeeping role in regulating partnership with non-state providers, which we will subsequently revisit.

Brokerage: A dynamic role in two respects

In the course of data collection, a number of non-state providers surveyed and interviewed point to one specific non-state provider (NGO-1) as a source of insights and access to other potential respondents. The dynamic role of NGO-1 stems from its two features. First, it is an organisation populated by members with connections to both the state and non-state sectors, thereby blurring its identity as a monolithic non-state provider (Mcloughlin, 2011). Yet, this very blurred identity makes it an effective organisation to serve as a broker between the two sides. Williams (2002) refers to this as "boundary spanners", i.e. entities or individuals with the capability to manage networks, mobilize resources and build relationships with multiple actors inside a policy environment. PE-2 attests to NGO-1's capabilities: "mind you, NGO-1 is running without any budget, it's purely voluntary. The fact that they are able to do what they are able to do, I respect that, that's why I'm on board."

The second feature of NGO-1 is that it is able to facilitate other collaborating non-state providers to shift between cooperative and complementary roles depending on whether they administer their informal education programmes together with, or separately from the MOE. Partnering with NGO-1 has allowed some providers to benefit from its network:

> Starting from last year, we have been actively involved with NGO-1 to reach an even bigger audience. (NGO-2)

> Their main objective is creating more awareness on STEM. NGO-1 doesn't run any programmes per se, but [they've] got partners like myself and other people, each of them brings something different. (PP-1)

The brokerage role played by NGO-1 echoes Najam's (2000) claim that government and NGOs "complement each other in the achievement of a shared end, even through dissimilar means. Where the preferred means are also similar, complementarity will blossom into cooperation" (p. 387). In other words, non-state providers' role in relation to the government is not necessarily static. Instead, the nature of their role may shift depending on the means they choose, in this case whether they decide to piggyback on NGO-1's brokering capabilities or choose to deliver their informal STEM education separately.

Purposive value as the primary motivation

Non-state providers in this study orient themselves around two main purposes compelling them to play a role in raising STEM interest among Malaysian students. The first is related to encouraging students to pursue STEM in order to meet the target of the 60:40 policy, fulfil the manpower requirements of the industry, and hence realize the national agenda. Consider the following observations by an NGO and a private university respectively:

> People from the academia and industry…are very concerned about the declining interest and participation of the youngsters in STEM related disciplines. Our motivation is to see more students entering the science stream and pursuing STEM related courses. (NGO-1)

> Malaysia with the vision to be a high-income economy by 2020 must have a high proportion of the workforce well trained in STEM channelled into the industry if it aims to achieve the vision. (PU-1)

The second theme is related to the urgency of equipping children with the necessary skills for the future. Non-state providers in this study emphasized the need to cultivate problem solving skills and scientific thinking, resilience, leadership, as well as a growth mindset among Malaysian students through informal STEM education. One private provider of STEM informal education observed:

> Children are so scared of failure. But we think that actually life is not always [a] success. So through this activity we can teach our kids that…we have to keep trying and trying…We also encourage kids to be rigorous, even if they fail they will have a growth mindset…This is very important in science and maths, and when they go to adulthood: how they survive in the society. (PP-2)

Both of these themes suggest that Malaysian non-state providers of informal STEM education are driven by concerns tied to posterity and national development that echo the state's own concern of waning STEM interest among students. Alford & O'Flynn (2012) observe that "one reason that providers might 'buy-in' to the mission of a government agency is that the actual mission is consistent with their purposive value" (p. 73). Interestingly, the narrative of national development and survival as motivation for non-state providers' partnership with the MOE can be situated within the nascent discourse of neoliberalism and STEM education. Carter (2016) argues that "within a neoliberal sensibility, what counts as scientific research becomes a consequence of national economic interests, linking the demand for skilled scientific workers to global competitiveness" (p. 34). As such, neoliberal influence is doubly imbricated in the context of this study, which we highlight in dialogue with the existing literature tied to globalisation in education discussed herein (Carney, 2009; Verger et al., 2016). The advent of NPM in education encourages non-state providers to support MOE's efforts through complementary informal education. At the same time, the MOE's priority of addressing the declining interest in STEM among students - shared by many non-state providers - finds its logic in neoliberal discourses of nation-states' global survival and competitiveness.

The reality of partnership: "the red-tape is so great"

In the survey, non-state providers were asked to identify the support and/or incentives they have received from the government in the course of administering their informal STEM education. The proportions of providers receiving the various forms of incentives from the government are reflected in Figure 1, which indicate that endorsement/advocacy (for example, through media, publications and attendance at events) appear to be the main incentive enjoyed by 47% of non-state providers. One organisation described the form of endorsement they received as follows:

> The government, especially the Ministry of Education and Ministry of Science, Technology and Innovation have very much supported our programme; they said yes please, let's do this together. So that kind of endorsement. They would then invite, through their network, teachers, parents. The patronage, support, non-financial is what we've been getting from these two ministries. (NGO-1)

Interestingly, 34% of the surveyed providers declared that they receive no support from the government. As part of the interview, we probed for reasons why some providers did not receive any support from the government. The hassle involved in applying for government support and potential compromises prove to be discouraging for non-state providers:

> It was an opportunity cost to me. How long would it take, how much effort would I have to spend to knock on doors and put in proposals and have meetings to be able to get a grant. I might have a certain objective or approach which might not sit with [that] of the government…might have to turn and bend and change things…so from

> that perspective I quite quickly decided I'm not going to [seek government support]. (PP-1)

This finding is consistent with the theory that some non-state providers might be hesitant to seek government support due to concerns of losing their autonomy, becoming dependent on the state, and compelled to act as its agent (Batley, 2011). Additionally, grouses over the laborious process in dealing with the MOE, tight regulations and excessive bureaucracy cropped up repeatedly in the surveys and interviews. Non-state providers highlighted redundancies in liaising across multiple agencies and different levels of MOE, the cumbersome approval process for permits, the lack of autonomy as well as barriers to engage with schools. NGO-1 describes the frustrating ordeal:

> STEM content providers want to conduct a programme in school, firstly they have to get the approval from the school, they cannot enter into a school and offer a programme, even if it's a wonderful programme, the school principal asks 'Have you got *surat kebenaran daripada Jabatan*? (approval letter from the Regional Department of Education)' If you don't have, you are not allowed...So what happens to this vendor? He has to go to the *Jabatan* (Regional Department of Education). And *Jabatan* isn't going to give that letter either, they say you have to go to the Ministry, and the red-tape is so great.

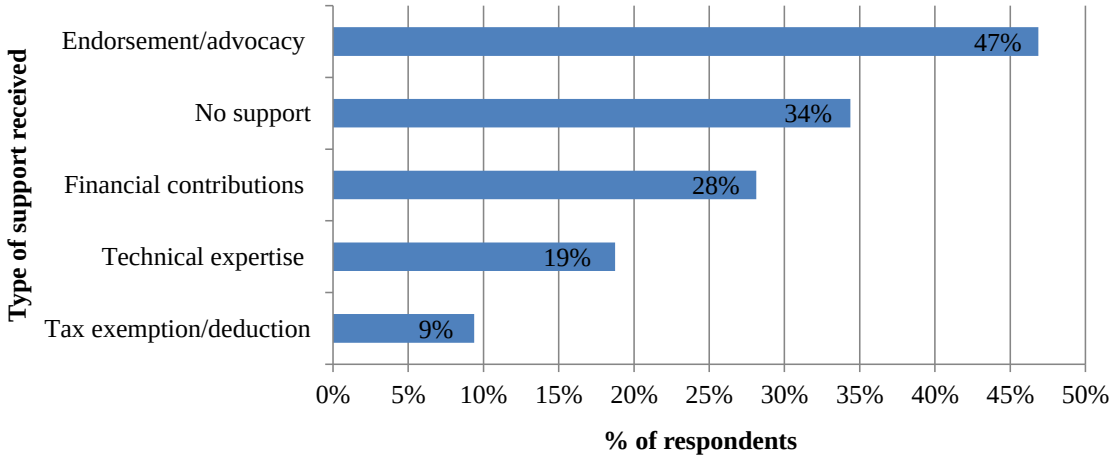

Figure 1: Government incentives for non-state providers
Note: Respondents could select multiple options.

Although the MOE advocates for partnership at the policy level, evidenced in the Education Blueprint discussed earlier, the reality seems to reflect a tension between MOE's policy aspirations and actual implementation of partnership mechanisms with non-state providers on the ground. In a study of government-funded education partnership with the non-state sector, Woods et al. (2013) highlight "a recurring theme in participant reports of factors working against effective partnership…was the part played in collaborative endeavours by imbalances, real or perceived, in power and territory" (p.

762). A similar observation is present here, evidenced above as well as through NGO-1's earlier trepidation of framing the nature of their collaboration with the MOE, thereby reflecting Coston's (1998) idea of the political competition that determines the tone and extent of partnership with non-state providers. This tension is even more salient in the context of informal education, which exists in parallel with formal education administered by the MOE in a complementary fashion, and as such partnership - and encountering the associated barriers and power dynamics - become inevitable. Contrast this with the involvement of non-state providers in non-formal education, such as low-fee private schools, which in some developing contexts escape the purview of, and may be implemented unmonitored by, the government (Steer et al., 2015).

Issues regarding excessive hierarchy and bureaucracy in the Malaysian government have been highlighted in the business realm and subsequently improved (Siddiquee & Mohamed, 2007), though perhaps this has yet to trickle into the education sector. The literature on PPP point to the government's role in providing facilitating measures and convenience strategies that minimize barriers to entry, simplify the regulatory hierarchy and allow partners to exhibit autonomy, thereby improving their motivation (Alford & O'Flynn, 2012; OECD, 2012). For the non-state providers surveyed and interviewed in this study, contact with the government, particularly the MOE, is inevitable. Many non-state providers expressed the need for a platform to facilitate greater dialogue, collaboration and engagement with each other and with the MOE and government more broadly. Some providers highlight the need for greater stakeholder voice in policy formulation and stronger ties with industry, while others expect the MOE to continuously inform them of the latest national agenda. The MOE's take-up of non-state providers' aforementioned suggestions will depend on the delicate balance of innovative partnership and the state's insistence of maintaining its traditional monopoly on public education and all the activities - both formal and informal - within it.

Discussion and Conclusion

By collectively interpreting the roles and motivations of non-state providers in relation to the MOE, this study revealed two layers of neoliberal influence: the MOE's propensity for partnership with non-state providers along the lines of Public-Private Partnership (PPP), and a shared agenda of national development through STEM, couched in economic and market discourses tied to global competitiveness. This shared agenda is reflected by the alignment of goals between the state and the non-state providers: to address the declining interest in STEM among Malaysian students. Nevertheless, the majority of non-state providers adopted different means which they argued were distinct from the MOE's approach to formal STEM education, hence pointing to their complementary role to provide elements deemed lacking in the formal STEM education. An important insight is that informal STEM education cannot be delivered without contact with the state, given the nature of the latter as gatekeeper (literally and figuratively) for schools and the nature of informal STEM education as enrichment to state-administered formal education. Thus non-state providers have little choice than to continue engaging with the state through the MOE if they are keen to contribute to the shared agenda. In instances where non-state providers describe themselves as cooperating

with the MOE, it was necessary to understate their role so as to avoid the perception of political competition with the government in the delivery of education as a public service. Non-state providers in this study point to the excessive bureaucracy (what one provider termed as "bureaucrazy") as a major barrier to better partnerships between the sectors in delivering informal STEM education. Thus the ambivalence reflected by MOE's aspiration for partnership based on a mutual goal compared to its facilitating manoeuvres (or lack thereof) point to the primacy of power and political competition in influencing the nature of partnerships. Despite the aforementioned layers of neoliberal influence, could MOE's ambivalence as reflected by the frustrations of non-state providers point to the last vestiges of the former "protecting" Malaysia's public education system from the creeping influence of the latter? Time will tell.

One unique finding is related to the role of one non-state provider that serves as a broker between the MOE and other non-state providers, allowing the latter to shift roles between complementing and cooperating with the former. The emergence of this dynamic role portends the changing landscape and dissolution of boundaries in Malaysia's public education, which is no longer purely the remit of the state. In fact, brokerage is afforded precisely due to the provider's hybrid composition that blurs state/non-state dichotomies, echoing contemporary practices elsewhere described by Ball & Junemann (2012). This broker perhaps serves as the most strategic actor for the benefit of both the state and non-state providers. For the state, the broker's allegiance may provide a lever to secure more instances of partnership on its own terms. Meanwhile, by allying themselves with the broker, non-state providers are able to circumvent bureaucratic barriers, leveraging the established trust between the broker and the state to deliver their provision of informal education. Perhaps linking with such brokers is the best path forward for non-state providers intending to operate in education contexts demonstrated by the Malaysian case.

The exploratory findings from this study related to the power-laden tensions of complementarity, cooperation and brokerage open up the space for more nuanced theorisations of the role of non-state actors in the provision of informal education. A larger survey of various types of non-state providers implementing informal education across countries with varying degrees of maturity in PPP environments can provide useful comparative insights into the typology of their roles in relation to the state. It is possible that a one-sided view from non-state providers as discussed here may reflect a misunderstanding of the government's concerns and associated bureaucratic manoeuvres. Thus, further research and pathways for dialogue are needed to elucidate perspectives of the government as the voice of the state, in addition to the point of view of the intended beneficiaries of informal education. An approach that incorporates the views and concerns of all stakeholders is crucial to facilitate continuous discussion and engagement for mutual understanding, stronger partnerships and impactful outcomes. Such breadth in point of views will render a more holistic account of state/non-state relationships in informal education provision, thus expanding scholarship and improving practice in this growing area.

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Appendix: Contextual information of study participants

No.	Participant code	Mode of main informal provision	Content focus area	Geographical coverage in Malaysia
1.	PP-1*	After school club	Eng	Central P
2.	PP-2*	Hands-on workshop	BSc, Bio, Chem, Phy, ICT, Eng, Math	Central P
3.	PP-3*	Hands-on workshop	BSc, Bio, Chem, Phy, Eng	Central P
4.	PP-4	After school club	ICT, Eng	North P, Central P, South P, East M
5.	PP-5	Hands-on workshop	BSc, ICT, Eng, Math	Central P, East M
6.	PP-6	Hands-on workshop	Eng, Oth: Sustainability	Central P
7.	PP-7	Hands-on workshop	BSc, ICT, Eng	East M
8.	PP-8	Hands-on workshop	Eng	Central P
9.	PP-9	Competition	BSc, Chem, Phy, ICT, Eng, Math	North P, East P, Central P, South P, East M
10.	PP-10	After school club	ICT, Eng	North P, Central P
11.	PP-11	Hands-on workshop	BSc, Bio, Chem, Phy	Central P
12.	PP-12	Competition	BSc, ICT, Math	North P, East P, Central P, South P, East M
13.	PP-13	Mix of all	BSc, Bio, Chem, Phy, Math	North P, East P, Central P, South P
14.	PP-14	Hands-on workshop	BSc, Bio, Chem, Phy, Eng, Math	Central P
15.	PP-15	Hands-on workshop	BSc, Bio, Chem, Phy, Math	North P, East P, Central P, South P, East M
16.	PP-16	Online talk	BSc, Bio, Chem, Phy	North P, East P, Central P, South P, East M
17.	NGO-1*	Exhibition/fair/carnival	BSc, ICT, Eng, Math	Central P
18.	NGO-2*	Competition	Oth: Earth Sc	North P, East P, Central P, South P, East M
19.	NGO-3	Hands-on workshop	ICT, Eng, Oth: Arts & Upcycling	North P, Central P, East M
20.	NGO-4	Career talk	ICT	North P
21.	NGO-5	Competition	BSc, Bio, Chem, Phy	North P, East P, Central P, South P, East M
22.	NGO-6	Competition	Oth: Innovation	North P, East P, Central P, South P, East M
23.	NGO-7	Exhibition/fair/carnival	BSc, Bio, Chem, Phy, ICT, Eng, Math	North P, East P, Central P, South P, East M
24.	NGO-8	Hands-on workshop	ICT, Eng	East M
25.	NGO-9	Hands-on workshop	BSc, Bio, Chem, Phy, ICT, Eng, Math	North P
26.	NGO-10	Hands-on workshop	Oth: 3D Printing	South P

27.	NGO-11	Mentoring	BSc, ICT, Eng, Math	North P, East P
28.	PE-1	Hands-on workshop	BSc, Bio, Chem	Central P
29.	PE-2*	Career talk	Eng	Central P
30.	PSDC-1	Exhibition/fair/carnival	BSc, Chem, Phy, Eng, Math	North P, East P, Central P, South P, East M
31.	PU-1	Exhibition/fair/carnival	BSc, Bio, Chem, Phy, ICT, Eng, Math	North P, East P, Central P, South P, East M
32.	PDA-1	Exhibition/fair/carnival	BSc, Bio, Chem	North P, Central P, South P, East M

Legend:

*: Participants that were involved in the interview after the survey

PP: Private provider of STEM educational activities
NGO: Non-Government Organisation/Charity/Foundation
PE: Private employer (STEM educational activities not the core business activity)
PSDC: Private STEM Discovery Centre/Museum
PU: Private university
PDA: Professional/Discipline-related Association

BSc: Basic Science
Bio: Biology
Chem: Chemistry
Phy: Physics
ICT: Computer Science/Information & Communication Technology
Eng: Engineering/Robotics
Math: Mathematics
Oth: Other

North P: North Peninsular Malaysia (Perlis, Kedah, Penang, Perak)
East P: East Peninsular Malaysia (Kelantan, Terengganu, Pahang)
Central P: Central Peninsular Malaysia (Selangor, WP Kuala Lumpur, WP Putrajaya)
South P: Southern Peninsular Malaysia (Negeri Sembilan, Melaka, Johor)
East M: East Malaysia (Sabah, Sarawak, WP Labuan)