How can we think geographically?
An investigation into designing reasoning tasks to promote geographical thinking at Key Stage 3

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A Research & Development Project

Submitted for the MSc Learning & Teaching 2020

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This dissertation is dedicated to my supervisor who has provided unending inspiration and support from the start of my PGCE course and onwards through my career.

Abstract

Thinking geographically; "to have a trained capacity to construct a mental map and see patterns, to recognise relationships, to see movement, to take that map and clothe it in meaning" is a key term in the Geography Education Community (Morgan, 2013, p.275). However, my Part 2 research established that despite being familiar with term, what *thinking geographically* consists of, or looks like in the classroom is not clear for many teachers. Where this ambiguity exists, it is much harder for teachers to target its development. Therefore, this research aims to clarify what underpins *thinking geographically*, from a knowledge and learning perspective, but also – and perhaps most importantly – attempts to consider practical methods to support its development in a Key Stage Three classroom. The research began by examining what skills underpin *thinking geographically*. Through the course of the literature review, these skills appeared very similar to skills identified as 'reasoning': cause and effect reasoning, argumentation, gist reasoning, for example. Therefore, *thinking geographically* could be understood as discipline-specific utilization of reasoning skills: when students are *thinking geographically*, they are synchronously employing a variety of reasoning skills to make sense of geographical processes and systems. With this understanding, the research considered practical solutions to support the development of *thinking geographically* by targeting reasoning skills in a variety of tasks. Three different tasks are designed; two original and one inspired by the Thinking Through Geography 'mystery' task (Leat, 1997) and their nature and efficacy evaluated.

Introduction

Thinking geographically is the foundational core of geography education. The process; to take geographical content and 'clothe it with meaning', contextualise it and identify patterns and relationships, is what transforms thinking *about* geographical information to *thinking geographically* (Morgan, 2013, p.275). It shifts a student in a geography classroom to a geographer, an agentic and reflective citizen who understands human occupancy and interactions with the earth, and can situate themselves within these interactions (Lambert, 2011). However, whilst *thinking geographically* is a term widely used within the Geographical Education community, features frequently in the Geographical Association's (GA) projects (GeoCapabilites, 2016 for example), is addressed in most Geography ITT schemes (my own at Oxford University Department of Education, for example), many teachers and students struggle to articulate what *thinking geographically* actually means. My personal interest in thinking geographically, and how its epistemological foundation could be practically applied was first ignited as a PGCE student, where I had the opportunity to collaborate with my PGCE tutor and other geography interns, to investigate how inferentialism may support pre-service teachers' planning and instructional design. As we evaluated and wrote up our findings, I found myself grappling to find practical solutions to support thinking geographically. When discussing with other geography teachers, they shared my confusion about the core elements of thinking geographically; its descriptions were clothed in ambiguity with very few and equally vague suggestions to specifically target it in classrooms.

My MLT Part 2 research began to unpick teachers' perceptions of the term, and found both teachers and students can often explain what it feels or looks like in the classroom, or give examples when they felt they were *thinking geographically*, but cannot necessarily externalise or break down the elements that support and make up this process. Therefore, a natural progression of my Part 2 research was to consider what tasks could be designed to support *thinking geographically* and thus forms the basis of the Part 3 project.

In September I moved schools and was charged with developing a new Key Stage Three (KS3) course. At the beginning of the new academic year, with the considerable school, house and county change I was worried that this year may not have been the right time to pursue my Part 3 project and considered postponing. However, as I began teaching, the importance of pursuing the design and evaluation of tasks to support *thinking geographically* emerged fully, and thus the research and design was inspired by a number of specific characteristics of my school's KS3 course.

The academic context of this new school was not dissimilar to my previous; both are selective and independent; however, this new school was all-boys with the school starting at Year 9. Therefore, geography had one year of compulsory teaching before it was picked or dropped for GCSE.

The first key characteristic is that we had students with a huge variety of geography experiences. In theory, students had had two years of KS3 teaching so far, in a variety of schools. About a third had followed the Common Entrance (CE) geography curriculum (an extremely prescriptive course; it is essentially a slimmed down version of the GCSE, with most major topics covered to some degree), a third had come from international schools where some had studied geography, but a great deal had not, and the last third came from a variety of prep, lower or secondary schools, who had loosely followed the national curriculum. This meant that the nature of the students' geographical education was extremely varied; a boy who had studied the CE, and could label and name all the capital cities of Europe was sat on a table with one boy who had never explicitly studied geography, but had had first-hand experience of a natural disaster, and another who had studied a national curriculum inspired course and most recently looked at 'Amazing places'. Therefore, this year was about standardising the approach and skills in geography. The department needed a course that would act as a 'levelling' agent; so that all students could succeed at GCSE, regardless of their prior experiences. Furthermore, content and examples needed to be

picked that very few – or ideally none- had previously studied, so it was interesting and new to all. Finally, with regards to the variety of students' experience we needed to make sure that all students could access the curriculum, yet there was still enough challenge and integrity to the course. This applied at a macro (the whole scheme of work) but also micro (the individual tasks) level.

The key second characteristic was that our KS3 course is effectively one year long; this is our only year to teach and develop *thinking geographically* before students could opt out or would be guided more by prescriptive curricula from exam boards; where content and exam technique may take priority. We don't have the luxury of embedding strong geographical principles and *thinking geographically* skills over the course of three years, therefore this year needs to be as efficient and effective as possible; tasks need to work for all teachers and students!

These two factors: the need to provide a level playing field, and to maximise the efficiency of the course solidified the need to investigate ways to promote *thinking geographically*. Therefore, the Part 3 assignment was a natural progression of my initial investigation, and in this new school setting, even more reason and impetuous to explore *thinking geographically* and the skills that underpin it. This project, therefore, aimed to explore and evaluate possible tasks designed to support *thinking geographically.*

As the term developed and I began to research the concept of *thinking geographically* to build my understanding in preparation for the classroom research, I realised more attention was needed on the cognitive processes that underpinned *thinking geographically.* This process implicitly emerged as *reasoning*, which itself has a variety of characteristics and applications. Therefore, to fully identify what it meant to be *thinking geographically*, and design tasks to support its development, reasoning processes and their connection to *thinking geographically* needed attention. This project then evolved from simply designing tasks that facilitated *thinking*

geographically, to considering the relationship between reasoning and *thinking geographically* and thereby attempting to design tasks that developed reasoning skills which then developed *thinking geographically* for students in KS3. To that end, the final research was focused around three key questions:

1. What is reasoning? How does it relate to *thinking geographically?*
2. What do teachers understand by *thinking geographically?*
3. What tasks can support and develop reasoning in the classroom?

The Impact of Covid-19

On 20th March 2020, our school closed in line with Government guidance on controlling the spread of Covid-19. This had serious implications for my study. Firstly, by the time school had closed, I had not yet been granted ethical approval for my research. This meant that I did not yet complete any part of the planned research project.

By April, and the time my CUREC submission was approved, it became apparent that we were unlikely to return to school in any recognisable capacity for the rest of the academic year. This was especially so in my individual case, as I work in a boarding school, where it would prove much harder to have students in classrooms as we were before. Although we taught throughout the summer term on Zoom; transitioning our usual timetable and teaching into a virtual version, school did not look and feel the same. Given these significant changes to my day-to-day teaching, and that my colleagues and students were experiencing very exceptional and difficult circumstances, I did not feel that it would be appropriate to try to continue with the research. Following discussion with my supervisor, the nature of this research project changed considerably. Instead of actively doing action research, I have followed the research sequence (as closely as possible) entirely hypothetically. Below is a table which highlights the key differences.

Table 1: Updated Covid-19 action

Summary of Intended Course of Action	**New Action**
The issue of 'what is *thinking geographically?'* and 'what does *thinking geographically* look like in the classroom?' is identified through the process of Part 2 of the MLT. These questions are supported by those emerging from the literature (mainly: 'how is *thinking geographically* related to reasoning?') to form the basis of the research questions.	This stage occurred before lockdown, and so is complete.
Meet with my departmental colleagues who teach Year 9 in a small focus group to understand what is meant by *geographical reasoning* and *thinking geographically.*	I have been unable to collaborate with my colleagues. Therefore, I have considered what each focus group meeting would address, evaluate the planning and nature of them and

Summary of Intended Course of Action	New Action
	consider what value they would have brought to my research.
Complete an online, anonymous questionnaire with the Year 9 students to establish what *they* understood by *geographical reasoning* and *thinking geographically.*	This stage has not taken place.
Meet again with my colleagues that taught Year 9 to plan three tasks, to further discuss the teachers' and students' perceptions of *geographical reasoning* and *thinking geographically.*	My colleagues have not designed a task each. Instead, I have designed 3 different tasks.
Each teacher would teach each lesson with the specially designed original tasks to their respective groups. We would take photos of the work completed by students.	I have been unable to teach these tasks. Instead I explain the planning process of the tasks, linking them to the literature and exploring what reasoning skills should be developed. I shall – as objectively as possible – attempt to appraise each of the three tasks.
The Year 9 teachers return as a small focus group to review and reflect on the tasks' functionality and efficacy with the different groups.	This stage is principally addressed in the stage above; but I shall also attempt to consider other factors that may have impacted the efficacy of the tasks.

These changes meant that whilst most of my methods had already been chosen and designed, because they were not implemented, possible issues or weaknesses of their use did not emerge, nor could the methods evolve to better suit the research. For example; I had planned to take photographs of students' work to identify frequency of words that may indicate reasoning. However, I had envisioned an abductive approach to this; whilst I was anticipating using specific words as a reference, I was also prepared to see other emerging trends that may then impact my conclusions. Similarly, whilst I had planned a framework of questions for my focus group, I had also anticipated other ideas emerging, which could be followed up. Therefore, when I answer the questions myself, the answers are invariably limited, as they reflect only my ideas and my experience.

The following discussion, therefore, is entirely hypothetical and limited; I aim to reflect on my own ideas and tasks as objectively as possible and appraise their possible efficacy in light of the literature and my own knowledge. Similarly, my answers to the research questions are not grounded in any evidence and are my own ideas.

Literature Review

Thinking Geographically

The nature, role and value of school geography has long been argued amongst politicians, academics and teachers and at times has been in danger of being disassociated from the academic discipline (Lambert, 2011). However, Lambert (*ibid)* argues that "all children and young people deserve the best geographical education therefore, since it contributes significantly to their knowledge and understanding of their place in the world. It teaches us about human relationships across the globe, and the interactions of people with the physical environment" (p.249). How can we provide children with an integrated and deep understanding of geographical systems and processes? We need to answer these questions to continue to validate geography's inclusion in the curriculum. Perhaps the answer to this is to develop pupils' *thinking geographically*.

John Morgan, explains that to *think geographically* is "to have a trained capacity to construct a mental map to see patterns, to recognise relationships, to see movement, to take that map and 'clothe it in meaning'" (2013, p.275). He goes on to explain that this aids students to make "informed judgements", "intelligent guesses" and to rationalise theirs and others' ideas (*ibid*). Peter Jackson, author of the key 2006 article *Thinking Geographically* adds that *thinking geographically* facilitates young people and students to identify connections and relationships between places, scales and concepts "that others frequently miss"(p.203). Brooks *et al.* (2017) surmises that to *think geographically* is an essential skill to cultivate as it "provides an integrating bridge between the human and natural sciences" and helps students "impose order on a seemingly chaotic world" , tying together the "geographical threads that connect people and places" (p.4). It is the development of these processes and their real-life application to help young people make sense of their position in the world that makes *thinking geographically* the geography teacher's answer to why their subject is valuable. However, in his updated chapter, John Morgan (2018) laments that

thinking geographically has not had proper attention from the geography education community; and does not foresee more attention in the near future. Part of the issue, perhaps, is that understandings of *thinking geographically* are so vague, and practical applications or strategies to develop students' *thinking geographically* are extremely hard to find. Morgan suggests that often, although heralded as *thinking geographically*, approaches have more emphasis on 'thinking' or 'thinking about thinking', than on *geographical thought* (*ibid*).

The term *thinking geographically* is usually attributed to Jackson's 2006 article, and since then has taken strong roots in the foundation framework for the teaching of Geography in schools. The GA summarise it as "a process that involves asking questions within a relational or holistic framework" (GA, 2011, p.3). This definition is a little broad: Jackson suggests that the best place to start, when considering what it means to *think geographically* is to consider the vocabulary and grammar of the subject (2006). The vocabulary is concerned with the "apparently endless list of place names"; Geography is indeed a terminology heavy subject (*ibid*). Jackson's geographical grammar, however, are the concepts and the theories that underpin the subject, that help geographers attach meaning and make sense of those long lists of places and facts. His key concepts are: space and place; scale and connection; proximity and distance; and finally – relational thinking (*ibid*). This last concept is, compared to the others, of a slightly different nature; it is concerned with looking and considering the similarities and differences that exist between the self and other, and how these ideas are constructed and the significance of these constructions *(ibid*). The idea of *thinking* geographically is not new, Morgan (2013) attributes some aspects of it to Mackinder "the so-called 'founding father of geography" (p.275). Mackinder highlighted that Geography was not a collection of facts, but rather a trained capacity for thought (*ibid*). Morgan (2013) summarises that these mental constructions and patterns developed through *thinking geographically* are "a form of visualisation, and one which is powerful because it is to make informed judgements, intelligent guesses and to situate itself in human culture" (p.275).

The problem with *thinking geographically* is that there are a number of rather vague descriptions outlining what it allows students to do, such as 'making sense' and generating meaning (Jackson, 2006). However, there are virtually no explanations of how to support students to make this sense or generate this meaning. What are the tangible elements of *thinking geographically?* Are there specific skills or process that underpin and facilitate *thinking geographically?* These core elements need to be identified and specifically supported to help students in their *thinking geographically*.

Hooghuis *et al.*, (2014) use the term *geographical reasoning* to describe a number of the processes outlined in *thinking geographically*: "we define geographical reasoning as reasonable reflective thinking about the relationship between mankind and environment focused on deciding what to believe or do in situations where location matters." (p.242). Jackson's 2006 article on *thinking geographically* is referenced in their work, however they make no direct reference to the process of *thinking geographically*.

Cox *et al.* (2019) makes one of the most specific references to explicit skills underpinning *thinking geographically*. Having summarised Jackson's 2006 article, they identify relational thinking as one of the core elements of *thinking geographically*; to "examine and understand interconnections between geographical phenomena from a holistic perspective" (p.239). To achieve this, their study looks at students' reasoning about relations involved in different geographical contexts from population issues to coltan mining. They call this relational reasoning about geographical processes and systems '*geographical reasoning'.* Here we have one the most explicit identifications of a skill: relational reasoning, that is directly linked to geographic learning, however, although the concept of *thinking geographically* is referenced and explored in their introduction as an aim for their study, there is no explicit articulation of skills involved in *thinking geographically.*

Another study that makes some suggestions about specific processes implied in *thinking geographically* is that of Karkdijk *et al.*(2019). They identify that "relational thinking is at the core of the secondary school subject of geography", in particular thinking about interconnectedness (p.5). Here, they cite Peter Jackson's article, however make no further reference to it. As with Cox *et al.* (2019), Karkdijk *et al*. (2019) looked to develop relational thinking in geography students, to develop their *geographical reasoning*. However, as with the previous paper, whilst there is very informative explanation about the development of the skill: relational reasoning, and this skills is highlighted as a key component of *geographical reasoning* there is no tying together of *geographical reasoning* and *thinking geographically.*

Despite much of the descriptive literature around *thinking geographically* coming from academics based in the UK (Jackson, Lambert, Morgan etc.), Hooghuis *et al.* and Karkdijk *et al*. were based in the Netherlands, and Cox *et al*. in Belgium. The well-known work explicitly relating to reasoning in geography from UK academics is that of David Leat and colleagues in the *Thinking Through Geography* (TTG) project (1998). The TTG makes no explicit reference to *thinking geographically,* however it does explain that its approach develops a number of key geographical thinking skills, including reasoning (although it makes no specific reference to *geographical reasoning*). Through the various tasks outlined in the TTG handbook (Leat, 1998), students are supported in developing skills to process, classify and code information, identify patterns and relationships, make inferences and supported claims, predict consequences, extend their ideas and suggest hypotheses and make judgements about the value of information. These are explicitly identified as 'skills' but are very similar to examples of what students can do when they are *thinking geographically.*

Inferentialism

To support the development of *thinking geographically*, its foundational elements need consideration, yet these are not made explicit in the literature. Attention is given to inferentialism, (also known as inferential reasoning or an inferential/ist approach) as it may provide additional epistemological context to *thinking geographically*. Although often referred to as a type of reasoning, inferentialism is not associated with an explicit skill, rather it is concerned with how we, as humans, create meaning and develop conceptual ideas (Brandom, 2000). Brandom argued "to understand ourselves as knowers we need to prioritise inferentialism over representationalism. His theory forms part of philosophical work which sees the human mind as inseparable from the world and language; a socio-historical account of the acquisition of reasoning" (Firth, 2017, p. 86).

A student may have a strong *representational* understanding of the content in a geography lesson; their understanding of ideas is referenced based and awareness comes from understanding a concepts relational position in the world (Derry, 2007). This understanding may be considered superficial and will not stand when context is removed. American philosopher Robert Brandom proposed the idea of *inferentialism* in contrast to a representational (or referential) approach. Simply put, an inferential approach sees the student create meaning and develop their understanding through the giving and asking of reasons, (Brandom, 2000). Crucially, students are able to respond to the reasons they have elucidated, and not just the causes (Firth & Strutt, 2019). This leads to a much more embedded and deeper understanding: "inferentialism lays out our understanding of the world not in terms of what our words and thoughts refer to in the world, but in relation to networks of inferences that drive the need to know. Inferentialism emphasises the role of reasoning (i.e. inference making)", to really understand something is to be able to *do* something with that understanding (*ibid,* p.144).

Inferentialism as a theory is concerned with how as humans we come to know and inferential reasoning is prioritised. Without the ability to construct chains of reasons (using inferential *relational* reasoning, for example, students would be unable to adopt an inferential approach. *Inferential* reasoning is demonstrated through a number of reasoning skills and processes connected to causality and identifying conditions and concessions (Luckett, 2016). In turn, this enables "a complex flow of unpacking and repackaging meanings as inferential reasoning moves between theory or interpretation and data, evidence or references to other texts" (*ibid,* p.1008). It is this description that makes inferentialism an important idea to consider for this study, as there are parallels to the approach implied in the descriptions of *thinking geographically.* For example; an inferential approach bears similarities with *thinking geographically* in that rather than have a fixed and tangible set of skills, an inferential approach is the product of the combination a number of reasoning skills interacting with each other. It is also similar in the sense that it is concerned with generating meaning, rather than on the skills that underpin it. Firth and Strutt (2019) suggest an inferential approach would enable students "to access the meaning making that is valued in the disciplinary discourse" (p.154). If *thinking geographically* is the term geographers use to describe engagement with our disciplinary discourse, then the value of an inferential approach is clearly highlighted.

While work on inferentialism's practical inclusion in education is principally based in mathematics and science, it's value for humanities subjects is steadily emerging. Luckett (2016) identifies an inferential perspective as the key tool for granting students epistemic access and achieving mastery. McCrory (2015) explores its importance in history classrooms as a tool for ensuring deep understanding ; "another important issue is that teachers can struggle to teach for the depth of reasoning needed to make statements meaningful because they distort knowledge into its representational guise, severed from its inferentially determined meaning." (p.41). This statement warns that reasoning may be superficial if it is grounded in representations, rather than

inference. For example, a student may be able to give apparently well founded statements: 'X *happens because of* A,B,C', however these 'explanations' are given as statements of fact, rather than understood concepts. In geography classrooms, Firth (2017) echoes McCrory's warning that reasoning "may be capped at representational level", and that "students only know a concept if they are able to make some of these inferences correctly, in essence, if they are able to reason with it" (p.88). Firth reiterates that to be able to make sense and derive meaning of concepts, students need time to consider their relational nature through reasoning (*ibid).* In both the history and geography context, where students are required to develop deep understanding of relational concepts and frameworks, an inferential approach is important. Such an approach will allow students to deliberately build up and strengthen their knowledge "through relevant reasoning about authentic encounters with the referents of particular words and not simply by providing the words themselves." (McCrory, 2015, p.42).

Although exploring inferentialism provides an epistemological perspective of *thinking geographically*, there are still few practical suggestions for its development in classrooms. However, reasoning is identified by both McCrory (2015) and Firth (2017) as a central skill in inferentialism. Therefore, if we want to develop our students' *thinking geographically,* it is evident that we need to directly target the development of the reasoning skills that underpin it. To do this, we need to develop tasks that address such skills.

Reasoning

As a practitioner, identifying specific and tangible skills is key for me to support my students' *thinking geographically.* Reasoning is the term most frequently – although again ambiguously – used in the practical descriptions of what *thinking geographically* is.

What is reasoning?

'Reasoning' is a term used widely in education literature to describe the holistic cognitive process of "solving problems, making judgements and decisions, and formulating ideas" (Cerbin, 1988). It is a term familiar to teachers; reasoning is mentioned explicitly as a key learning objective in the National Curriculum for England for Key Stage One and Two (Department for Education, 2013). Reasoning tasks feature implicitly or explicitly in all part of assessments through all key stages both at primary and secondary level (Department for Education, 2016) and even form part of the assessments to join the Department itself in its graduate recruitment (Gov.uk, 2019). Reasoning, therefore, needs attention from educational researchers and teachers, given its extreme emphasis in our national assessment landscape.

There are vast quantities of literature addressing what is meant by reasoning and identify it as a complex construct with no concrete definition (Ding *et al*., 2016). The consensus is that reasoning includes the development of mental strategies that help assist in the processing of information, the identification of relationships between previously arbitrary or discrete nodes of information and the derivation of logical conclusions from evidence (e.g. Ding *et al.,*2016; Bunge & Leib, 2020). Within the wider concept of reasoning there are further categorizations of types of reasoning, which to the lay reader – or educational practitioner – often appear confusingly similar. *Gist* reasoning, for example, "allows one to 'connect the dots' between separate pieces of information, facilitating construction of generalized meanings rather than processing facts in isolation" (Gamino *et al.,* 2014). *Inductive* reasoning, however, "is aimed at detecting generalizations, rules or regularities"; this description reads similar to that of *gist* reasoning (Klauer & Phye, 2008). *Relational* reasoning is the ability to observe and make comparisons, or integrate disparate nodes of information (Bunge & Leib, 2020). *Justificatory* reasoning is the ability to justify arguments and beliefs which are logically cogent and ethically grounded (Lee *et al.,* 2019). There is also *causal* reasoning, which considers the epistemological underpinnings of explanations (Stoel *et*

al., 2014); *formal* reasoning, where formal deductive processes such as logic are employed; and *informal* reasoning, which focuses on claims supported by evidence (Cerbin, 1988). Kim and Pegg (2019) discuss how there are three key kinds of reasoning for supporting claims with evidence in science (science and mathematics are the predominant field of study for applied reasoning): *phenomenological* (a single observation) *relational* (as previously discussed – a contextualised relationship) and *rule-based* (generalised theory, principle or law). Reasoning plays a key role in the development of knowledge in science and mathematics, and it is in these two fields we see the greatest amount of literature concerned with the use of reasoning in constructing knowledge claims and its practical development in students of those subjects. *Scientific* reasoning is a much broader term, generally including all of the types of reasoning outlined above, with the addition of formulating new hypotheses and finding creative solutions from "puzzling phenomenon" (Ding *et al*., 2016).

Whichever term precedes it, reasoning – which has no prefect taxonomy for classifying the various types - is ultimately concerned with *making sense* and supporting claims and ideas with this *sense* (*ibid*).

Let us continue with the notion that reasoning, whichever type or classification we may choose to assign its various modes, is a key cognitive skill. It is often cited as the key tool in the formation of effective arguments and rationales (von der Muhlen *et al.,* 2019). The process of reasoning "involves critical evaluation of one's own and other people's beliefs" (Asghar & Rana, 2019 p.144). There is an emphasis that reasoning leads to cognitive scrutiny, to be able to classify, provide an analogy and identify relationships between concepts (Klauer & Phye, 2008). In professional education literature, reasoning is also often linked to metacognition and thinking skills, on the formulations of arguments based on knowledge, rather than the original construction of knowledge (Hooghuis *et al.*, 2014). In Toulmin's 2003 book, Return to Reason, he explains that

reasoning is not so much giving your argument so passionately that you ignite the same sentiment in one's audience, rather you help them achieve a more comprehensive grasp of your claims by developing their understanding. An effective argument *is* the product of reasoning, Cerbin concurs, citing Toulmin's original thesis on argumentation (1988). Argumentation is often discussed in reasoning literature; both as a product of the process, but also as a tool for a more advanced reasoning process: evaluation (Kim & Pegg, 2019). In fact the two have a cyclical relationship; effective evaluation allows the development of a strong argument, but an argument needs to be effectively evaluated for its validity.

Reasoning in Education

Reasoning processes are repeatedly highlighted as a key skill, not only for academic progress, but to provide agency and self-efficacy in daily life (Cerbin, 1988). This sentiment is echoed by Janssen *et al.* (2019) who explicitly sate that "scientific reasoning skills are not just for researchers, they are also increasingly relevant for making informed decisions in our everyday lives". In the era of 'fake news', it has never been more important for young people, our next generation of decision makers and world leaders, to be able to critically engage with the information they are presented with, assess its value and form their own views (UNESCO, 2018). Reasoning arms students with the ability to critically evaluate; through the identification of arguments, assess the evidence provided in support and evaluate the conclusions presented (Asghar & Rana, 2019). However, Gamino *et al.* (2014) fear that reasoning skills are being side lined in educational systems due to emphasis on superficial coverage of circumscribed details, specified by curricula. This leaves vulnerability in our future workforce, explains van der Schee *et al.* (2003), as we move into an era defined by the information economy, with rapidly evolving technological landscapes, the ability to continuously re-skill and up-skill will prove more essential than a largely factual-based understanding. Therefore, those who are "active and critical learners during school

time" will be agentic and successful 21st century citizens, whereas those who are "passive consumers of knowledge" will be left behind (*ibid)*.

Since schools are in the "knowledge development business", it's obvious that this is the environment to hone and nurture reasoning skills (Lambert & Hopkin, 2013, p.74). Aries *et al*. (2015) are not overly optimistic about this; they state explicitly that "secondary school pupils underachieve in tests in which reasoning abilities are required" (p. 210). However, young children are reported to frequently display cognitive processes that could be identified as precursors to reasoning (Janssen *et al.,* 2019). Lambert and Biddulph (2015) echo this idea; "even the youngest school children are agentive and have already become human knowers, which means crucially, that they have experience and concepts on which to draw inferentially. In this sense, they already occupy a 'space of reasons'" (p.218). Such observations are echoed in secondary schools; students are using reasoning skills frequently, just not in an overly refined fashion (von der Muhlen *et al.,* 2019). Therefore, students have the 'raw materials', so to speak, the education community and teachers need to work together to develop them more specifically. But perhaps the tide is turning. As an international effort grows to design curricula to arm the 21st century student with the skills they need beyond school, we see increased attention for teaching reasoning skills (can der Schee *et al*., 2003).

Reasoning in Geography

It has been identified that the recognition of school geography as an integrated and holistic body of knowledge, rather than a random collection of unpronounceable landscape features and out-of-date statistics would enhance its academic integrity (Walshe, 2007). Reasoning and reasoning skills are undoubtedly the tool to support this understanding of the subject. Reasoning is happening in geography. However, although there is explicit reference to it (Karkdijk *et al*., 2019 for example), as previously outlined, and a few specific tasks that are identified in supporting it (Cox *et al*., 2019 for example), there is not a great deal of literature available. Hooghuis *et al*. (2014)

describe *geographical reasoning* as "reasonable reflective thinking about the relationship between mankind and environment" (p. 243). That is to say that within geography itself, we have our own specific process that draws these connections and makes developed, well founded statements to describe the physical and human processes taking place; that can draw together the disparate nodes of information (Walshe, 2007).

Much of the explanation of what *geographical reasoning* entails is very similar to generic descriptions of reasoning. It is the development of the ability to independently make decisions, to formulate conclusions that are well supported by explained assumptions and arguments, to scrutinize of the validity of statement and "above all a process of searching for plausibility" (Hooghuis *et al*., 2014, p.244). Whilst the number of direct references to developing *geographical reasoning* are not frequent, and already highlighted, there are a number of indirect approaches, which we will now consider.

Geographical Capabilities

A key attempt to address reasoning skills (although still rather implicitly) is the GeoCapabilities project (GeoCapabilities, 2016). The GeoCapabilities II Project, which is funded through support from the European Commission (their website has not been updated to suggest any change post-Brexit) was launched in partnership with Geography's professional body, The Geographical Association (The GA) (The Geographical Association, NDa). GeoCapabilities II is multi-phased, and "was developed to be a vehicle for teachers' professional development", in particular to support their understanding of and engagement with 'Powerful Disciplinary Knowledge' (GeoCapabilities, 2016). This support for teachers then aids the development of students' capabilities in the subject, in particular "to think, make good choices and decisions about how to live" (*ibid*). However, ultimately the project was directed at teachers, and their pedagogical development, with skill development of students as a by-product, rather than explicitly addressing it. GeoCapabilities is underpinned by a 'capabilities approach', whose origins lie in Sen's 2006

influential – and Nobel prize-winning – research into theorising human development and welfare economics (Lambert, 2014). The key idea of the original approach is to provide students with specialised knowledge which empowers them and enhances their personal freedoms (*ibid*). There are different capabilities developed through the pursuit of different subjects; geography's capabilities are most concerned with "developing a sense of the global", to ask why and how (*ibid*, p.106).

The term *geographical capability* emerges infrequently in the literature beyond that produced by the GA (for example, in Kinder, 2013). This 'capability' is "enhanced through the acquisition and development of world knowledge, development of inter-relational understanding (the basis of grasping global interdependence) and enhanced propensity to think, through decision making and other activities" (*ibid.*, p.6). Although no explicit reference is made to reasoning, it is hard to suggest the key capabilities outlined are wholly separate to those of reasoning. For example, to have a strong understanding of the interdependent world, relational thinking is key. Relational thinking is an aspect of reasoning (Bunge & Leib, 2020). Therefore, perhaps it is possible to suggest that whilst GeoCapabilities doesn't explicitly identify reasoning as one of its aims, the successful implementation of such a project would implicitly develop reasoning skills. These reasoning skills we could call *geographical reasoning*, especially where they are relating located information; hypothesising the outcomes of different geographical processes (geomorphic, demographic, climatic etc); using their knowledge of one type of process to make well found inferences about another.

Thinking geographically and geographical reasoning

Perhaps it can be suggested that *thinking geographically* and *geographical reasoning* represent the same processes. For example; aspects of reasoning are specifically concerned with making links and identifying relationships between concepts (Klauer & Phye, 2008), or more specifically Bunge and Leib (2020), who highlight reasoning as "the ability to compare or integrate

the relations between disparate pieces of information" and therefore *geographical reasoning* would refer to these links and relationships between geographical processes and systems. *Thinking geographically* echoes this very closely: as outlined in Morgan's (2013) summary when he highlights *thinking geographically* is about seeing relationships and connections. *Gist* reasoning is making well founded generalisations (Gamino *et al.*, 2014); *thinking geographically* is demonstrated by making informed judgements (Morgan, 2013). Therefore, we can assume that students who demonstrate *thinking geographically* are demonstrating reasoning skills, and that *thinking geographically* and *geographical reasoning* are synonymous from a core-skills perspective; it is a discipline-specific utilization of reasoning skills. Inferentialism could also be added to the understanding of *thinking geographically*: it is the utilisation of discipline-specific reasoning to generate meaning through an inferential approach. For the duration of the research, therefore, I shall take *thinking geographically* to mean the holistic and simultaneous demonstration of reasoning skills (such as argumentation, relational thinking, *gist* reasoning etc.) to think about geographical systems and processes. Inferentialism is not specifically addressed in this research; but it has helped inform the understanding of *thinking geographically*.

Tasks to support reasoning

Profound reasoning and metacognition and therefore *thinking geographically* is not "a spontaneous outcome for most pupils" argues Leat (2000), rather "it requires deliberate action" (p.25). What might it look like in the classroom? Hooghuis *et al.* (2014) suggest that some of the most effective teaching strategies to promote *thinking geographically* come from the *Thinking Through Geography* (TTG) approach. TTG is best summarised in the 1998 book "Thinking through Geography" written by David Leat and a number of teachers in the North East. The aim of the approach was to provide the rational for and specificities of practical, tangible classroom strategies with detailed examples. The approach aimed to develop five key skills in line with the National Curriculum guidance at the time. These skills were: information-processing skills, reasoning skills,

enquiry skills, creative thinking skills and evaluation skills. Although developing 'reasoning skills' is an explicit aim of the approach, all skills directly or indirectly support reasoning. The table below links these skills explicitly with the literature on reasoning.

Table 2: List of reasoning skills from TTG

Description of skill (quoted directly from TTG, 1998, p.3)	Examples of links to reasoning
Information-processing skills these enable pupils to locate and collect relevant information, to sort, classify, sequence, compare and contrast, and to analyse part/whole relationships.	Bunge and Leib's (2020) relational reasoning: directly refers to the ability to compare pieces of information.
Reasoning skills these enable pupils to give reasons for opinions and actions, to draw inferences and make deductions, to use precise language to explain what they think, and to make judgements and decisions informed by reasons or evidence.	A much more self-explanatory link, but for example, Kim and Pegg (2019) outline different ways to use evidence in scientific reasoning.
Enquiry skill these enable pupils to ask relevant questions, to pose and define problems, to plan what to do and how to research, to predict outcomes and anticipate consequences, and to test conclusions and improve ideas.	Development of formal informal arguments from conclusions derived from evidence (von der Muhlen *et al.*, 2019)
Creative thinking skills these enable pupils to generate and extend ideas, to suggest hypothesis, to apply imagination and to look for alternative innovative outcomes.	Constructing hypotheses from puzzling issues (Ding *et al.*, 2016)
Evaluation skills these enable pupils to evaluate information, to judge the value of what they read, hear and do, to develop criteria for judging the value of their own and others' work or ideas, and to have confidence in their judgements.	Kim and Pegg (2019) outline the engagement of dilemmas encourages the evaluation of effectiveness of knowledge and the use of argumentation and conjecture to justify solutions. Lee *et al.,* (2010) discussion of justificatory reasoning.

These links are but a few examples that support the idea that the TTG is the embodiment of reasoning in the classroom. In TTG, a number of practical tasks are suggested for the development of the skills outlined above.

However, despite its widespread use by geography teachers, the TTG approach has faced a degree of criticism. Morgan (2018) suggests 'the activities were more likely to prompt "thinking

about thinking" than about what it means to "think geographically"' (p.292). Morgan suggests that some of the tasks included in TTG are simply models of thinking, rather than developing 'complex *geographical thought'* (*ibid*, p.293). Therefore, although TTG does offer some of the most practical solutions for teachers, the design of the specific tasks themselves need consideration to avoid developing superficial ideas. This notion brings us back to the inferential approach; which cautions the prioritisation of representational knowledge claims over those generated from inferences.

The conception of a problem or idea can be a hard task for students, especially when the geographical ideas we are asking our students to consider can be so far removed from their own lived experience. Take life in favelas, for example, the concept of a favela may prove intangible for students living in the United Kingdom. However, tools such as concepts maps and the building of models can be very effective at helping a student to externalize their internal issue and thus help build a stronger mental representation (Cox *et al.*, 2019a). Concept maps and diagrams can help organise information, highlight the related variables and agents within a context and allow them to further develop their cognitive schemata (*ibid*). The identification of relationships between concepts is a key factor of reasoning, and there is evidence from a number of studies that echo the idea that concept maps are some of the most effective ways for students to represent their knowledge structures whilst also providing insights to their understanding (Karkdijk *et al.*, 2019). Therefore, not only do concept maps help students, as they externalize the thinking process, but teachers can gain far greater oversight of the processes of the students; identifying missing concepts or links and help draw students' attention to these (*ibid*).

Causal diagrams are specific types of concept maps. Whilst a concept diagram shows generic links between concepts, causal diagrams are focused on the causal relations. The grasping of causal relationships is a fundamental aspect of *thinking geographically* (Maude, 2017), and is a key aspect of reasoning (Bunge & Leib, 2020, for example).

The rationale behind designing tasks that externalise and visually represent the cognitive process is grounded in the psychology. Markman (2012) explains:

> "An early use of structured representations in psychology was semantic networks... In a semantic network, objects are represented by nodes in the network. These nodes are connected by links that represent the relations among concepts. The links are directed so that the first argument of the relation points to the second."(p.44)

Therefore, where students create a diagram that represents the chain of consequences, an understanding of cause and effect, direct and indirect impacts and changes over space and time is fostered.

There are a number of articulated benefits of using mapping and relating tasks in the classroom. Firstly, the recalling of the related concepts, agents (often known as stakeholders in Geography), flows and causal relationships is a revision process and helps students see 'the sum of the parts', the holistic overview of the geographical idea. Most importantly though, by externalizing the relationships of the idea, the synthesis of all the connections allows students to "go beyond the information given", thus strengthening relational reasoning (Stratford *et al.*, 1998, p.224). Basic concept maps or more complex causal diagrams not only aid relational reasoning, but also develop *spatial* orientation and visualization (Favier & van der Schee, 2014). These two skills are key in spatial reasoning and spatial representation, which are not uniquely geographical skills, but are key in effective *thinking geographically* (*ibid*). All four aspects of Jackson's 2006 work on *thinking geographically* highlight the conceptualization of space and its internal and external relationships as foundational elements of *thinking geographically*. In a very basic task, students could superimpose their concept map or causal diagram onto a map to show flows of ideas or goods to provide some spatial context. As their mental spatial representations become more secure, and the concept of space is not defined by a map, they could extend their relational thinking to consider issues such as: "how the Arab Spring is related to the heat wave in Russia in 2010; why some glaciers in South Norway are advancing, while they are retreating in the rest of the world" suggest Favier and van der

Schee (2014). Such tasks require students to recognize spatial distributions and patterns, explain them and reason how they may change in the future, all the while developing their "geospatial relational reasoning processes" (*ibid).* A teacher may get a few raised eyebrows if they wrote '*to develop geospatial relational reasoning processes'* on the board as the lesson objective, but probably far fewer for *design flow maps to show interconnection between x and y*. Additionally, these visual tools can also support inferential reasoning; where "inferentialism lays out our understanding of the world not in terms of what our words and thoughts refer to in the world, but in relation to networks of inferences that drive the need to know", externalising these inferences is likely to deepen students' understanding (Firth & Strutt, 2019, p.145).

Concept maps and causal diagrams are effective tasks to promote *thinking geographically*, in particular students' relational reasoning. However, a variety of tasks is key. A more implicit task that develops relational reasoning is a mystery task (Karkdijk *et al*., 2019). Leat (1998) considers the mystery task the most powerful of those developed by the TTG team. The aim of a mystery is to "encourage pupils to deal with ambiguity through addressing a question which has no single correct answer and where they are not even sure what information is relevant – rather like real life in fact" (*ibid*, p.51). The mystery encourages the sorting and organising of information, coding that information as relevant or not, linking the information, developing hypothesis, checking and synthesising ideas and articulating decisions (*ibid)*. All of these skills are inherent reasoning skills. The mysteries will produce diverse answers from a single open ended (and often deliberately ambiguous) question (Leat *et al*., 2005). The initial question is posed to the class, who are then provided with information, usually as strips that can be moved around the table. The second phase involves these strips to be coded; information is classified into groups, often causes, consequences, external factors and – importantly – seemingly irrelevant information (Leat, 1998). After a fixed period of time where students are synthesising and sorting the information, the teacher moves to

the final phase, and facilitates a reflective debrief, where students discuss and challenge their conclusions (*ibid*).

A lesson may be brought to a close with a reflective discussion, an opportunity to open up and unpack thinking (Leat, 2000). These are key to allow students to develop their *geographical reasoning;* reflective discussions and debriefs are "essential for the transfer of knowledge and self-regulation"(Hooghuis *et al.,* 2014, p.243). The 'reflective' aspect of the debrief is crucial as it highlights the importance of metacognition, consideration of the perspective and frame of reference and to consider the overall value of a conclusion (*ibid)*. Whilst reflective discussions and debriefs are a desirable plenary activity for concept mapping and causal diagrams, it is an essential part of the mystery (Leat, 1998). The teacher can facilitate the debrief by asking a variety of open ended questions, encouraging students to justify a given answer, referencing the 'big' geographical concepts at play and drawing links from the lesson outcomes to other subjects and everyday life (Leat, 2000).

What are the benefits of such tasks? In an intervention study looking at the impact of constructing causal diagrams on students' reasoning skills, teachers reported that students reasoned much more freely about the content during the construction of their causal diagrams (Cox *et al.,* 2019b). There was some initial hesitation from students; their initial causal relationships were shallow, however teachers reported that by the end of the lesson students "reasoned more spontaneously", and this carried forward to other learning phases (*ibid,* p.244). The construction of causal diagrams and mysteries are effective 'low threshold, high ceiling' strategies; that is to say, with a little scaffolding from the teacher, students of all attainment can access the task, but there is no limit to the extension (Zolkower & Rubel, 2015). Therefore they are effective tasks in a mixed

ability classroom, providing appropriate challenge for all students, thus addressing Leat *et al.*,(2005)'s concern over lack of intellectual stimulation.

The mystery is included in 'tasks that externalise thought', because the action of moving and sorting the information (which is almost always presented tangibly to the students) is such an externalisation. Other than making the cognitive process visible, the mystery is effective in a number of ways. Firstly, the coding and categorising of information and deeming it 'valuable' or not to their task links to von der Muhlen *et al.*, (2019)'s suggestion that critically engaging with information and discriminating between relevant and irrelevant statements is a key reasoning process, especially in the formation of effective arguments. Secondly, during the course of the second stage of the mystery, the teacher can reveal additional information which may make the information previously considered irrelevant. Students need to then consider and rationalise if this new information has any value to the arguments they are already formulating.

The final phase of the mapping or mystery lesson, the debriefing, can produce some of the most profound reasoning from students. Incomplete reasoning and any misconceptions can be identified and addressed by the teacher (Karkdijk *et al*., 2019). In this stage, students are encouraged to review their own thinking processes, thus introducing them to the skill of metacognition. Furthermore, the debrief allows the chance to listen and consider, and then critically evaluate the thinking processes and arguments of their peers – another key reasoning process (Asghar & Rana, 2019). Students have the opportunity to summarise their ideas, either verbally or on paper. This summary is a useful opportunity to develop argumentation, a key skill in reasoning (von der Muhlen *et al*., 2019). Argumentation is a way of developing and thereby representing a chain of reasons or arguments, it is a key tool in articulation and communication (Morawski & Budke, 2019). Students are challenged on their conclusions and in their justifications can synthesise and link their ideas together. Because there is often no single right answer, there is an opportunity for teachers to highlight the importance of perspectives and how different

subjectivities can impact knowledge construction (and thereby argument construction). Debriefing episodes encourage students to give reasons, to clarify their own thinking and "lead to greater cognitive processing" (Leat & Min, 2003, p. 396). Supporting students in reviewing and considering their own role in knowledge construction is important for the establishment of deep and profound geographical thinking (Firth, 2013). Talk is "the central vehicle for sharing and analysing ideas, value and practice", and a debriefing episode facilitates just that (Leat & Min, 2003, p.404). In fact, the debriefing process, if carefully managed by the teacher, can elucidate much more profound answers from lower prior attaining pupils; they are exposed to their peers' ideas and have to consider which claims best support their own argument, they are constantly developing and deepening their ideas (Leat & Nichols, 2000).

In the evaluations of the studies that use concept maps, causal diagrams and mysteries, there are a few factors that need to be considered. Firstly, "facilitating reflective discussions with students appears to be an obstacle for teachers" (Hooghuis *et al.,* 2014, p.243). Leat explains that facilitating debriefing is a hard skill, and many teachers are reluctant to attempt it (2000). This is for fear of disrupting routines, perhaps concern over behaviour or the fact that it may not result in anything written into books (*ibid*).

Regarding mysteries; as the most effective mysteries are based around an ambiguous question, teachers need to be secure in their subject knowledge, as there are an infinite number of routes a student could take (Karkdijk *et al.*, 2019). This may mean that some teachers are reluctant to engage with mysteries or may design a question that is too narrow and with a fixed outcome, which would reduce the efficacy of the task (Leat, 1998). Furthermore, students' subject knowledge may be lacking to such an extent where even developing a basic line of reasoning is difficult (Hooghuis *et al.,* 2014).

A lack of time to develop the resources for such tasks (mysteries in particular require considerable planning and resourcing) is also highlighted as a constraint (*ibid*). Teachers reported that a standalone lesson is often not enough time to develop ideas, especially as it can take a while for students to 'warm up' into the task (Karkdijk *et al.*, 2013).

Additional considerations for task design

Authenticity

Before individual tasks can be designed, consideration needs to be given to the wider curriculum context. For students to provided with an opportunity to engage critically with the content; to be challenged and stimulated; and for the content to make a difference to their understanding of the world beyond the classroom, authenticity is key (Pollard & Hesslewood, 2015). The topics studied should be "topical, relevant and contemporary", and 'the point' should made clear and tangible to students (*ibid*, p.11). Biddulph advocates that students should consider the contribution of a task to their community, lifestyle, connection to places, responsibilities and natural curiosity about the world (2009b). At the end of a lesson, students should be encouraged and able to connect what they have just learnt to their own context (*ibid*). For example, a lesson on the different stakeholders in a mineral conflict should leave students thinking about their own agency and role in the other resource conflicts. An enquiry into sustainability issues in a tourist location should leave students questioning their own actions on their next holiday.

Skills

If the grammar of *thinking geographically* is the subject's big ideas and the vocabulary is the geographical content, then perhaps the *syntax* is the geographical *skills* (Wood, 2013). Certain skills are mandated by the National Curriculum and Awarding Bodies' GCSE and A Level syllabus, and therefore their integration at Key Stage 3 is useful (*ibid*). The 'geographical' skills that first come to mind are usually those relating to fieldwork, map work and geographical literacy (key terms and

definitions and so forth), however, numeracy, analytical, enquiry and research skills have become increasingly recognised as 'geographical' (*ibid*). The crude term 'analytical', as previously discussed, may be considered a lay-term for reasoning. Therefore, within a scheme of work, tasks need to target and develop a variety of skills, to enhance students' *thinking geographically* and understanding *and* develop their reasoning skills (*ibid).*

Generalisations

Formulating rational generalisations is identified as a *thinking geographically* skill. Generalisations are 'powerful' for two main reasons: firstly because it requires students to summarise key content, making it much easier for them to process and remember it and secondly because it encourages students to transfer the knowledge to different contexts, thus testing and solidifying it (Maude, 2016). Tasks that require students to look to the future, and hypothesis about what might happen, and give evidence and explanation to suggest why they have drawn such conclusions is supported by strong generalising skills (*ibid*). Making strong and well-founded generalisations are at the core of *gist* reasoning (Gamino *et al.,* 2014). Such a skill is transferrable well beyond the boundaries of classroom Geography, because it gives students agency and self-efficacy, it allows them to consider their futures and "identify ways of taking actions that improve their own and others' futures" (Maude, 2016, p. 74).

Challenge

Many sources report that students are not successful in Geography at school because they are not challenged sufficiently (Hopkin, 2013, for example). In fact, Leat (1997) goes so far as to say that "the failure of most geography textbooks and much geography teaching is that they fail to challenge pupils" (p.146). This is echoed by other members of the geographical education community, who are concerned that the lack of challenge reflects a lack of concern for the intellectual development of students (Leat *et al.*, 2005). Therefore, the level of challenge within the course and individual tasks must be considered. Teachers' expectations are not reported to be

overly high; and especially so at Key Stage 3 level, where classes are most likely mixed ability and the subject is a compulsory part of the curriculum (*ibid*). Challenge can be added in a number of ways, but within a cognitive and epistemological context Leat (1997) suggests 'cognitive conflict', where students' pre-existing paradigms are established and then challenged by new experiences or evidence, can be effective at increasing levels of challenge in the classroom. Conflict can also be presented via the nature of the knowledge, not just of the knowledge itself. Conceptual conflict; where a great deal of ambiguity and no clear answer exists can be effective at encouraging students to think critically and thus *geographically* (*ibid*).

One way to introduce challenge into tasks is not only with ambiguous arguments or questions, but to address controversial topics (Mitchell, 2013). The teaching of controversial topics also offers a very effective chance for *thinking geographically* and thereby *geographical reasoning* to take place; making sense of the issues required value judgement and critical analysis of reasoning processes, allowing even higher-level reasoning to take place (*ibid*). Students have the opportunity to present the reasoning behind different opinions, and then analyse and critique the value principles behind such judgements (*ibid*). Karkdijk *et al*. (2013) echo this; they explain that teaching with conflicts can have positive effects not only on academic understanding, but also on a student's wellbeing and sense of self.

Methodology

Before I outline the methodology of the research, quick reference must be made here to the impact of Covid-19. The full impact is addressed in an earlier section, but the reader may notice that the following prose is written in the hypothetical, outlining the approach and methodology intended should Covid-19 have never hit.

This research aligns itself with the action research approach. The process of action research is situated within the practitioner's context and aims to address issues that directly arise from this specific context to improve outcomes of students (Baumfield *et al.*, 2013). Therefore, any research is influenced by the characteristics and needs of their students, curriculum and colleagues. This gives the research significant value; even if the issues or questions are not directly answered, the process of identifying and considering them is beneficial to all involved; as enquiry and reflection are a key components of action research (Menter *et al.,* 2011). However, 'completed' practitioner action research is sequential: an issue is identified, specific context and academic theories consulted, a study is designed, data is collected, analysed and interpreted, and then shared and implemented (Efrat Efron & Ravid, 2020). The most effective research may follow this sequence a number of times, each building from the previous cycle. A clear sequence was designed for this specific project.

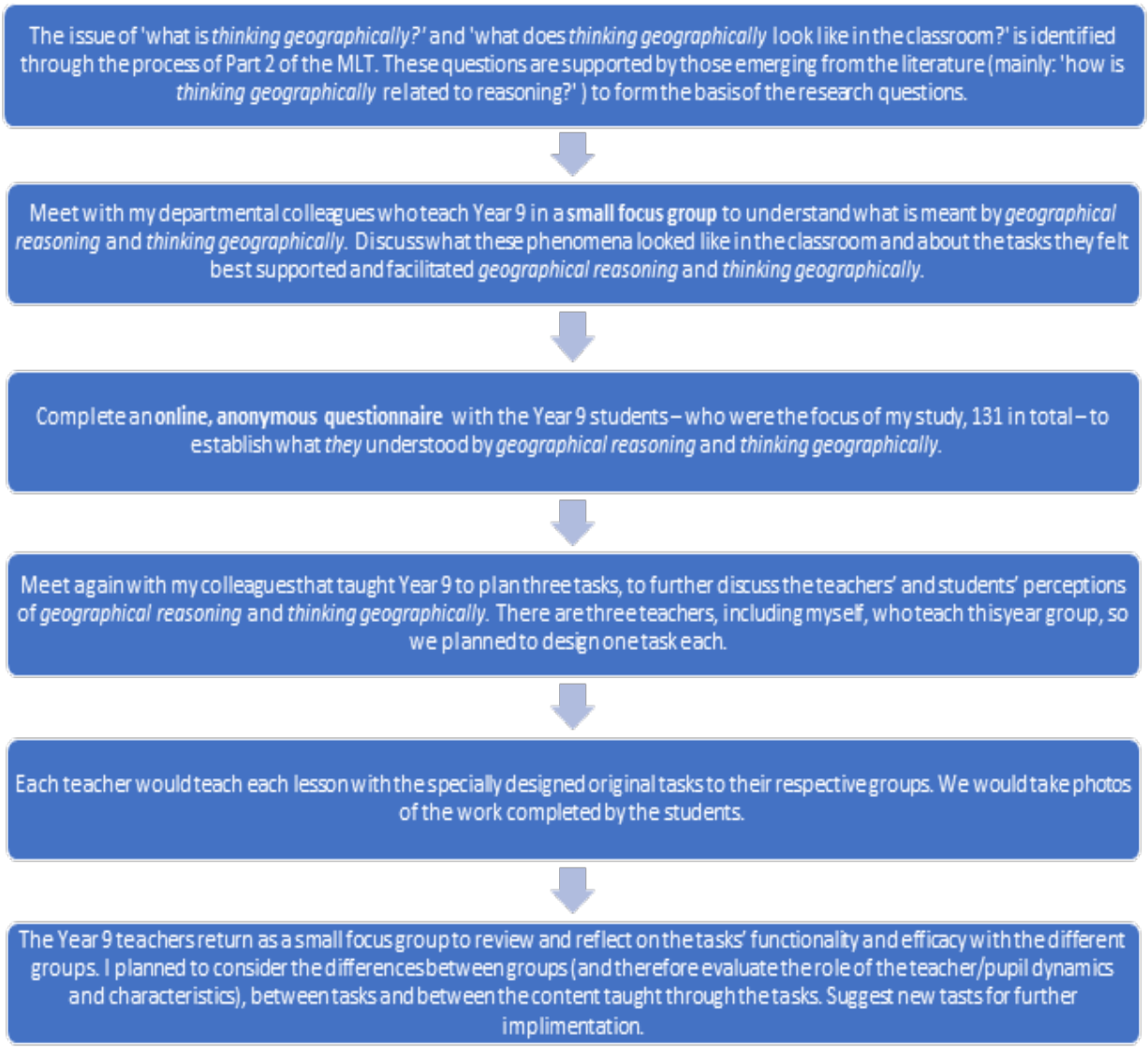


Figure 1: Original sequence of research

Participants of the study

A whole year cohort of 131 male students were due to be involved in the study. This year group was identified as the most appropriate for a number of reasons. Firstly, geography is compulsory in Year 9, and is also the year the School starts. This meant that there was a great variety of past geographical education experiences in the cohort and both those who enjoyed geography, and those who would not continue with it included. I felt that this gave us the most broad range of students, in terms of ability, past experience and interest, which would hopefully increase the authenticity of the results: this was not a self-selecting group of keen

geographers! Participating in the research was therefore not optional, however this fell in-line with the CUREC modus-operandi: designing tasks and reflecting on them is a key everyday process in teaching, and would not serve any identifiable disadvantage to the students (CUREC, 2016). Secondly, in this year we do not begin teaching the GCSE and as an independent school we are not obliged to follow the National Curriculum (although we do use it as a guideline), so had freedom with both the length and content of the tasks. This year group was also preferable as the teaching is split into 6 classes of roughly 20 students. There are three geography teachers who each teach two classes. We follow the same curriculum and generally use the same, centrally available resources. This would continue through the study; each teacher would teach the same tasks to their two classes and would then feedback their ideas. This increased the size of the sample and would also allow for discussion about the impact of the individual teacher and any other specific contexts of those individual classes.

The final size of the cohort was not a predetermined number. In terms of research specifically aimed at developing reasoning, Klauer and Phye (2008) outline:

> "The overwhelming majority of the training experiments included only small samples of children or youths because it is more efficient to conduct inductive reasoning training in small groups rather than in an entire class. This is a trade-off. Although training can be more effectively administered to small groups, statistically significant findings may be less likely to result." (p.98)

While I agree with the argument that developing reasoning is more efficient – and therefore more effective – to a smaller group, but within the constraints of our timetable, smaller groups would not be possible. Therefore, I was content with the research happening in six separate classes of around 20 students. Disparities in the experiences of each class will be acknowledged in the analysis.

The teachers are all female, we have all completed a geography degree followed by a PGCE qualification. Teachers 1 and 2 are in their 4th year as qualified teachers, Teacher 3 has over 20 years of practice. All students and teachers will be anonymised; specific students will be given a random initial, and teaching sets will be given a code. (There are two sets that are considered 'higher prior

attaining'; these are students who successfully sat the Scholarship Entrance paper or are in top sets for English, Maths and Science. Whilst there is no geography element to the setting process, it may prove useful to identify these particular sets and hence they are identified as Set 1A and Set 1B for the purposes of the study. Sets 2A-2D are all mixed ability with no obvious differing characteristics between them). Teachers will be given a number. The researcher is Teacher 1.

Table 3: Coding of teaching sets

Teacher	**Teaching Sets**
Teacher 1	1A (Scholars set)
	2A
Teacher 2	1B
	2B
Teacher 3	2C
	2D

Collaboration

Collaboration in practitioner action research is often highlighted as a key component of successful research; both in terms of increasing potential efficacy, but also comes with holistic benefits (Menter *et al.*, 2011). By planning times to sit down and 'formally collaborate' for the research, we are more likely to strengthen our professional relationships; by successfully sharing ideas and working together, we may turn our collective attention elsewhere in the future (*ibid*). The two other teachers who teach Year 9 both consented to be involved as participants and actively collaborated in the research. Collaboration was central to this project, both as their insight and experiences would be collected and treated as data, but also in planning and implementing the research.

Firstly, their individual experiences would help generate the context and highlight the issues to be addressed by the tasks. Whilst action research specifies a particular and individual context, given the characteristics of geography taught in Year 9, and based on our mutual feelings about the *thinking geographically* ability of the whole group, we felt that our individual context was shared and therefore a whole-cohort approach would still be effective and appropriate. These

explanations of their context and issues provided the basis of the first stage of the action research sequence (identifying issues) and provided the key data for research questions 1 and 2. Their feedback and reflections following the teaching of the tasks would provide data for research question 3.

The second key aspect of collaboration was the designing of the tasks themselves. The research planned to teach 3 different tasks, each designed independently. This would provide a new perspective for myself as the researcher, but would also help generate more 'data' about teachers' understanding of tasks that support reasoning. Before the teaching of each task, teachers would come together and explain and justify their tasks; how to run the task, identify any success criteria, and explain how and why they felt it would support reasoning. Once the research had run this initial cycle, the findings would be shared with the department and SLT, and would hopefully help to inform future task design.

Research Methods

One of the potential pitfalls of this research project from the outset will be the ability to measure the efficacy of the reasoning tasks. 'Reasoning' as outlined in the literature review is a multifaceted, multi-layered process, and like other high-level cognitive processes, can be hard to objectively identify (Halpern, 2001). Evidence of reasoning may be very extremely subtle and may take a significant period of time to emerge (*ibid).* However, given the time frame and nature of the research, qualitative methods were planned to gather data.

Small Focus Group

The specific data collection for this research was planned to begin with a small focus group of my Year 9 colleagues, and would provide the 'data' for all the research questions. We had planned to meet afterschool, with no time limit to discuss. To ensure that I was present and focused

on the conversation of the group, I planned to write key questions and discussion prompts; and with the participants consent, record the interview. We planned to meet on a number of occasions:

- Initially, at the start of the research to identify their understandings of *thinking geographically* and how *thinking geographically* is linked to *geographical reasoning.*
- Following the Year 9 online questionnaire to discuss their ideas and agree on which tasks and addressing what content we would design to avoid repetition.
- Following the planning time to share our tasks and explain how we had envisioned teaching them, and to justify their design.
- Following the teaching of the tasks to discuss our different experiences, appraise the tasks themselves, and evaluate the student work.

I had intended that each focus group would follow a similar format; I would pre plan some specific questions but allow the discussion to evolve organically.

The benefit of the focus group over individual interviews is what emerges from the interaction *between* participants*,* not just between researcher and participant (Kitzinger, 1995). One participant may make a statement that prompts another to develop their own ideas, that process is often articulated, and in itself holds value for the researcher (Williams & Katz, 2011). They work particularly well with practitioner action research as the research and the participants are often already connected, so feel comfortable to share their thoughts thereby doing so more authentically (Mentor *et al.,* 2011). However, there would be some potential limitations. Firstly, in the first focus group meeting, there would be a much clearer division between researcher and participant. However, the following focus group meetings would see me being both researcher (i.e. structuring the group, asking the questions, recording the notes etc.) and a participant. I felt that this was important; as part of our process of collaboration, I needed to share my findings and justify my task design, as well as record the ideas of my colleagues. Had the research been able to reach

this point, I would have sought further advice from my supervisor to consider how best to manage this conflict. Furthermore, I was conscious of the time I was asking of my colleagues. Whilst willing and consenting, it was hard to predict how long these focus sessions may be, and whilst I had planned them in line with known commitments; school invariably throws up unexpected demands on teachers. This may have impacted their willingness, or the extent to which they would participate; we may have ended rushing through the group – or it may not have happened at all. Another possible limitation is that of the 'dominant voice' (Smithson, 2000). Thankfully, with only two participants and myself, all of whom are the same 'grade' in our school would have hopefully mitigated any individual dominating the responses. However, as the circumstances of the focus group were manufactured; i.e. my colleagues were well aware of the 'point' of the focus group, their answers may not have been as authentic as they would have been if were simply collaborating for the sake of sharing good practice.

Online Questionnaire

As part of our daily routines at school, we often use online surveys as a tool to collect pupil voice or in a subject specific context. This meant that all students in the research were used to using and responding in a survey; this made me hopeful for an authentic response. I planned to use Microsoft Forms, a function that we have with our school's IT provision, as the platform to collect responses. A link to the form would be scanned as a QR code, and students will be encouraged to complete the survey on a class set of iPads. They would not need to log in with an email address, or give their name, but encouraged to spend at least 10 minutes (as part of an extended starter activity). Their answers would then be held in a spread sheet that I could abductively assess for insights around students' understandings of *thinking geographically*, which I would then code to see if any patterns emerged.

The survey or questionnaire is a useful data collection method as they can be used to collect a large amount of data in an efficient way, both in terms of time and labour (Menter *et*

al., 2011). Furthermore, collecting the data via a platform such as Microsoft Forms is additionally effective as it automatically collates the data into a spread sheet to allow for very easy sorting and coding. Overall, it would have proven a very efficient way to collect responses from 120 students completing the questionnaire asynchronously, storing them securely (we have a two factor authentication process to access our school accounts, and no other person would be able to access my data) and then process it at my convenience. However, inevitably there will be students who will not engage with the questionnaire and may rush through answers that do not fully reflect their ideas. Students may also see their peers have finished and so finish more promptly, rather than taking more time to finish their answers. Furthermore, questionnaires do not allow the researcher to ask a participant to develop or exemplify their ideas in a timely fashion; especially when collecting responses anonymously (*ibid.*).

Photographs of students' work

One of the key data collection methods to assess the efficacy of the tasks, and thereby address research question 3 was to analyse the extended responses of the students following the tasks. In their books, students individually responded to open ended questions. I planned to collect a random sample (by numbering students and using a random number generator to identify four students in each set), photograph their work and analyse with my colleagues in the final focus group. I planned to identify reasoning when students were using extended clauses in their writing or developed or countered an idea; indicated by words such as 'because', 'however', 'on the other hand', 'if' (Mercer *et al.,* 2013). I planned to highlight these words to then identify their frequency relative to particular tasks, time or (especially in discussion with their individual teachers) any additional factors.

This data collection method was picked because it would allow students to respond to the question in class without any obvious intrusion from the intervention; they are doing their work as they normally would. Taking photographs could anonymise the students in the first instance; we

could objectively look over their work, but then later if we needed to add any additional context, we could share their identity within the focus group of Year 9 teachers. The sample size was small enough to look through and manage in a reasonable timeframe; (24 students' work) but still large enough be to be a statistically valid representation. However, to fully understand how representative these students' responses were to the task, and not the students' usual work, it may have proved helpful to go back through the book to see of earlier examples. These earlier examples would not automatically be included in the task.

Ethical Considerations

Ethical considerations were prioritised in the design of the study. In the first instance I wrote to the Headmaster (as per BERA guidelines, section 11, 2018) , and with his approval applied for ethical approval from Oxford University's Central University Research Ethics Committee, through CUREC A. As a teacher, we already work under highly scrutinised and ethically guided policies, and my research was focused on developing my own practice – using methods and gathering student feedback data as I would normally – so I only needed to formally seek consent from my Headmaster. This is in line with the Modus Operandi for the Oxford University MSc Learning and Teaching. I had, however, sought the consent of my Year 9 teaching colleagues as both collaborators and participants. Furthermore, their identity has been anonymised as outlined above. Before the very first questionnaire I had planned to outline to the students that the questionnaire was to help me with my research and assured them that the answers were anonymised. I also explained that we would be trying some new tasks, and the other Year 9 teachers and I would randomly look through their work; but reiterated that there was no penalty or implications to this, and again all work would be would be anonymised. I also kept in mind BERA's suggestion (Section 20, 2018) that social dynamics may complicate ethical considerations. For example, where the researcher is also a teacher of the participants (like the students in the study) or a friend (like my Year 9 colleagues), the researcher must be mindful of their position, and how this may impact the

participants ability to actively give consent. This was not so much of an issue with the students; as my research fell in line with the Modus Operandi. However, I was more aware that with my colleagues they may have felt an obligation to participate and collaborate. Therefore, I did my best to reassure them that their involvement was totally optional, and they could opt out at any point, including once the research began. As the research did not take place, there are no further ethical implications to be considered.

Discussion

As previously outlined, and in line with the revised criteria, I shall attempt to critically evaluate the potential value of the planned research.

Teacher Focus Group Meetings

Meeting with my colleagues played a vital role in this research project; and I had planned to meet with them four times over the course of the research. I held my own interpretation of *thinking geographically* and personally felt that *thinking geographically* was demonstrated through the reasoning skills outlined in the literature and *thinking geographically* is the discipline-specific term used in the Geography Education community to articulate these skills relating to geographical processes or systems. However, this was only my opinion, and therefore seeking my colleagues' understanding and interpretation of these terms was crucial. If we shared differences in opinion, this may have been reflected in the tasks designed, or in the evaluation of the work completed by the students. Therefore, having an opportunity to discuss our ideas and explain why we held such beliefs was important. The different focus group meetings had different objectives but shared the common purpose of teachers rationalising their understanding. Given the subjective nature of the 'data' (i.e. the students' work) we were to collect, being able to talk this through and hear my colleagues' ideas would increase the likelihood of effectively appraising the efficacy of the tasks.

In the first meeting I had planned to have only two specific questions, although I had several possible prompts ready, and I wanted the conversation to organically evolve to ensure my interpretation of my colleagues' understanding was as authentic as possible. The two questions were:

- What does *thinking geographically* mean to you?

- How do you know when a student is *thinking geographically?* (Prompts: what does it look like in class discussion, in written work, in questions they ask?)

I had planned to prompt them to articulate any specific skills demonstrated through *thinking geographically*, and between that initial meeting and the second to cross reference these to the literature. This would have given me a clearer idea whether my colleagues also felt that *thinking geographically* was the term we use to describe the skills and processes of *geographical reasoning*. I planned to ensure that I did not share my own beliefs with them to avoid influencing their ideas. Had they been unfamiliar with the term, I had planned to give them Peter Jackson's 2006 article; (in the majority of literature I read, it is referenced when *thinking geographically* is discussed, therefore, I felt it fair to consider it the autorotative piece of literature) to further avoid sharing my own ideas. I was not interested in whether they *knew* the term, rather their *interpretations* of it. This would have helped me answer the second research question.

My second and third meetings would have been informed by the initial meeting; their interpretations would determine what we valued from the student questionnaire and what criteria we would set for the tasks. In these meetings, my colleagues shifted from being participants to collaborators; during this process I had planned to share more of my own ideas and thoughts about the terms and about possible tasks. However, in the process of discussing the student responses and explaining the design of the tasks, I had hoped my colleagues would further explain their interpretations. We may have identified different examples from the students' responses, and in explaining *why* we had picked *those* examples, have further articulated our explanations. When explaining the task they had designed, colleagues may have emphasised *why* a particular question was phrased a certain way. Each of the explanations would tacitly reveal their interpretations. Therefore, although these meetings had a different objective, I had hoped that they would continue to indirectly inform my understanding of my colleagues' interpretations, further assisting me in answering the second research question.

The final meeting would have addressed the third research question, to appraise the tasks we taught and therefore suggest what tasks would support the development of reasoning skills, thereby improving *thinking geographically*. This was the meeting I envisaged would take the most amount of time, and had a planned format:

1. We would take each task in turn and share our experience of teaching them (Question prompts: where there any particularly interesting moments in the lesson series?) I had also planned to assess, from a practical level, how teachers found the tasks. We could also design a task that we regarded as very effective at developing reasoning skills, but if it placed significant time, effort, and resource expectations on a teacher, then it may well limit its overall value in the future.
2. The photographs of students' work across the whole cohort would be shared and we would look for examples of reasoning. I had planned for those who had designed the task to look at the photographs specifically relating to their tasks, so in the first instance, the designer could appraise their own task. This self-evaluation was an important step, because whilst the designer would have explained the rationale of the task in the previous meeting, the other two teachers' understanding of that rationale may have been limited. Therefore, it was important to me for the designer to lead the evaluation of their own task.
3. I would then lead a discussion to objectively evaluate the overall efficacy of the tasks in supporting the development of reasoning. This may have proven to be the hardest aspect, as it may have been difficult to remain fully objective. Furthermore, our individual classes, classroom set ups and relationships with our students are all different, and these will have impacted the experience of each task. For example, the task I had planned to design was a mystery that included a lot of physical resources. I know one of my classes would have shown much better self-regulation when it came to working with the resources, whilst the

other has a greater propensity for fidgeting and mischief-making. However, as long as we shared the reasons behind our overall conclusions, the ideas would still have great value. Additionally, I think it would have been hard to specifically identify one task as most effective; the task that most clearly shows any obvious development to reasoning skills. Therefore, rather than try to rank the tasks, I hoped to identify what was effective about each task and why. Of course, any development may just be a function of time passing in these students' education; one would expect more developed answers as the course of the year went by, irrespective of any specific interventions. Furthermore, we had planned to space out the tasks, with two weeks between tasks, so variety was maintained in the scheme of work (we were aware that all tasks would have an extended writing element, so we didn't want students to have to do this too frequently). Therefore, it would be plausible that the last task would have shown the most developed reasoning; the effect would have been cumulative. As we discussed this, our knowledge of the students and other external factors would need to be considered.

These meetings may have been limited by several factors. Firstly, and possibly the greatest threat to these meetings were the external factors. Working in a busy boarding school, each of us with additional responsibility, there was a very real likelihood of our time being compromised by unforeseen demands. These demands are the double edge of practitioner action research; being *in situ* gives the researcher's efforts additional credibility, however, the researcher is also – and sometimes first and foremostly – a teacher, head of year, designated safeguarding lead, head of department. Anderson *et al*. (2007) share the reflections of a teacher on this matter, "snatching time for research in the midst of an already busy schedule was an ever-present struggle....Although I wished for a leisurely hour for this debriefing and meaning-making, in reality we had about 20 minutes" (p. 115). Had this become an issue, I could have modified the involvement of my

colleagues; perhaps I could have planned all three tasks for the three of us to teach (as opposed to design one each and teach all three). This would have reduced the workload for my colleagues.

As the meetings progressed, I may have found that my colleagues became disengaged or we shared significantly different views on *thinking geographically* and what it looked like in the classroom. This was a real potential issue given the small size of the group; myself and two other teachers. Although it would not have affected the second research question, it would have raised interesting points to discuss and would have made the task designing and appraisal process more complicated.

Task 1: Snakes and Ladders – Who is the winner of GERD?

This first task aims to help students understand the short- and long-term impacts of the development of the Great Ethiopian Renaissance Dam (GERD). The plan for the sequence of lessons is outlined in the table below:

Table 4: Plan of Snakes and Ladders task

Task 'Name'	Snakes and Ladders – Who is the winner of GERD?	
Aim of Task	To help students develop understanding of both positive and negative impacts of GERD in the three main nations involved.	
Lesson 1: GERD conflict introduced	The previous lesson had looked at a timeline and background information of the dam, aiming to provide a context.	
Lesson 2: Task launched	Students to be split into groups of six, and further into pairs. Each pair is given a country to focus on. Using their knowledge and notes from the previous lessons and the additional fact files, students need to fill in the snakes and ladders templates. Ladders will represent positive impacts of GERD, snakes will represent negative impacts. **Key Points** (written on the board): • How bad/good are the impacts? These are represented by the length of the snakes and ladders. Students will need to justify these. • Where should various impacts come? These will need careful positioning on the board. What does the sequencing of various impacts mean? • Which impacts might outweigh others? Are there, for example, any positive impacts that will take countries above the negatives? How long should it be before any positives are reached? How could you use the snakes and ladders to demonstrate the time scale of the impacts?	**Differentiation:** Lower prior attaining (LPA) groups can have more detailed information at hand, already split into positive and negative impacts, and it is up to the students to place these at relevant points. Higher prior attainers can have more information and need to sift through these to find the key information.

Lesson 3: Who is the winner?	1. Students play a game from the other countries (i.e. if the students designed a game on Egypt, they would 'play' Ethiopia and Sudan's game, as designed by their peers). 2. Debriefing – following the mystery debrief format. The key points from the previous lesson should be discussed, along with ideas such as: 3. How could the different countries' games be linked? Where do they cross over? 4. Which country is most likely to 'win' or 'lose' this game? 5. Within the different countries, are there specific stakeholders who 'win' and 'lose' as a result of GERD? For example, how might someone in Ethiopia (generally considered a 'winning' country) actually lose out from the dam? How might someone in Sudan win? 6. Students respond to specific questions in an extended writing task, exemplifying the skills developed in the tasks.	**Differentiation:** • LPA can make notes on a structured work sheet, higher prior attaining (HPA) can make open ended notes. • Teacher manages Q+A through differentiated questions. • Differentiated by outcome.

Maude (2016) reiterates how important recognising cause and effect and the nature of causal relationships are to geography. I have often found that students can articulate short-term impacts well, however when asked to consider longer-term impacts students immediately jump to very catastrophic impacts like 'everyone dies'. Furthermore, students are often good at *recalling* a chain of impacts, but this recall is often very superficial; they lack understanding of the underlying factors, external circumstances or context that can exacerbate certain impacts, or change the course of the impacts all together. This harks back to McCrory's (2015) warning that understanding may be reference based. The aim of this task is to help students recognise that there is a chain of consequences that builds over time and certain interventions (both positive (e.g. delivery of humanitarian aid), and negative (e.g. a tropical storm)) can by-pass, accelerate or change the course of these impacts. Therefore, helping students develop a deeper understanding of the impacts of

GERD; to look beyond the obvious environmental impacts (e.g. Sudan would lose a very significant water supply), and to consider the holistic impacts (for example, linking lack access to water to reduced female education). I wanted to separate the impacts of each country so students could firstly disentangle the circumstances and consider the countries separately, and then look more specifically for patterns and links between countries to consider the whole case study.

Board games have often been used to support the learning of abstract concepts; they provide instant feedback to players helping maintain focus and attention (Huang & Ho, 2017). Games are used widely in geographical education; and games such as Snakes and Ladders are useful vehicles to communicate a large amount of information in an active learning situation (Warburton & Madge, 1994). Paterson (1984) uses Snakes and Ladders to help simulate geographical processes; in his case drainage basin systems. He encourages the teacher to highlight how the game simulates reality, but the teacher could also ask students what factors the game could not include or represent. These may be questions like: 'what sort of event may slow the construction of GERD? How does the length of construction change the impacts?'. Such questions would be posed by the teacher in the debrief session. The importance of the debrief is advocated in Leat's (1998) work; it provides the key moment for students to reflect and articulate their ideas, it provides opportunities for consolidation and to apply the learning to other contexts. Leat calls this the "multiplier factor"; the debriefing exponentially enhances the learning from that particular task or lesson (*ibid.,* p.6).

The debrief reinforces the reasoning skills, but these are not honed through the playing of the game; rather in the students' designing of it. Snakes and Ladders is a familiar game; students do not have to expend effort understanding the design, rather can divert their attention to the construction of the game and thereby focus on developing the snakes and the ladders that represent the causes and effects (Warburton & Madge, 1994). It is this part of the task that has several aspects designed to develop reasoning skills, thereby encouraging students' *thinking geographically*. I had planned to give each group some of the key information that they would have

to sift through, to establish which information was relevant or not. This aspect of the task was inspired by Leat's (1998) mystery instruction; it is important to create opportunities for students to deliberate over information and classify it as valuable or not. Not only does this encourage students to read and consider all of the information (rather than just engage with it on a superficial level) but also gives an additional opportunity for the teacher to ask students to explain *why* they chose certain information, and extend their explanations. This process itself may help students articulate and thereby make clearer their own understanding. The main reasoning skill developed through this task is causal; of linking information together to show their impacts to, or from each other. Causal reasoning is identified as a specific reasoning skill in (Stoel *et al.,* 2014), and is further identified in references such as Bunge and Leib (2020), who explain reasoning skills develop the ability to link and relate separate information. Linking together disparate information and identifying cause and effect relationships is certainly a demonstration of *thinking geographically;* as Maude (2016) articulated. The task later requires students to devise causal conclusions (i.e. convincingly answering the question: 'who is the winner of GERD'), which is an additional reasoning skill (Ding *et al.*, 2016).

The task has a number of possible limitations; firstly, and possibly most importantly: the lack of time. Devising the game has been given one lesson; in my school that is 40 minutes. In reality, by the time the task is outlined, resources handed out and then packed away, there is probably only 25 minutes available to students. Similarly, in the third lesson of the whole sequence, students would play the game, debrief *and* complete their extended responses. Achieving all of this without any aspect being rushed seems very optimistic. It would be possible to allow each task to naturally run its course, and take as much time as needed, however, if this meant a section of the lesson straddled two lessons, some of the momentum may be lost. There would be the potential to set the extended response writing as a homework task. This could be problematic

for two reasons; firstly, my school has a very strict homework schedule, and so the allocated homework slot may not fall in line with the lesson. This could be accommodated with careful planning, but is still a consideration, especially when attempting to teach the whole cohort as synchronously as possible. The second issue is that setting the extended writing as homework delays the process; this may mean that any additional thinking or understanding developed through the debrief is lost in the time-lag between the lesson and the students completing the homework. This is likely to be most detrimental for the LPA students who may have found the debrief especially useful to hear examples from their peers or be supported by their teacher in their own articulation of their ideas. In my experience, it is often (although not always) the case these students delay doing their homework, thus further separating their writing from the lesson. The impact of this could be reduced by providing prompts or scaffolding, however this may compromise the authenticity of the students' ideas.

As with any group task, some students may struggle to share the cognitive workload, and some may do more than others. However, I do not necessarily foresee this being an issue more than it would in any other tasks. Similarly, there may be some students who get distracted by the aesthetic nature of the task and having to make the game, rather than focus their attention on the geography that underpins it. This is also an issue with any kind of 'creative' task. Both of these issues are easily manageable with assertive supervision and encouragement from the teacher.

Task 2: Mystery – Who is responsible for the blood in 'blood coltan'?

This second task is designed for students to understand the role and accountability of different stakeholders in the coltan industry, and to ultimately come up with some ideas about who

is responsible for the atrocities caused by the industry. Although an original task, this second task is entirely based upon Leat's mystery task, as first outlined in Thinking Through Geography (TTG) (1998).

Table 5: Plan of mystery task

Task 'Name'	Who is responsible for the blood in 'blood coltan'?	(A mystery based on TTG's mystery format)
Aim of Task	To identify different stakeholders' responsibility in the coltan mining industry	
Lesson 1: Task launched.	(This lesson has previously followed a lesson on 'Blood Diamonds') 1. Students split into groups of 3 or 4. 2. Distribute resources. 3. Ask students to read key question on the envelope and come up with suggestions based on blood diamond. 4. Spread contents of envelope over table, check they have full set and read through. 5. Explain aim of the task is to answer the key question, but there is no right or wrong answer. Explain that sorting the statements may help them organise the evidence to answer the questions. 6. Allow the mystery to begin. After 5 minutes or so, see how the 'sorting is going on'. 7. Give students fixed time period ready for debrief. 8. Debrief: Led by teacher. Follows debrief guidance from TTG. Allow questions to be organic and encourage students to 'piggy-back' and challenge each other's ideas.	**Differentiation:** • Allow HPA to come up with their own coding classifications. LPA may be given some suggestions of categories. • Ask HPA to also order their information in terms of most useful to support their conclusions. • Open ended questioning in the debrief.
Lesson 2:	1. Summary of debrief 2. Extended writing to answer the initial key question.	**Differentiation:** • Begin with LPA to summaries simpler facts from the mystery. • Students use their notes and additional information from the previous lesson (I.e. a summary sheet of the information, not necessarily cut or sorted, but available to prompt memories. • Additional questions for HPA who may have finished: "How might things be different in

		the future?", "Should coltan mining be happening at all/what would be the impact of it being banned?"

The context of the case study; coltan mining in the DRC is likely to be very abstract to students in rural Surrey, however they are inextricably linked to the conflict as all of them will have a device that uses coltan. I deliberately chose the mystery, rather than one of my original tasks to explore this case study as I wanted to ensure that I could facilitate students thinking about their own position. The mystery is a tried-and-tested method, particularly useful for helping students to think about moral or ethical issues in geography, where there is no fixed answer, and the content can be contentious (Applis, 2014). Furthermore, Karkdijk *et al.* (2019) specifically identified the mystery as a strategy "designed to provoke geographical reasoning and relational thinking by students" (p.5). Therefore, a research project looking into tasks designed to support *thinking geographically* and its associated geographical reasoning would be negligent to not include a task inspired – at least in part – by the TTG mystery.

Developing arguments is undoubtedly the key skill developed through mystery-style tasks and can happen in a number of ways throughout the task and the associated debrief/extended writing. Just as in Snakes and Ladders, some information slips in the students' packs were deliberately ambiguous and open; requiring students to critically evaluate its inclusion in their arguments (Leat & Nichols, 2000). This can provoke a dialogue between students as they work together to justify inclusion and can be further built upon by the teacher in the debrief. Sifting through information to choose specific evidence that will support a claim is a key reasoning skill; helping students develop successful argumentation (von der Muhlen *et al.*, 2019). Dialogue between students, both in the 'solving' of the mystery and that facilitated by the teacher during the

debrief provides a key opportunity for students to rationalise and develop their arguments. The initial claims made by the students are likely to evolve as the dialogue between them continues; as they entertain each others' viewpoints, or attempt to make stronger their own claims to convince each other, their explicit explanations and justifications are likely to develop (Leat & Nichols, 2000). To make these claims, students need to process and make sense of disordered information, classify and categorise it (Leat, 1998). To be able to complete these aspects of the task, students need to inductively reason about the information in front of them; scrutinising the information both for its individual value, but also within the context of other information (Klauer & Phye, 2008). As with Snakes and Ladders, I had intended the mystery task to be followed by a debrief and some extended writing time. This would allow the students time to piece together the arguments they had built and heard from their peers to think reflexively, consolidating both the skills developed and content learned in the lesson and the task (Leat, 1998).

One of the limitations associated with mysteries is the lack of written work they produce (Leat & Nichols, 2000). This would have not been an issue in my study as written work was my intended 'method' of data collection, so became an additional element of the task. Therefore, this usual limitation was reduced. However, Leat (1998) explains how the quality of written work does not often reflect the quality of the discussions and debriefing; that without the prompting and structure provided by the teacher in the debrief; "too many students just wrote down what they could remember was on the statements without much attempt to explain" (p.57). However, this may be overcome with additional prompts and criteria set, to encourage as much explanation and justification (and therefore demonstration of the reasoning skills) as possible.

The mystery shares the same potential limitations as Snakes and Ladders; imbalances in groupwork, time pressures and potential silliness with the resources. However, I feel these could be mitigated again through careful planning. The biggest limitation of the mystery is the time

requirement of the teacher; and I experienced this in my planning and is echoed by Leat in his summary (1998). As the task was never taught, I did not fully resource it; but researching the information, making the slips and then cutting them out would have taken a great deal of time. As I intended this mystery to be as authentic as possible to the TTG formula, I was caught between following Leat's instructions (set out clearly in the 1998 TTG handbook) and worrying that I was trying to fit content into a task that might not represent Leat's intention. For example, generally it is advised that the overall question to the mystery is open-ended and deliberately intriguing and ambiguous (*ibid.*). However, I struggled a great deal in coming up with this question and am still not convinced it would have met Leat's criteria. Moving forward, the time and thinking required by the teacher in preparation is something that may well discourage wider use of the mystery. Another limitation to consider is the debriefing. Whilst this is a key aspect to the mystery, it is potentially limited by the teacher's efficacy and competence (Hooghuis *et al*. (2014). The attention-span, behaviour and willingness of the students must not be underestimated. Without even teaching the task to my two classes, I could confidently predict that one class would engage with the debriefing much more than the other; whereas attention span and resistance to cognitive challenge may compromised the debrief with the other. This in turn may have impacted the extent to which students could express their ideas in their written work; if they had not had time in the debrief to consolidate their understanding, they may have found this concluding element even more difficult.

Task 3: Favela 'Shapes'

This task focused on identifying the relationships and conflicts that exist between different stakeholders in the favelas of Rio de Janeiro.

Table 6: Plan of shapes task

Task 'Name'	Favela Triangles	
Aim of Task	To show cause and effect and interconnected relationships between stakeholders in favelas in Rio de Janeiro	
Lesson 1: Task launched.	Concept of informal settlements and their development introduced. Context of Rio and favelas explored.	
Lesson 2:	1. Students watch a short video about life in favelas, paying particular attention to the different stakeholders. 2. Through class discussion, the main stakeholders in the favela conflict are identified (favela residents, police, gangs, politicians etc). 3. Students pick at least three stakeholders, and write their names, well spaced out, on their paper. Then, draw double ended arrows between all of the stakeholders. Each arrow is then annotated explaining the conflict between those two stakeholders, outlining each stakeholders' opinion. 4. Other annotations can be added to the 'shape'; external factors, the impact of another stakeholder on a conflict between two separate stakeholders etc. This part of the task should take at least 20 minutes or so. 5. Students respond to questions on the board such as: • Which conflict would be easiest to resolve? • Which stakeholder impacts other stakeholders' conflict the most? • How might these conflicts change in time?	**Differentiation:** The key opportunity for differentiation comes from the number of stakeholders added to the diagram. For lower prior attaining students, three (favela residents, police and gangs) could be used. As the links between these groups become clearer, students could be encouraged to add additional stakeholders or annotations.

This task is inspired by the Cox *et al*.'s (2019) work on causal or relational diagrams. They suggest that supporting students to externalise their ideas and demonstrate mental representations help "contribute to a better understanding of the related variables and to the elaboration of the cognitive schemata in the head of the learner" (*ibid*, p. 15). This leads to much more profound relational reasoning (*ibid*). As with the other conflicts explored in this topic, I anticipated many of the students would struggle to mentally situate themselves in the context of the case-study; Rio de Janeiro's favelas are a long way away from our school. I wanted to come up with a way to represent and highlight the complexity and interrelated nature of the conflict, rather than just list those

stakeholders involved. Over the course of the task I had hoped that the shapes (the relational diagrams) would not only show the relationships between stakeholders, but also help students recognise the external factors and variables, cause-effect relationships, the effect of time and space and feedback loops. This would then lead to "the idea of geographical systems thinking, which is a holistic approach that focuses on how constituent parts of a geographical system are related to each other, how such a geographical system responds to changes, and how geographical systems work within the context of larger geographical systems" (Favier, 2017 as quoted by Cox *et al.*, 2019b, p.239). Relational thinking (a type of reasoning identified by Bunge and Leib (2020) about geographical information is a key component of *thinking geographically* (Lambert & Morgan, 2010).

Having constructed their shapes, the students could refer back to these connections in their extended writing. The writing task following the construction of the shapes would be shorter than those following the Snakes and Ladders and mystery tasks, as the annotations on the shapes could also demonstrate relational thinking and be used to assess the task. Compared to the other tasks, relational diagrams are simpler and the development of skills more tangible; the whole point of the task is to externalise the relational aspects. However, I do not feel that the simplicity of the task would reduce its efficacy; in fact, I think it may be a considerable advantage. As there is no group work required, students need to work independently, allowing the teacher to identify anyone who may need more support. As the students are given creative licence to design whatever shape they like, I hoped this would encourage them to think a little more reflexively about the connections between stakeholders. As with the previous tasks, there is no required outcome, no right or wrong answer, and I also hoped this would give students confidence to explore their ideas.

Without completing the tasks it is not possible to establish if it could have been improved by including a debrief. It would have been interesting to compare the quality of the answers

produced by tasks followed up with the debrief with that of the shapes task. This would be something easily established through future research. As with the other tasks, there may be a danger of students getting distracted by the creative aspect of the task, rather than the geography, but with careful support they could be easily steered back on course.

Additional Considerations

To holistically evaluate the tasks, there are a number of additional considerations. In terms of teacher workload, the Favela Shapes task is certainly the simplest; there is no additional research or resourcing required, and as there is no groupwork; much less practical classroom management required. Whilst this seems a far less profound attribute to acknowledge than those concerned with learning, it is an important consideration. A task that is simple, low-stakes resourcing and easier to manage is more likely to inspire confidence in the teacher, who may then feel more relaxed about the task evolving organically. If one had spent hours researching, printing, cutting and putting information into envelopes to have your class not buy into the task, the teacher may feel more obligation to 'make the task work'. This could result in more 'helicopter' teaching, which would reduce the organic learning otherwise initiated by the tasks. Leat warns against giving too much support to the mystery; as it can compromise the discussion that develops the thinking (1998). The mystery and Snakes and Ladders require a significant amount of planning that may not be practical or sustainable for some teachers.

Time required to teach the task must be considered. Overall, Snakes and Ladders and the mystery would have taken the longest amount of time; requiring a lesson to introduce background content, one lesson to construct the game or solve the mystery and another for debrief and extended writing. Whilst the length of each of these tasks and their associated teaching does not necessarily impact their efficacy in developing reasoning skills, it is a possible limitation. If three lessons are required to teach one case study, this may have implications on the teaching of other aspects of the course; potentially requiring the teacher to teach some aspects more superficially

than others. My concern with time may be specific to my context: we only teach 40 minute lessons. However, in my previous school, all geography lessons were 60 minutes, which would have meant the tasks may have only spanned two lessons, rather than three. The best solution may be to pepper a topic with a variety of tasks such as these, rather than repeatedly use them. In the planning of a scheme of work, it may prove useful to highlight topics that would lend themselves to specific tasks, rather than try to make a task work for an arbitrary topic.

This leads to another consideration when evaluating the overall efficacy: what is the possible use of tasks across other topics? The mystery and Snakes and Ladders are the tasks that seem least able to be adapted easily across the curriculum; they fit and serve the learning of a certain type of content (problem solving/ cause-and-effect) best. However, a task based on relational diagrams, such as the Favela shapes could be used to explore other geographical systems, webs or context that experience flows and stores. Therefore, whilst relational diagrams may not necessarily elucidate the most profound examples of *thinking geographically*, they certainly support one of the most important aspects of it (Lambert & Morgan, 2010), in the widest variety of contexts.

I had initially planned to rank these tasks, in terms of most effective at supporting the development of reasoning skills, and thereby demonstrating *thinking geographically*. However, through the process of designing and appraising them, ranking them in relation to each other is futile. Firstly, and from a research perspective, each task has far too many variables to make a valid comparison. These variables would have included the order they were taught, the accessibility of the content, even the proximity of the lesson to lunch break may have impacted the students more than the tasks themselves. Secondly, the tasks all develop a different reasoning skill, and whilst individually they can be appraised in developing their specific skill, it would have been nearly impossible to compare them. Of the reasoning skills targeted by the task; relational thinking, cause-

and-effect articulation, argumentation etc., some may be more easily developed than others. Establishing this was beyond the scope of the study, whether it had actually managed to happen or not. Furthermore, as tasks would have been taught over the course of the term, each would have (hopefully) had a cumulative effect on students' reasoning skills, and therefore their ability to demonstrate *thinking geographically*. This meant that the task taught last may well have generated the most profound answers and clear examples of *thinking geographically* without being independently responsible. From a teacher's perspective, this is only a positive outcome; by whatever means positive development is always positive. However, from a researcher's perspective, not being able to identify the cause of the positive development would be frustrating. Roberts (2014b) explains how students will benefit over time if the teacher has established a "culture of critical enquiry in which they are constantly expected to ask questions, scrutinise data and consider the extent to which evidence supports claims and conclusions"; students will become "naturally critical thinkers" (p. 58).

Conclusions

Thinking geographically underpins school geography and informs the tasks designed and set by teachers. However, it is also the approach that allows students to actively engage in the geography around them, outside of the classroom. It grants them agency and brings them meaning. Therefore, identifying the reasoning skills that underpin *thinking geographically* and attempting to actively develop them are important processes to support students' geographical education. Despite not being able to do any of my planned research, this project provided an opportunity for me to really consider what *thinking geographically* means, and how it might be supported in my classroom. I hope that when we return to school, the ideas and theories underpinning *thinking geographically* and *geographical reasoning* will inform my practice. I am planning to present my findings formally to my department, and to our SLT. I feel that there is significant scope for the application of these tasks; to other subject areas. A mystery could be well utilised to address a historical enquiry, Snakes and Ladders could demonstrate an economic period to business students, causal diagrams could help students engage with complex character relationships in a Shakespeare play. No doubt other subjects already have specific tasks to address their discipline-specific reasoning skills, but cross-pollination may prove interesting.

With regards to the research questions, conclusions are limited in their validity as no research took place. However, through my literature review, appraisal of my methods and designing the tasks myself, it is possible to make a few suggestions based on the process of my theoretical and 'hypothetical' research.

1. What is reasoning? How does it relate to thinking geographically?

Through the analysis of the literature, my interpretation of *thinking geographically* is that it is the organic and holistic demonstration of a number of reasoning skills, such as linking ideas, developing claims with solid explanations, making thoughtful suggestions about what might happen in the future. These skills are reasoning skills, and when they are used to make sense of geographical processes and systems, a pupil is demonstrating *thinking geographically.* Academics such as Karkdijk *et al*. (2019) and Cox *et al*. (2019) refer to this as *geographical reasoning*, but through more thorough examination, their explanation of *geographical reasoning* seems synonymous with *thinking geographically*. The only minor difference, perhaps, is that *geographical reasoning* may be the use of one specific skill to understand a geographical process or system, whereas *thinking geographically* is the collective and holistic use of a number of skills, and is also informed by an inferential approach, rather than a representational one.

It would have been very interesting to talk through the implications of the semantics of these terms; does identifying them as skills (based on reasoning skills), or a subject specific process (*geographical* reasoning) or a holistic concept (*thinking geographically)* impact the way teachers and students think about what they are doing?

2. What do teachers understand by thinking geographically? When do they see it in the classroom?

Sadly, due to the closure of schools, I have not been able to complete the planned research to answer this question. I have my own understanding of *thinking geographically* which I have outlined above, but I would not want to use my understanding to make a sweeping generalisation. Should the opportunity arrive, I would still like to interview my colleagues to develop my understanding of their interpretations.

My Part 2 thesis began to address this question, yet I felt the need to include it in my Part 3 research as I did not yet feel I had a great enough understanding. This research question also allowed for natural collaboration that evolved from the focus group; as my colleagues discussed their understandings and interpretations of *thinking geographically*, these may have evolved further as we designed the tasks. Therefore, ongoing collaboration was vital to ensure that any developments of my colleagues' understandings were shared, and able to address this question.

I feel strongly that there is great value in establishing teachers' understandings of this question. Based on my prior experience, and suggestions from academics such as Morgan (2017); one of the reasons *thinking geographically* remains a buzzword or concept, rather than physical process is lack of clarity in teachers' interpretations of the term. I feel that many teachers' understanding, including my own to a certain extent, is representational, rather than inferential. Perhaps this is the reason we have previously struggled to practically incorporate it into our classrooms. I had hoped that my research would help unpick these understandings, to help build back up in a more meaningful way for teachers.

3. What tasks can support and develop reasoning in the classroom?

I feel confident that all the tasks I designed would have supported the development of a reasoning skill, and therefore through the scheme of work, pupils' overall reasoning would develop. As these individual skills developed, and pupils began to express them in their written work, I feel I would have been able to conclude that they were *thinking geographically*. I have done my best to objectively appraise the tasks, but without doing a 'live run', it is impossible to fully assert if the tasks would even work; let alone develop reasoning skills. Again, when the opportunity arises to teach these lessons, I will have the chance to consider their efficacy.

As a busy teacher with a hundred balls in the air, I really value tried and tested tasks and lessons my colleagues have shared. I feel very strongly that for the best outcomes for the largest numbers of students, teaching needs to be a collaborative process; work and ideas are shared, cross pollinated and reflected on as a team. I had hoped that these tasks' theoretical base and practical design would have been validated through the research – even if it took a number of cycles – and could be shared to support *geographical thinking* in different classrooms. Part of the benefit of performing practitioner action research is direct link between research and practice, and how they can inform and develop each other. I hope in due course, this can take place.

Further Research

The primary objective for any further research will be to teach the tasks planned, share with my colleagues for collaborative evaluation and modification and attempt to make more formal and substantiated conclusions. Following completion of these tasks, my primary interest would be to investigate the connection between *thinking geographically* and inferentialism. This research merely touched upon the connection; and used this possible connection to help reiterate the importance of developing reasoning skills. This research focused on the practical application of *thinking geographically*, but there is great potential to further develop the theoretical understanding of the concept; its role in knowledge construction and meaning making.

However, there are some additional areas for future attention:

1. **Tasks and reasoning skills**
    - Design of tasks that address other reasoning skills and assessment that helps evaluate a student's reasoning.
    - Consideration of the extent to which explicitly identifying skills to students supports their understanding of the skill. These tasks do not intend to explicitly draw the

students' attention to the individual skills, instead it focuses on the holistic product of the skills: developing substantiated claims and ideas. Would the students' understanding and adoption of the skills be more efficient and effective if they were more explicitly addressed?

- How might these reasoning skills have application across the curriculum? Are other subjects attempting similar tasks, and how might they inform practice in Geography?

2. Interpretations of *thinking geographically*

- The meaning and interpretation of *thinking geographically* by practitioners and academics could have further attention, especially regarding its application in assessment. How does it, or can it underpin assessment, and does it have a role in public examinations?

3. A curriculum-wide approach

- Where other subjects use similar terminology to *thinking geographically*, (for example, the use of *computational thinking* in computer science), how do they use these terms to inform their practice?

Teachers are developing effective practical tasks that support the development of specific skills in their classrooms everyday. However, as we unpick *thinking geographically,* we can more explicitly describe how and why these tasks are working. Once I have had the chance to teach these lessons, further appraise them with my colleagues and modify and improve them, I hope to be able to share them through the Geography Education community for other teachers to use, provide feedback and improve. This may inspire the development of more tasks that address other reasoning skills which may help students, it may provoke more conversation about what *thinking*

geographically means and what it looks like, and will hopefully ensure that it remains the greatest defining feature of geography students.

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