Facilitating Curiosity and Creativity in the Classroom
An International Multisite Video Study

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Foreword

This report details the research study *Promising Practices: Curiosity and Creativity* conducted by a team at the Oxford University Centre for Educational Assessment and funded by the Jacobs Foundation. We would like to acknowledge the generous award from the Jacobs Foundation which made this research possible during the pandemic. The research project has been possible despite the challenges faced during lockdown because of its very collaborative nature. We therefore would like to thank and show our appreciation to colleagues in different organisations across countries and time zones which made this project possible.

The purpose of the report is to examine the promising practices documented through the video recordings of 21 teachers from 19 classrooms across nine different countries, with the aim to share results to improve classroom instruction globally. The research team collected data in International Baccalaureate Primary Years Programme schools in Denmark, Germany, Ghana, France, India, Italy, The Netherlands, Norway, and Sweden from May to November 2021.

We would like to thank Professor Marte Blikstad-Balas, University of Oslo, Norway, our Expert Advisor on video studies, for her ongoing commitment to the project, and, for her advice during the research process and her feedback on the research instruments. We would also like to thank Edlyn Chao, Research Manager at the International Baccalaureate for her feedback on the research instruments, the interim report and analyses, and for her support in the recruitment of schools. We further thank colleagues at the Australian Council for Educational Research (ACER) for the collaboration throughout the project, including the initial seminar on Curiosity and Creativity in September 2020 and the curiosity and creativity literature reviews which were helpful in the development of our research instruments. A particular thanks to Brad Shrimpton who was a key person in the first phase of the project, facilitating the online, global seminar in collaboration with Josh McGrane and Therese N. Hopfenbeck from OUCEA and Sarah Richardson in ACER. A special thanks go to Nora Marketos from the Jacobs Foundations who has followed the process through Advisory Board meetings and provided helpful input and facilitated opportunities for dissemination at an early stage.

We would also like to thank the participating teachers in Denmark, France, Germany, Ghana, India, Italy, The Netherlands, Norway, and Sweden who participated in this research study, and gave their time to share their knowledge and experience on teaching and learning in the PYP programme. Given that we have collected data during a pandemic, we acknowledge the workload and stress teachers and school leaders have been facing. This research study could not have been conducted without their valuable input and their willingness to share their experiences and expertise. In addition, we would like to thank all the student participants who agreed to take part in the study and volunteered to be interviewed to elaborate on the issues around curiosity and creativity. We also thank the parents of students who provided their consent for us to engage with their children. As this report demonstrates, at the heart of promising teaching practices, is the teachers' ability to listen to students' voices. We are grateful to students who shared their views on what they believe enhances their curiosity and creativity and hope the knowledge can inspire teachers who continue to educate students for tomorrow's world.

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1. Introduction

Curiosity and creativity are recognised as important skills to support future generations to grapple with the important questions, shifting challenges and exciting opportunities of the 21st century (Organisation for Economic Co-operation and Development [OECD], 2018). Researchers highlight that curiosity is associated with knowledge acquisition, effective learning experiences, and academic progress (Australian Council for Educational Research [ACER], 2021b; Pekrun, 2019; Shin, & Kim, 2019). The development of creativity encourages imagination, experimentation, and thinking outside the box to solve problems (ACER, 2021a; Kaufman, 2018). Both skills are needed to facilitate more equitable outcomes for students and increase their chances of thriving in a changing society (OECD, 2018, 2021). But how do teachers around the world foster these skills? This multi-site, international study across 19 classrooms and 9 countries reveals the promising practices of teachers working in diverse global contexts to foster curiosity and creativity among primary school students, within the International Baccalaureate's (IB) primary years programme (PYP).

Recognition of the essential role of curiosity and creativity in education is increasing (e.g., Barbot et al., 2015, Dede, 2010; Jirout, 2020; Plucker et al., 2004; Vincent-Lancrin et al., 2019). The purpose of this study is to understand how teachers from diverse contexts facilitate curiosity and creativity among primary school students, and the findings will be used to develop resources that will enhance teachers' professional development. These resources will be shared following the publication of this report.

The Promising Practices Study

The study has been conducted in four phases that were agreed with the Jacobs Foundation and the International Baccalaureate Organisation (IBO).

Phase 1 - Instrument development for documenting promising practices: OUCEA developed classroom observation tools, video analysis protocols, interview schedules and quantitative curiosity and creativity student tasks. Instruments were developed for documenting and codifying promising practices that are suitable for use in PYP classrooms across different contexts and cultures. Instrument development were informed by previous studies, and the online symposium on Curiosity and Creativity in September 2020, facilitated by the Jacobs Foundation and the IBO, which brought together experts from around the world to launch the research partnership.

Phase 2 - Recruiting schools/teachers and building partnerships: OUCEA secured the participation of schools and teachers for the rigorous exploration of promising practices that are implemented in the selected IB schools. Recruitment commenced through first inviting all PYP schools, using IB communications channels, to express interest in study participation. Recruitment efforts were hampered by the Covid-19 pandemic which severely limited the availability of schools willing to participate. As a result, seven of the nine participating schools are in Europe.

Phase 3 - Data collection in IB PYP schools: Due to the global Covid-19 pandemic, the original proposal of in-person international data collection could not be carried out. To address our research question of how teachers facilitate curiosity and creativity among primary school students, the research team developed a strategy to collect data from classrooms across the globe remotely using self-captured classroom videos to enable an in-depth exploration of practices to occur remotely. We have collected

multi-site data through online consultations, teacher-captured classroom videos, online student creativity and curiosity tasks, and online teacher and student interviews.

Phase 4 - Material finalisation: The research team have developed project videos to explain the different promising practices that foster curiosity and creativity and engage teachers in knowledge exchange and feedback. Further resources and materials, including infographics, have been co-developed throughout this process.

The Research Questions

The following research question was agreed with IB to be addressed in the research study:

How do International Baccalaureate teachers foster curiosity and creativity among primary school students?

The following sub-questions were developed to explore different aspects of the main question:

- What are the observable promising practices that teachers use for fostering curiosity and creativity?
- Which observable practices align with the literature, and which are novel?

2. Literature Review of Curiosity and Creativity

2.1 Defining Curiosity

Heard and Anderson (2021) suggest that "Curiosity is a cognitive state that involves the recognition of a meaningful gap in one's knowledge or understanding, the desire to fill that gap and the motivation and intrinsic satisfaction of doing so." (p.5). Pekrun (2019) provides a similar definition, "a psychological state that includes three components: recognition of an information gap, anticipation that it may be possible to close it, and an intrinsically motivated desire to do so" (p.905). Pekrun distinguishes this from the broader concept of interest which he defines as "intrinsically motivated engagement with any specific object, content, or activity" (2019, p.905). Loewenstein (1994) describes curiosity in terms of a "cognitive appetite" which is stimulated by a lack of information which causes uncertainty or put another way, curiosity is the desire to fill an information gap to ease the psychological discomfort of uncertainty (Loewenstein, 1994, p.855). The OUCEA research team explored teacher practices that encouraged and fostered this desire for knowledge, and we also sought to illuminate student experience of this.

Scholars have written about different types of curiosity. For example, *epistemic curiosity* is the desire to seek and obtain new knowledge and this can be facilitated by events such as 'novel questions' or 'unsolved problems' that reveal a gap in knowledge and a desire to fill that gap (Litman et al., 2005, p.559). In addition, Boyle (1983) and Grossnickle (2016) describe *trait (or diversive) curiosity* as dispositional or a characteristic of an individual. This is sometimes referred to as dispositional interest or I-type (Litman & Silva, 2006; Litman et al., 2010). This is, however, not useful for this project as our goal was to identify best practices of teachers rather than the enduring characteristics of students. Moreover, our aim in the study was to identify practices that foster curiosity as opposed to interest (see Shin & Kim, 2019 for current debate on the difference between interest and curiosity). There is also *state (or specific) curiosity,* which is temporary and situational, and this is sometimes referred to as deprivation-curiosity or D-type (Litman, & Jimerson, 2004; Litman & Silva, 2006; Litman et al., 2010).

Another distinction is backward versus forward curiosity (Shin & Kim, 2019). *Backward curiosity* is triggered by surprise when a prediction is proven incorrect (an incongruity), which leads to a search to determine why and knowledge revision (Kashdan, et al., 2018). This aligns with previous information gap filling models of curiosity (Loewenstein, 1994; Markey & Lowenstein, 2014). *Forward curiosity* is triggered by a lack of desired knowledge and anxiety which lead to knowledge acquisition. Shin and Kim (2019) have suggested that backward curiosity promotes deeper engagement. Both types were relevant for this study, and we sought to illuminate instances of each.

Lastly, Kashdan (2009) has suggested that stretching and embracing are two dimensions of curiosity. *Stretching* involves the motivation to seek knowledge and new experiences, while *embracing* is about a willingness to embrace that which is uncertain or unpredictable in life (ACER, 2021b; Kashdan, 2009). While *embracing* was beyond the scope of this study as it requires more in-depth engagement with participants, *stretching* was relevant, and we identified examples of this. Lastly, *social curiosity* (overt) refers to curiosity about other people (Kashdan, et al., 2018). This was also relevant to our study particularly when group work was involved.

The Australian Council for Educational Research (ACER) proposes a framework for thinking about curiosity in the classroom, the framework comprises two dimensions: focusing curiosity and resolving

knowledge gaps (Heard & Anderson, 2021). Each dimension is then subdivided into three further subdimensions:

Dimension 1: Focusing curiosity
1.1 Engages with and explores conceptual conflicts
1.2 Enhances motivation to learn
1.3 Refines questions of value

Dimension 2: Resolving knowledge gaps
2.1 Explores answers and thinks critically
2.2 Sustains effort
2.3 Evaluates learning
(Heard & Anderson, 2021, p.9)

This framework helps conceptualise curiosity as different from interest, by emphasising the distinguishing element of 'knowledge gaps' which is noted as a key element of the 'informational gap theory' (Loewenstein, 1994; see also Grossnickle, 2016; Pekrun, 2019). As this curiosity framework was developed simultaneous to our data collection, the ACER framework did not exist in time to inform our method development. However, it has been a very useful lens to further interrogate and analyse our findings: in Sections 5 and 6, we discuss the value of this framework and the 'curiosity thermometer' (Heard & Anderson, 2021, p.22), as a reflective tool and their implications for promising practices for fostering curiosity.

2.2 Defining Creativity

There are numerous definitions of creativity and scholars do not agree on one specific definition. Despite this, over the last 60 years, there has been a broad consensus on the components of creativity, with most researchers agreeing that creativity includes at least two core aspects: newness or originality and usefulness of the creation (Guilford, 1967, 1975; Helfand et al., 2017; Torrance, 1962). Rhodes (1961) 4P model has also been influential, it conceptualises person, process, product, and press (press meaning the individual's environment and surroundings). Scoular and Ramalingam (2021) define creativity as "a material, mental and/or social process that leads to the production of novel and useful ideas, approaches and solutions. It involves the exploration, generation and evaluation of both problems and ideas, made possible through divergent, experimental and convergent thinking" (p.6). Of importance to the current study is the consideration that creativity is best understood through the lens of the sociocultural and historical context within which the creation occurs (Helfand et al., 2017). Creativity can also be described as the interaction among aptitude, process, and environment by which an individual or group produces a perceptible product that is both novel and useful as defined within a social context" (Plucker et al., 2004, p.90). Furthermore, creativity consists of originality and effectiveness (appropriate and useful) (Runco & Jaeger, 2012, p.92). We explored teacher practices that encouraged and facilitated this process and we also analysed student experiences of this.

Scholars have written about different types of creativity including "Big-C" or *eminent creativity*, which impacts society and "little-c" which refers to everyday creativity which most people have. Kaufman and Beghetto (2009) expand on this and propose a Four-C model of creativity, adding "mini-c" which accounts for interpersonal insights and interpretations: the authors provide a further explanation of this from the work of Vygotsky (1967/2004): "any human act that gives rise to something new is referred to as a creative act regardless of whether what is created is a physical object or some mental

or emotional construct that lives within the person who created it and is known only to him" (p. 7). Kaufman and Beghetto (2009) use the example of a child who likes princesses and whose parent is a mycologist, and the child creates the concept of a 'mushroom princess'. This notion may seem to push against the idea that creativity necessarily produces both a perceptible and useful product. However, it may be that this idea is, in some way, useful to the child. Lastly, there is Pro-c, *professional level creativity*, which considers gradations between professional and eminent (Kaufman & Beghetto, 2009; Kaufman, 2019). The Four-C model attempts to conceptualise the variations and gradations between Big-C and little-c which may be useful for identifying different types of creativity in educational contexts (Kaufman, 2019).

ACER proposes a framework for thinking about creativity in the classroom and articulates three dimensions: problem definition, generating ideas and quality of ideas (Scoular & Ramalingam, 2021). Each dimension is then subdivided into further subdimensions:

Dimension 1: Problem definition
1.1 Discovery-oriented behaviour
1.2 Formulating a problem

Dimension 2: Generating ideas
2.1 Fluency
2.2 Flexibility
2.3 Experimentation

Dimension 3: Quality of ideas
2.1 Originality
2.2 Fitness for purpose
2.3 Elaboration
(Scoular & Ramalingam, 2021, p.9)

As previously mentioned, this framework was also developed simultaneous to our data collection, therefore the framework did not inform our method development. This framework provides a useful lens to critically analyse our findings; in Sections 5 and 6, we discuss the value of this framework and the 'creativity thermometer' (Scoular & Ramalingam, 2021, p.24) as a reflective tool, and their implications for promising practices for fostering creativity.

2.3 Why is Curiosity Important?

ACER (2021b) have noted that curiosity has been found to positively correlate with several aspects that facilitate learning, including inquiry (Murayama, 2019; Murayama et al., 2019; Pekrun, 2019), knowledge acquisition (Kashdan et al., 2018), memory and effective learning experiences (Gruber et al., 2014), engagement (Vracheva et al., 2020), academic achievement and meaning of life and life satisfaction (Kashdan & Steger, 2007). Critical curiosity is a component of learner commitment and engagement, with learners taking more responsibility for their learning, demonstrating a willingness and enjoyment of asking questions and embracing deep learning strategies (Crick et al., 2004, p.255). The desire to learn is one of the most important determinates of how successful people will be in school, in work and in life and employers are more likely to seek out and hire those with high levels of intellectual curiosity (Horvathova, 2019, p.43).

2.4 Why is Creativity Important?

For policymakers, "the purpose of promoting creativity, at a general level, can be seen as a means of meeting the challenges posed by a changing world and its unknowns" (ACER, 2021a, p.3). Rhodes (1961) characterizes creative learners as being able to look at things differently (which suggests divergent thinking), utilize imagination and experiment with ideas and perspectives. This suggests that this sort of 'thinking outside the box' may result in creations or solutions to problems that more rule-bounded thinking may not observe.

Kaufman and Beghetto (2013) cite several studies that demonstrate the importance of creativity. Florida (2002) asserts that creativity is considered a crucial economic resource for the 21st century. Agars et al. (2008) also consider it vital for organizational success. Other studies suggest that people engaged in creative activities have better physical health (Stuckey & Nobel, 2010), may have higher general wellbeing (Carson et al., 1994; Plucker et al., 2004; Richards, 2007), and resiliency (Chen & Padilla, 2022; Metzl, 2009). In addition, studies find creativity is associated with improved mood (Amabile et al., 2005), and reduced personal stress (Nicol & Long, 1996). Creativity has also been linked to academic achievement and stronger relationships have been identified when creativity is measured using a standardised as opposed to self-report measures (Gajda et al., 2017).

Beghetto and Kaufman (2007) found that mini-c creativity can serve as the foundation for higher levels of creativity. In addition, these authors also argue that mini-c insights are a key aspect of meaningful learning (Beghetto & Kaufman, 2009, 2010a; Kaufman & Beghetto, 2009b). The authors also note that mini-c insights can develop into larger creative contributions, and as such, educators should be aware of it and cultivate it in the classroom.

2.5 Early Research on the Link between Curiosity and Creativity

We have defined curiosity and creativity and discussed the importance of each for education and career. Early exploratory research suggests there may be a relationship between the two concepts. ACER (2021b, p.30) note that curiosity has been found to stimulate creativity in some instances. They cite the work of Hardy and colleagues (2017) who argue that diversive (as opposed to specific) curiosity may encourage:

> *"*… a broad focus of attention that facilitates breadth in information seeking and a cognitive emphasis on global information processing that is fundamental to idea generation." (p. 235)

In addition, Schutte and Malouff (2020) conducted a meta-analysis of the relationship between curiosity and creativity in which the consolidated results across 10 studies with 2,692 individuals found that there was a significant association between more curiosity and greater creativity (p.940). Despite this, creativity is not readily understood. This is in fact one of the primary reasons for the increased focus on gaining more robust assessments of creativity (OECD, 2021), and more meaningful ways to evidence progress in this domain (Richardson & Krstic, 2021).

It is important to note that research tends to explore either just creativity or just curiosity: meta-analyses suggest there is emerging evidence of the two skills' connection (Schutte, & Malouff, 2020) and recent research emphasises a strong call for investigation into the two to develop an evidence base to better understand the link between curiosity and creativity (Gross et al., 2020; Hagtvedt, et al., 2019). The current study responds to this call by examining the ways in which teachers are fostering these skills within the classroom.

2.6 Developing Curiosity and Creativity in the Classroom - Promising Practices

ACER (2021b) cites several studies that discuss instructional approaches that have been shown to facilitate curiosity. These strategies include the development of inquiry-based activities (Murayama, 2019; Murayama et al., 2019; Pekrun, 2019); personalizing the learning experience and relating topics to students' lives (Markey & Loewenstein, 2014), and helping students identify gaps in knowledge, determining what they already know and need to know to begin a learning activity. In addition, stimulating and teaching students how to be comfortable with uncertainty can drive curiosity (Peterson, 2020; Jirout, et al. 2018). However, strategies for scaffolding should be employed to ensure the degree of uncertainty does not hinder curiosity (Shin & Kim, 2019). Teachers can also encourage students to ask questions, and they can model curiosity and scaffold exploration (ACER, 2021b, p.20). We will discuss the aforementioned teaching strategies in more detail.

Inquiry-based learning approaches are learner-centred and utilize questioning to stimulate student engagement (Chu et al. 2017). This approach has been shown to promote students' ability to apply knowledge, foster deep learning (beyond rote learning or memorization, a focus on understanding or imposing meaning), reasoning and problem-solving skills (Harada & Yoshina, 2004; Saunders-Stewart et al., 2012). One characteristic of this strategy is that it generates "a high amount of uncertainty due in part to the freedom given to the student to determine their own strategy for investigation" (van Schijndel et al., 2018, p.997). However, as stated earlier, uncertainty is one of the drivers of curiosity. Inquiry-based learning is related to project-based learning where learners engage in exploratory multi-faceted and thought-provoking learning (Harada & Yoshina, 2004) through developing and creating projects with real-world relevance (David, 2008). In addition, Barell (2013) provides examples of statements and questions that can be used to model curiosity and help children grow intellectually: these include "I wonder ...; What do you suppose would happen if...? Let's see if we can figure out why...? and I'm curious about ..."; "I don't know. What do you think?" and, "How can we find out? Let's go exploring for answers" (drawn from suggestions in Barell, 2013). These can be utilized by teachers and others working with children and young people.

Personalized learning is about tailoring instruction to the individual needs and skills of each student. In addition, learning experiences prepare students for college and careers and teachers provide guidance and support that allows students to take ownership of their learning. Pane and colleagues (2015, p.3) outline four strategies for personalized learning often present in schools that they studied. These include 1) learner profiles which provide teachers with an understanding of students' strengths, needs, progress and goals; 2) personal learning paths which allow for flexibility of content and structure of lessons based on the needs of students, and create meaningful opportunities to engage inside and outside school; 3) competency-based progression which means students' progress when they are ready to demonstrate competency; and 4) flexible learning environments where the use of time and education spaces are used flexibly to suit the needs of students (Pane et al., 2015, p.3).

Since curiosity is the drive that pushes one to close gaps in knowledge, it is important for students to be able to identify the gaps. To develop this skill in students, teachers might utilize the **K-W-L strategy** (Ogle, 1986). The letters represent 'what I know', 'what I want to know' and 'what I learned from the lesson' (Ogle, 1986; see more recently Meutia, 2021). This engages students in sharing their knowledge and asking questions to determine the gaps in knowledge.

Scaffolding is an instructional strategy that helps students build on prior knowledge to enable them

to develop new skills that are beyond their current abilities. As students become more competent the level of support decreases. Bruner (1976) discusses the importance of the teacher in helping students to discover on their own. He described the teacher's role in 'scaffolding' as allowing the child to complete those parts of a task for which they are capable and "knowing what elements of a solution the child will recognize though he cannot yet perform them."(p.xiv). The concept of scaffolding is related to Vygotsky's (1978) concept of the zone of proximal development which refers to the difference between how learners can perform on their own and how they can perform with instructional support. Capturing how teachers' model or scaffold curiosity was an important element of this study.

For creativity, strategies that involve **divergent thinking** are essential. They include tasks that facilitate thinking of many possible solutions to a problem. The opposite is convergent thinking where only one correct solution has been presented for a problem (Lewis & Lovatt, 2013). Divergent thinking is powerful for creativity as it is needed to develop new and novel ideas. In addition, strategies that involve exploration, for example, inquiry-based learning experiences can also facilitate creativity. Appendix 4 to 7 provides an overview of additional ways in which curiosity and creativity are fostered in the classroom.

The goal for the current study was to identify these and other strategies used by teachers in IB PYP classrooms to encourage curiosity and creativity and to illuminate instances in students where these have been activated.

2.7 Working Definitions

For clarity when interacting with teachers and other stakeholders, we utilised the following working definitions for curiosity and creativity. We needed short practical definitions, using accessible clear language, that could spark discussions in order to gather diverse opinions and ideas on each concept. As was the case with the frameworks, the final ACER definitions were emergent in the later stages of this research, so although very valuable, the ACER definitions were not adopted as our initial working definitions, but our working definitions evolved as the research process developed. Though, it should be highlighted that our definitions incorporated components of ACER's (2021a definitions of curiosity (e.g., information-gap filling) and creativity (e.g., idea generation):

Curiosity is the strong desire to fill a gap in knowledge and the associated information-seeking behaviours (Loewenstein, 1994; Pekrun, 2019; Shin & Kim, 2019). Shin and Kim (2019) argue "When individuals feel curious, they engage in persistent information-seeking behaviour" (p. 854) to fill a gap in knowledge that is 'recognisable' (p.862). More broadly, we align our definition of curiosity with the tradition of epistemic curiosity, with a focus on its general (aligns with forward curiosity) and specific (aligns with backward curiosity) information seeking behaviours within the context of being curious about people, events, and places, as well as the closing of informational gaps (Berlyne, 1954; Litman, 2008; Loewenstein, 1994; Markey & Loewenstein, 2014; Shin & Kim, 2019).

Creativity is coming up with new ideas and solutions or the creation of a novel or useful product (Plucker et al., 2004; Rhodes, 1961; Vincent-Lancrin et al. 2019). The OECD rubric for creativity and critical thinking defines creativity as "coming up with new ideas and solutions" (Vincent-Lancrin et al. 2019) or the creation of a novel or useful product (Plucker et al., 2004, p.90). This definition was selected as it allowed for diverse manifestations of creativity and recognises the creative process itself is important and may not result in tangible products, but the outcomes may be more abstract such as

ideas or solutions (and that those should be recognised as creative) which aligns with Rhodes (1961) 4P model of person, process, product, and press (the individual's interaction with their environment and surroundings).

Overall, the definitions of curiosity and creativity in the current study were selected as they are sufficiently broad to capture the key components of curiosity and creativity, as defined by previous scholars. In addition, given the nature of this study (classroom based, remote), we were mindful that the components of the selected definitions could be sufficiently measured using our selected methodological approach (primarily video-based approach). Therefore, these definitions are a practical as they describe behaviours that might be easier to observe in a classroom context through video-based research, and, importantly, the definitions use language that would be accessible to children or that could easily be explained to children. However, we emphasise that these definitions were just a starting point and these working definitions evolved throughout the study, we used interviews to explore with teachers and students what creativity and curiosity meant to them, and how these two skills related to their everyday lives. We illustrate how students and teachers conceptualised these skills in Section 5. Moreover, we also want to emphasise that given the exploratory nature of the study, more research would be needed before schools implement any of the identified practices in Section 5.

3. Video Analysis and Classroom Based research

3.1 Rationale for Methodology Based on the Literature

A participatory, multimethod approach was employed which included video observation, teacher and student interviews and administration of student tasks. A collection of relevant documents was firstly reviewed to identify best practices in previous video research (Robson, 2016, see Appendix 8). These include academic books and articles, working papers and online resources (e.g., toolkits). Abstracts were read to determine relevance and selected documents were iteratively reviewed and synthesized to gain an understanding of best practices for conducting classroom video studies. In Section 3.2, we outline, and review lessons learned from these studies, and explain how they have informed our research study.

3.2 Lessons Learned from Previous Video Studies

3.2.1 Video Recordings

A participatory video approach was adopted for this study which allowed teacher participants to control the camera and what is ultimately captured (Jewitt, 2012). In the current study, the OUCEA team asked teachers to purposefully video strategies that they perceived as fostering creativity and curiosity during their lessons. Classroom video recordings can be leveraged for the professional development of teachers and can provide opportunities for them to view and reflect on their teaching (Center for Education Policy Research at Harvard University, 2015). The Best Foot Forward project at Harvard University has developed a module, Teacher Video Selfie, which instructs teachers on how to analyse their classroom instruction. From this module, we adapted the idea for establishing a set goal for discussing video clips with teachers and looking for connections between observed practice and teaching principles and frameworks. Our goal was to focus on what constitutes evidence of the teacher fostering curiosity and creativity and to identify the ways in which teachers can improve their practice in this area.

The Best Foot Forward Project developed a comprehensive summary of camera and microphone options, with explanations for best use in specific circumstances. They suggest that a guiding priority for choosing the right equipment is ease of use and thoughtful consideration should be given to what is to be captured, as that also guides the selection of cameras and microphones. Also mentioned was the necessity of having a viewing platform for teachers to upload videos. Based on the information provided in the aforementioned project and Jewitt (2012) who states that mobile phone cameras are frequently used in participatory video studies, the decision was made to provide teachers with mobile phones to record videos as most teachers are already familiar with the technology. Additionally, we utilized a secure drive at the University of Oxford for secure video uploads and storage.

3.2.2 Coding

There are a variety of approaches to coding video data. Jewitt (2012) suggests first sampling the video, moving from reviewing the video as a whole to focusing on segments as a unit of analysis to begin coding. Goldman and colleagues (2007) discussed three approaches to coding video data: inductive, deductive and narrative evolving (see also Jewitt, 2012). An inductive approach involves viewing video data repeatedly in more depth and coming to a consensus with the research team members on major themes and on the description of the structure of events (Goldman et al., 2007; Jewitt, 2012). Following Stigler et al. (1999), we developed instructions for coding videos and conducted tests to

ensure we attained a high inter-rater reliability rate.

A deductive approach works best when there are specific research questions. Researchers then identify or create a dataset and systematically sample from it to explore their research questions. A narrative evolving approach involves "the study of experience as story and a way of thinking—through storying" (Bruce et al. 2016, p.2; see also Clandinin & Connelly, 2000). This is related to the concept of the narrative turn, "legitimizing peoples' stories as important sources of empirical knowledge" (Bruce et al. 2016; Hyvarinen, 2010). It is often used to understand and interpret participant experiences.

The current study adopted an integrative approach (Bradley et al., 2007) employing deductive codes based on our research questions (See Section 1- Introduction for our research questions) and knowledge from literature reviews on creativity and curiosity conducted by ACER which present practices that facilitate creativity and curiosity. In the current study, the integrative approach was underpinned by a modification of Erickson's (2006) procedure which provides a 4-step deductive approach to analysing video data. The first step involves deciding on the specific phenomena that will be observed. Appendices 4 to 7 provide a detailed insight into the final codes that guided the deductive approach to analysing the data. Step 2 involves identifying every instance of the phenomenon being studied. Step 3 involves generating visualisations using tables or flow charts of the findings. Finally, Step 4 involves the identification of key quotes from the data that best represent the phenomena being studied. The composition of these quotes is useful for later reporting of the data. For further discussion of how this literature informed the analysis procedures in this study see Section 4.2.

3.2.3 Collaborating with teachers online – new contributions

The research team used a participatory video approach and collaborated with teachers online due to COVID-19 restrictions. Participatory approaches using visual methods aim to include the viewpoints and experiences of participants by giving them control of the camera (Jewitt, 2012). It is a process that allows researchers and research participants to become collaborators in knowledge production (Lawrence, 2017). The team met with selected teachers for meetings and interviews on Microsoft Teams to discuss the project and gain their insights for developing the research processes. Three consultation sessions were designed and delivered to participating teachers. Consultation 1 involved an introduction and welcome to the project. Consultation 2 and 3 focused on ethical considerations of collecting data and key considerations in the self-generation of classroom videos, respectively.

3.2.4 Summary of methodological best practices for our study

For video recording, the studies outlined in this report recommend 1) establishing a set goal for viewing video clips with teachers; 2) looking for connections between observed practice and teaching principles and frameworks; 3) utilization of mobile phone by teachers to record lessons; 4) utilization of Nexus 365 for Business at the University of Oxford for secure video uploads and storage.

For analysis, recommendations include: 1) Creating a content log of video data with content descriptions; 2) having several research team members review the video data and discuss interpretations; 3) review and discuss selected video clips with teachers for their interpretation and insights; and 4) utilize computerized data analysis software to organize, annotate and code video data. Recommendations for coding data include: 1) employing deductive codes based on our research questions and knowledge from literature reviews on creativity and curiosity conducted by ACER as well as our own review of the literature; and 2) following this up with an inductive coding approach to further explore the data.

Recommendations for collaborating with teachers online include following a participatory research approach with teachers being involved in the process of knowledge production providing their ideas and insights throughout the research process. To deal with potential concerns of teachers, parents, guardians and students, we followed recommendations to let teachers choose the videos they share, and we secured their permission to share any videoclips. We have also described the benefits of participation, for example, it provides an opportunity for teachers to share their knowledge with others, showcasing their work as exemplars to help other IB teachers. Parents and students were provided with information sheets and given instructions for how to opt out of the project. Students who agreed to be interviewed were asked to give consent along with their parents or guardians.

4.Methodology

This section provides information on the study design, instruments developed to carry out this study, the recruitment of schools, procedures, interview and informed consent processes, overview of participants and the project toolkit.

Figure 4.1 depicts the overall research design for the current study, which adopted an embedded mixed-methods design. In this design, both quantitative and qualitative data were collected, with a primary role for qualitative data and a secondary role for quantitative data. This is different to multi-method studies in which multiple types of quantitative or qualitative data are gathered (Plano Clark & Creswell, 2008), whereas in the current study qualitative video data and interviews were combined with traditional survey design (Creswell & Plano Clark, 2011). To this end and given the secondary role of the quantitative data in the current study, this data was only used to provide exploratory and therefore, suggestive evidence for the promising nature of the identified teaching practices that are considered to foster curiosity and creativity, as identified through the thematic analysis of the qualitative data. For the qualitative data collection, first, video data and then self-reports (via interviews) with open ended questions regarding participants' views about curiosity and creativity were collected. There is extensive evidence in the literature of the value of classroom videos studies (see for example Chuang, & Rosenbusch, 2005; Tripp & Rich, 2012). Regarding the embedded quantitative survey component, curiosity and creativity measures were developed and/or adapted from previous research. The embedded mixed methods design allowed us to capture data about the rich contexts in which promising practices are implemented, but also numerical scores that provide the potential of suggesting the effectiveness of these promising practices.

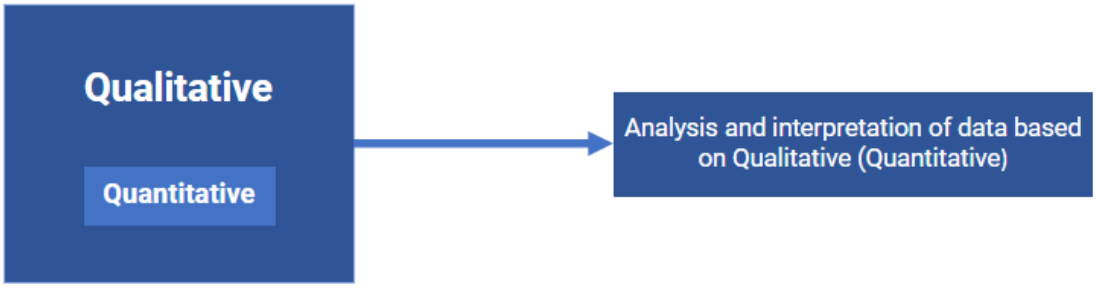

Figure 4.1. Mixed methods embedded design with a primary role for qualitative data and a secondary role for quantitative data

Mixed methods designs are particularly important for video-based researchers, as although previous scholars have noted the advantages of video observations in the assessment of behaviour, compared with attitudinal data, they are limited in the conclusions that can be drawn from relying soley on video data (Blikstad-Balas & Sørvik, 2015; Derry et al., 2010; Dignath-van Ewijk et al., 2013; Klette, 2009).

More specifically, although valuable, video data on its own is limited in explaining complex educational processes since researchers can only observe a limited number of lessons, participants' change their behaviour because they are aware they are being observed (reactivity of measurement) and there exists challenges in understanding the complexities in participant's cognitive processes within video observations (Dignath- van Ewijk et al., 2013). In addition, Creswell (2013) emphasised that a critical aspect in the collection of video data is engagement with process of member checking, in which participants are interviewed following the observations to enhance the credibility of data interpretation. Similarly, Erikson (2006) further discussed the importance of collecting additional sources alongside video observations, noting that the interpretation of video data should form part of multi data sources that produce a more comprehensive picture of educational processes. For these reasons, previous video researchers have recommended that, alongside video data, multiple data sources should be incorporated within research designs, which offers more *completeness* in data interpretation and *corroboration* of the findings (Blikstad-Balas & Sørvik, 2015; Derry et al., 2010).

In relation to the completeness component, we wanted to gain a more comprehensive understanding of promising practices that foster curiosity and creativity within IB PYPs, including an understanding of the potential impact of these practices on student's own curiosity and creativity. Regarding the corroboration component, the data from the quantitative data source relates to the ways in which curiosity and creativity were manifested by students. By evidencing the possible impact of the promising practices identified through thematic analysis of the qualitative data, we strengthen the case to suggest that these practices are likely to be promising in their ability to foster curiosity and creativity among primary-aged students. Consequently, the combination of both qualitive and quantitative methods likely offers a pathway to strengthen the validity of assessing these constructs within complex settings, including the conclusions drawn from these assessments.

4.1 Methods: Qualitative Data

4.1.1 Instrument development and administration of data collection

Online pre-engagement surveys were sent to prospective participants to gain an understanding of the practices they use to foster curiosity and creativity in students. The survey questions can be found in Appendix 1. Due to timing constraints, some teachers answered these questions during the interview. Tables which outline the proposed interview schedules with associated thematic codes for teachers and students can be found in Appendix 2 and 3. The tables in Appendix 4 to 7 outline the video data analysis tool with codes and definitions which were used to code teacher and student videos.

E-Interview Schedules

The development of the e-interview schedule for students was underpinned by best practices in interviewing children as suggested by O'Reilly and Dogra (2016). The approach taken was based on the United Nations Convention on the Rights of the Child (United Nations, 1989), particularly Article 3, which considers that any decision should consider the best interest of the child and Article 12 which highlights children's rights to express their views, and for those views to be heard and taken seriously.

Therefore, the development and implementation of the student interview protocol reflected child-centred practices, with a consideration that there is no universally accepted definition of child-centred given it is based on the context within which interviews are conducted (O'Reilly & Dogra, 2016). Understanding this was important for the current study, given that data collection spanned across several countries, each with its own unique cultural context. Nevertheless, with the aim of being child-centred, several components of child-centred approaches were considered, including reflection on the place of students in research, gaining certainty that students want to participate, providing

students with any expectations of the research team and finding out what they expect from the research team, focusing the interview on the students, offering students the opportunity to ask questions and employing age-appropriate language (Holt, 2004; O'Reilly & Dogra, 2016).

Video observation instrument: Development of video observation codes

Deductive codes, as reflected in Appendix 4 to 7, were developed using a theory driven approach as recommended by Boyatzis (1998). Theory-driven approaches to code development involve a three-step procedure (1) code generation, (2) reviewing and revisions of codes based on data and (3) examining code reliability and the reliability of coders. Following this procedure, codes were firstly generated based on theoretical frameworks guiding the current research. This initially involved an examination of the ACER curiosity and creativity literature reviews (ACER, 2021a, 2021b). This was complemented by additional examinations of research on curiosity and creativity within the context of education. This also included the examination of research on the factor structure of creativity and curiosity (e.g., Lucas, 2016) to gain a more comprehensive understanding of the dimensions of both constructs (see Appendices 4-7 for detail of key literature). In determining the codes, the research team engaged in a series of discussions about the theoretical frameworks guiding the study.

A total of 40 codes was initially developed to assess curiosity and creativity in teacher and student videos. To distill the number of codes, conceptually similar codes were firstly identified and combined into a single code. Distillation of codes for teacher-focused codes was guided by the final set of codes identified for students. This code reduction strategy for teacher-focused codes was devised based on the learning ethos of the IB organisation. The IB ethos suggests that learning should be learner-centred (International Baccalaureate Organisation, 2017). Therefore, it was important to determine which teacher-focused codes for curiosity and creativity would likely support the development of the selected student-focused codes for curiosity and creativity. Following this process, the codebook was reduced to contain 26 codes (see Appendix 4 to 7).

During the initial development of the codes, we met for a series of discussions across five sessions. The research team comprised diverse academic experiences which fostered differing understandings of the codes. We ensured that there was a constant challenging of each other's interpretation of the codes, which required a logical and coherent justification for maintaining, deleting, or combining codes. This reduced the likelihood of groupthink given that we commented and reflected upon codes until the team arrived at an agreement (Janis, 1972). Our discussions also focused on prioritising codes that could be directly observed from videos. Therefore, codes that were deemed as being too abstract (e.g., mental processes) were deleted. The team however considered mental processes as being important to the research study and agreed that if interesting events emerged during the videos (e.g., nonverbal behaviours such as facial expressions that signaled possible thinking processes), we would gain insight about such instances from our participants during participant e-interviews (see e-interview schedules for teachers and students in Appendix 2 and Appendix 3; the generation of codes for these schedules was based on the deductive codes developed for the teacher and student video codes in Appendix 4 to Appendix 7). In addition, to gain insight into promising practices of curiosity and creativity before data collection, we designed a pre-engagement survey that was provided to selected schools (see Appendix 1).

Overall, we aimed at generating code labels that were conceptually and contextually meaningful, clear, and succinct (Braun & Clarke, 2019). This was achieved by ensuring that our definitions and examples were specific, yet sufficient to capture the complexity of the constructs. Achieving this also required several iterations of code labels, including their definitions and examples. For example, in Appendix 4, we initially created the code label 'Motivators' to represent feedback in the form of

rewards provided by the teacher. However, we considered that this was quite restrictive considering findings that demonstrate the negative effects of external incentives on intrinsic motivation, which is important for the development of curiosity and creativity (Deci & Ryan, 2010; Gruszka & Tang, 2017; Hennessey & Amabile, 2010; Oudeyer et al., 2016). We therefore agreed that there would be more value in using the term 'Feedforward'. However, given that feedforward is used primarily in the context of higher education (our current focus is on primary school contexts), we decided that the final code label would be 'Feedback' as this code captures rewards provided by teachers, but mainly feedback dimensions such as feedforward and assessment for learning strategies (Black & Wiliam, 1998, 2018; Boud & Molloy, 2013; Hattie & Timperley 2007; Hopfenbeck et al., 2015).

The second (reviewing and revisions of codes based on data) and third (examining code reliability and the reliability of coders) steps of code development, as suggested by Boyatzis (1998), took place following the collection of video data. Prior to data collection, the team met across one session to distinguish between high and low inference codes. The initial agreement rate was 60%. Agreement of whether a code was conceptualised as low or high was 100% after the research team met to discuss initial categorisation.

4.2 Methods: Quantitative Data

This section outlines the quantitative curiosity and creativity tasks administered to students across the 9 countries in the current study (Sweden, Ghana, Germany, India, The Netherlands, Norway, Denmark, France and Italy). The main purpose of administering the student tasks was to provide preliminary evidence that would suggest that the promising practices, identified in Section 5 (Key Findings), were in fact promising with respect to fostering curiosity and creativity in primary school classrooms.

4.2.1 Participants

Complete curiosity questionnaire responses were received from 193 students in 9 schools (M_{age}= 9.10, SD = 0.89) and completed creativity survey responses were received from 179 students in 9 schools (M_{age}= 9.10, SD = 0.90).

4.2.2 Student Tasks: Development of instruments

The student tasks included a series of open (creativity task) and closed (curiosity task) ended response questions. Although the Promising Practices study primarily addresses the research questions through video and interview data, we collected further evidence by administering the student surveys to a wider cohort of students in each participating classroom at each of the nine schools. Instruments were designed by the research team specifically for this project and informed by previous research on assessing curiosity and creativity in primary aged students.

4.2.3 Curiosity questionnaire: The Epistemic Curiosity Questionnaire for Children

The Epistemic Curiosity (EC) Questionnaire for Children was developed by the OUCEA team for the current study to assess curiosity in children. It is a 13-item questionnaire measure for primary aged children. Given that our current study's definition of curiosity aligns with the overall concept of 'epistemic curiosity', a search of this term was run through Web of Science to identify previously developed measures of epistemic curiosity. Potentially relevant literature was identified in a Web of Science search of articles published between 1954 and 2021. The year 1954 was selected as the initial starting point given that this was the first citing of a measure of epistemic curiosity (Litman et al., 2010). The search returned 281 articles. Of these, 75 articles had the term 'epistemic curiosity' in its title or abstract. Of these, 20 articles reported one or more measures of epistemic curiosity in detail. Items that related to the concepts of epistemic curiosity (both diversive and specific) were selected.

A content analysis was conducted through NVivo to ensure that the EC questionnaire featured the most used concepts in previous questionnaires that measures epistemic curiosity. Table 1 provides examples of frequently used concepts that featured in these previous measures of epistemic curiosity, including their weighted percentages. Where necessary, items were then translated into age-appropriate language for 7- to 11-year-olds using Kuperman's age of acquisition psycholinguistics database (Kuperman et al., 2012). Three research members assessed the suitability of items for inclusion based on our shared understanding of curiosity. For the purposes of ensuring that the language of the items was appropriate for the identified age range, several versions of the way questions could be worded were explored, where necessary. The final selection of questionnaire items (see Table 5 in Section 5 for the list of the 13-items in the questionnaire) was based on consensus among research team members.

Only concepts that occurred two or more times were included (see Table 1 below). The most often occurring concepts—if relevant—were included in the epistemic curiosity, ascertaining content validity of the new measure.

Table 1. Frequency of concepts related to epistemic curiosity derived from measures used in studies between 1954 and 2021.

Concepts	Frequency (Count)	Weighted Percentages (%)
New experiences/information	29	4.41
Question asking	22	3.35
Finding	14	2.13
Learning	13	1.98
Enjoying	11	1.67
Problem-solving	11	1.67

4.2.4 Creativity task: Guilford's (1967) Alternate Uses Task

The task included three unusual uses tasks – uses for a key, a pen, and a chair – to measure creativity. To select the objects, ten picture stimuli databases were explored to identify objects that would be universally known; four of these datasets included data from children, aged 4 to 10 years old, including children from Spanish, Chinese and English backgrounds (Adlington et al., 2009; Berman et al., 1989; Brodeur et al., 2010; Broedeur et al., 2014; Cycowicz et al., 1997; Martinez et al., 2020; Snodgrass & Vanderwart, 1980; Shao & Stiegert, 2016; Viggiano et al., 2004; Wang et al., 2014). Although the target sample population in the current study are primarily English-speaking children, given the multi-site nature of this study, and to account for any possible differences in linguistic and socio-cultural contexts, it was important to consider the cross-cultural validation of these objects. Visual inspections of the familiarity and name agreement statistics within the picture stimuli database studies show that across studies are key, pen, and chair were suitable objects to include in our study. The mean familiarity rating and percentage agreement for each object are presented in Table 2. The mean familiarity is measured on a scale of 1 to 5 and denotes the extent to which the object is familiar to participants, with scores closer to 5 indicating higher familiarity. Free stock-coloured pictures of these objects were obtained from public photo domains (e.g., Pixabay) and were used in the current creativity task.

Table 2. Familiarity mean rating and name agreement percentages of objects selected for the alternate uses task

Object	Familiarity (Mean)	Name Agreement (%)
Key	4.37	88%
Pen	4.68	96%
Chair	4.51	87%

Note. It is important to identify the most common name of a picture and the extent of the variability in which participants agree upon this name. A strong measure of this is the name agreement percentage, which is determined by tabulating the proportion of all total responses regarding the name of a picture by participants. This has shown to be a more robust approach to measuring picture naming performance, especially when considering children as they are likely to be more variable in their responses or they are more likely to not have access to the name of a specific object (Wang et al., 2018).

4.2.5 Procedure

The research team administrated the online curiosity questionnaire and creativity task to the nine schools who participated in the video and interview component of the study. Each participant was first presented with the curiosity questionnaire and then the creativity task.

For the curiosity task, students were provided with each question and asked to rate the extent to which they agreed or disagreed with each statement, based on a 4-point Likert-type scale (1 = Disagree a lot; 2 = Disagree a little; 3 = Agree a little; 4 = Agree a lot). It is important to note that this was a measure of students' perception of their own curiosity, and, as for all studies relying on self-reports, this is a limitation of our study (Shroff, 2010). To mitigate for these perspectives, we have used procedures from large international scale test administration (e.g., Progress in International Reading Literacy Study [PIRLS] and Programme for International Student Assessment. [PISA]); students were provided with an example of the way in which they were expected to respond to each question. Each item was rated on the same scale used to examine individual differences in curiosity (Litman & Spielberger, 2003; Litman et al., 2010). Item 11 was reversed scored. Higher scores indicate higher levels of epistemic curiosity.

For the creativity task, students were explicitly instructed to generate as many different, creative uses for each object. Previous research highlights that it is important to instruct participants to be creative as this improves the validity of the responses, especially since the within-person variance is expanded (Harrington, 1975). Children's responses were transferred to a secure database and a research team member engaged in silently correcting errors (misspellings). The responses were presented without any contextual information about the student's country, so raters were unaware about this background information. In addition, raters were not aware of the students' responses to the EC questionnaire. To determine the best approach to scoring the inter-rater reliability of two approaches to scoring were implemented. Guilford's idea of creative thinking as uncommon, remote, and clever (Guilford, 1975) underpinned the scoring guidelines that were used in the current study (Wilson et al., 1953); these guidelines, including their descriptions, were obtained from Silvia et al. (2009). Typically, a 1 to 5 scale (ranging from not creative at all" to "very creative) has been used for snapshot scoring. However, a 1 to 3 scale was also recommended by the developer of the snapshot approach to scoring creativity scores (P. Silvia, personal communication, October 28, 2021). To determine the inter-rater reliability of each approach, two research team members scored 10 responses using a 1 to 5 scoring approach and three research members scored 10 responses using a 1 to 3 scoring approach. A 1 to 3 scale was identified as generating higher inter-rater reliability and research team members found that

this approach to scoring was quicker. To ensure consistency across ratings, the research team developed a scoring rubric. Lead researchers for each school sent follow-up emails to remind teachers of the completion of the online questionnaire and task. However, we were mindful that participation in some schools might have been reduced because of the ongoing pandemic and significant teacher workload.

4.3 Recruitment of Schools

The International Baccalaureate assisted with the recruitment of schools by posting information about the study in their newsletter and on their social media channels. From those channels, an initial list of interested schools was generated and the research team used that list to examine the websites and social media accounts of interested schools.

We conducted purposive sampling focusing on our specific criteria for the project (Robson, 2016, p. 281), locating schools that explicitly articulated in words and demonstrations, via their websites or social media accounts, a variety of strategies for the facilitation of curiosity and creativity. In addition, we wanted a diverse global sample with schools represented from various countries, cultures, and socio-economic status groups, state schools (no fee schools) and private schools, and schools where there is a possibility for extending the project to include Middle Years and Diploma Programmes at each site. We also took into consideration the infection rates of Covid in each country and tried to choose areas with very low infection rates.

Our goal was to recruit eight schools, with two of those being backups in case any of the six needed to withdraw from the study. We contacted, via email, a total of twenty schools in the first instance. The contact was usually the IB coordinator for the Primary Years Programme. We included a link to the IB blog about the research and some initial information about the project, for example, its aim, what participation involves and the benefits of participation. Teacher time was an important consideration for this study, particularly because of the pressure of working during the Covid 19 pandemic. The research team committed to working around teacher schedules and provided as much online support as needed. This commitment to assist was also communicated in our emails and online conversations with school leaders and teachers.

Recruitment Challenges

Several schools that initially expressed interest were unavailable because of the increased workload and pressure due to the Covid 19 pandemic. During our first round of recruitment, six schools agreed to participate: one in Ghana, one in Australia, two in India, and two in Western Europe. However, our two schools in India had to delay participation due to the rapid spread of Covid in late April. Both schools were utilizing online learning as their mode of instruction and the research team adjusted the methods to accommodate this. One of the schools in India completed participation in mid-July. However, the second school withdrew from the project. In addition, we were preparing for data collection at our Australian site in late May and they also incurred a lockdown due a rise in Covid cases. The Australian site experienced additional lockdowns in July and an extended one in August. Consequently, teachers expressed that they were not able to participate.

The research team worked to include both private and state schools in the study. There were significant challenges securing state schools due to the impact of Covid 19 and the local authority permissions processes. For example, in the United States we encountered messages on school websites that suggested that the schools were unable to participate in research unless it was flagged as essential or high-priority. Even ongoing research that was not considered a priority was temporarily

halted. In other instances, securing permission from district research review boards took longer than anticipated. The research team expected to have data collection completed by the end of July 2021. However, due to the overwhelming impact of Covid 19 on schools around the world, the research team worked to recruit schools and conduct consultation sessions until mid-October 2021. This involved going beyond the initial list of schools that expressed interest and reaching out to other schools. A total of ninety-six schools were contacted and we secured participation from 21 teachers in 9 countries. Due to recruitment delays, the timing for the collection of video data and teacher and student interviews extended into late-November due to the pandemic. See Table 3 below for an overview of participants and data collected.

Table 3. Overview of participants

Schools	**Number of Participating Teachers**	**Number of Videos**	**Number of Interviews**	**Number of student responses to curiosity and creativity assessment tasks**
1.Sweden	5*	10	Student: 28 Teacher: 5	Curiosity: 47 completed Creativity: 44 completed
2.Ghana	3*	4	Student: 16 Teacher: 3	Curiosity: 19 completed Creativity: 17 completed
3.Germany	2	6	Student: 12 Teacher: 2	Curiosity: 22 completed Creativity: 21 completed
4.India	2*	2	Student: 6 Teacher: 2	Curiosity: 14 completed Creativity: 14 completed
5.Netherlands	1*	11	Student: 4 Teacher: 1	Curiosity: 7 completed Creativity: 6 completed
6.Norway	1*	6	Student: 4 Teacher: 1	Curiosity: 5 completed Creativity: 5 completed
7.Denmark	2	2	Student: 8 Teacher: 2 Teaching Assistant: 1	Curiosity: 26 completed Creativity: 26 completed
8.Italy	3	4	Student: 8 Teacher: 3	Curiosity: 49 completed Creativity: 42 completed
9.France	2	1	Student: 6 Teacher: 2	Curiosity: 4 completed Creativity: 4 completed
TOTAL	21	46	Student: 92 Teacher: 22	Curiosity: 193 completed Creativity: 179 completed

**Teachers have submitted artifacts of student learning (e.g., photographs of student post-it notes, student creations).*

As seen in the table above, the number of videos submitted per teacher and school varies depending on the time teachers had for filming and situations where classes were conducted in English and a second language. In the later instance, teachers filmed the segments taught in English. There were others who simply chose to film several shorter segments in order to provide more examples of how curiosity and creativity are fostered in their classrooms. This meant that some teachers video-taped

one to three classroom lessons between 40 to 60 minutes in length while others submitted several short lesson segments. Lesson subjects included history, literacy, math, science, music, drama, or a combination of subject, as was the case in India.

4.4 Teacher and Student Interviews

Students (and their parents) and teachers were given an information sheet before the interviews and provided written consent for audio recording and transcription of the interviews. The interviews followed semi-structured interview guidelines where researchers prompted teachers and students to clarify their responses further or come up with examples or descriptions to better understand the teachers' and students' perspectives. All interviews were audio recorded in Microsoft Teams and later transcribed using Microsoft Stream, which is compliant with data protection laws including the General Data Protection Regulation (GDPR) and edited by three researchers on the team before the analysis was carried out by the research team.

All interviews were conducted within the schools opening times online. Twenty-two semi-structured interviews were conducted with teachers and 92 semi-structured interviews were conducted with students between the ages of 7 and 12 years old (see Table 3). This age range of 7-12 (the upper age group of PYP programmes) was chosen so that children would be able to understand the research language on the information and consent forms and so that they could participate meaningfully in interviews on these abstract concepts: the level of language used in information sheets and consent forms was checked to be appropriate on research language data bases as well as checked with the class teachers who could gage whether the language would be understandable to each student in their class. We could explain how we checked language appropriateness with research data bases, as well as with the class teachers of each group. Students between the ages of 7 and 12 were selected given that they have achieved cognitive and social developmental milestones that would allow them to meaningfully participate in the current study. Teachers were asked to select 3 to 4 target students to be interviewed. However, in many cases, several students wanted to participate, and the research team accommodated this.

4.5 Video Recording Toolkit and Protocol

The researchers conducted a rapid review of relevant literature to choose video recording equipment that would provide quality video and sound and would also be easy for teachers to use. Each participating school was provided with the equipment below (Figure 4.2):

Figure 4.2 Video Recording Toolkit

Rationale for Toolkit Choices

Based on information from previous studies, Jewitt (2012) and Center for Education Policy Research at Harvard University (2015), we chose mobile phones for their familiarity with most teachers, ease of use and quality of the video capture, portability and reasonable price point based on our set budget for equipment. The Rode Wireless Go microphone system captured teacher voices clearly, was portable, lightweight and easy to use and the Jabra 510 speakerphones worked well when sat on a table to capture the voices of target students (usually 3 to 4) seated together within close proximity to the speakerphone. The tripod and phone clamp were chosen for their sturdy construction and stability to position and secure the mobile phone for recording in the classroom. A voice recorder was sent as a backup device in case there were any mishaps with recording sound. In fact, we did encounter one incidence where a teacher recorded a lesson, and the sound was not audible. However, we were able to use the recording on the voice recorder and match it with the video recording. The mobile phones were purchased in the United Kingdom and a universal trans-world mains adaptors ensured the devices could be used in various countries around the world. Additional accessories such as phone cases and screen protectors were provided to reduce the chance of accidental damage to the devices.

In addition to the equipment listed above, the team developed a 10-step self-capture video recording protocol (see Johnston, Denton-Calabrese, Scott-Barrett, McGrane, Hopfenbeck, 2022), and two instructional videos to guide them on how to configure the equipment, capture the videos and upload them to a secure location. This protocol was developed after rigorous testing of the equipment, including testing of the best conditions under which to obtain quality visual and audio data.

Equipment Shipping Challenges

The research team were required to follow very specific DHL guidelines to ship equipment to participant countries. For example, only two items containing batteries could be shipped in one box which increased the number of boxes sent to schools. In addition, some shipments were delayed in customs and the process for getting the items released was not always clear and sometimes took several days. This delayed the time available for teachers to record sessions, which was particularly problematic for those close to the end of the school term.

4.6 Ethical Considerations

In order to ensure that the data collection, analysis and dissemination processes were conducted in a way that was both ethical and rigorous, the team dedicated a large portion of their focus to developing ethical research processes that would protect and respect the rights and wishes of all participants as well as protecting and securing the research data. Firstly, the team sought ethical approval from the University of Oxford Central University Research Ethics Committee (Reference number: ED-CIA-21-131). The researchers also used the teacher consultation sessions to ensure that the data collection processes were both ethical and rigorous in terms of research ethics as well as ethical and suitable according to each school's individual context and circumstance.

Receiving and monitoring consent from participants

Six consent documents were developed by the team and approved by the ethics committee: these included information sheets for teachers, parents and students, as well as online and paper consent forms for teachers, parents and students. The team ensured that the language level of the student information sheet was appropriate for students with a supplementary information sheet with photographs showing the students what the research materials looked like and what would happen during the research process.

The research team developed a system for receiving and monitoring consent from participants taking into consideration what worked best for each school. For example, some schools preferred to provide paper consent forms to parents and students. Others were happy to have the research team send consent forms through Qualtrics, a secure online platform which allowed the researchers to view the forms as they were completed. Schools that used paper consents scanned them and uploaded them to a secure server at the University of Oxford. After receiving the consent forms, researchers reviewed each one for any missing or unclear consent marks and these issues were raised with the teachers who reached out again to parents and students to confirm their wishes and they resubmitted any forms that were corrected.

Camera placement: respecting student wishes and photography rights

Camera placement was considered carefully to ensure that only students who provided their consent and from whose parents we received consent, were in view of the camera. During the consultation session on ethical considerations, the research team and teachers entered into a discussion about informed consent and how it guides student positioning in relation to placement of the camera. It was

recommended that teachers place the camera in the back of the classroom for an encompassing view of the students and activities. It was important to ensure that students who were not participating in the project were not excluded from any school activities. To this end, non-participating students were either seated behind the camera or involved in a parallel activity off camera.

Safe-guarding and interviews online

All interviews with students were conducted online and recorded using Microsoft Teams. A member of school staff was present during all interviews for safeguarding purposes. The research team requested this to ensure that a staff members would be available to assist if any of the children disclosed information that needed to be followed up or if any other safeguarding concerns were raised. Similarly, the teachers were briefed on how to pause the recoding in their classroom if they needed to attend to a concern of student well-being: teachers were also given the details of how to inform the research team if certain elements of the recording dealt with confidential student matters and were therefore not appropriate for analysis.

Privacy, confidentiality and data management

The importance of respecting the privacy of all participants and confidentiality of the data was also discussed in a consultation session on ethics. During this session, we posed several 'what if' questions to teachers. For example, 'What if a colleague, parent or student asks you to share a copy of the recording with them?' Some teachers mentioned that their schools often post lessons on social media and wanted to know if any information about the project could be posted on social media. This provided an opportunity to discuss the specifics of consent set out in our University of Oxford consent forms, and the ways in which we work to protect the confidentiality and anonymity of participants.

4.7 Analysis of Video Data

Analysis of qualitative data (video data and interviews with students and teachers) took a deductive approach to analysis focusing on instances that illustrated the facilitation of creativity and curiosity by teachers during their lessons and demonstrations of creativity and curiosity from student video interviews where they talk about and showcase their lessons. Following Derry et al. (2010), we created a log of video data and engaged in multiple viewing of video segments with several research team members to discuss our interpretations. Three researchers met to discuss and agree on the instances in videos (videos of the physical and virtual classroom). We also discussed clips with the teachers who recorded them for their interpretation and to help us gain deeper insights. Analysis of classroom videos were conducted with a highly structured observation protocol (see Appendix 4 to 7) developed by the OUCEA team for the current study. A detailed step by step iterative process of the video analysis for the current study is illustrated in Figure 4.3.

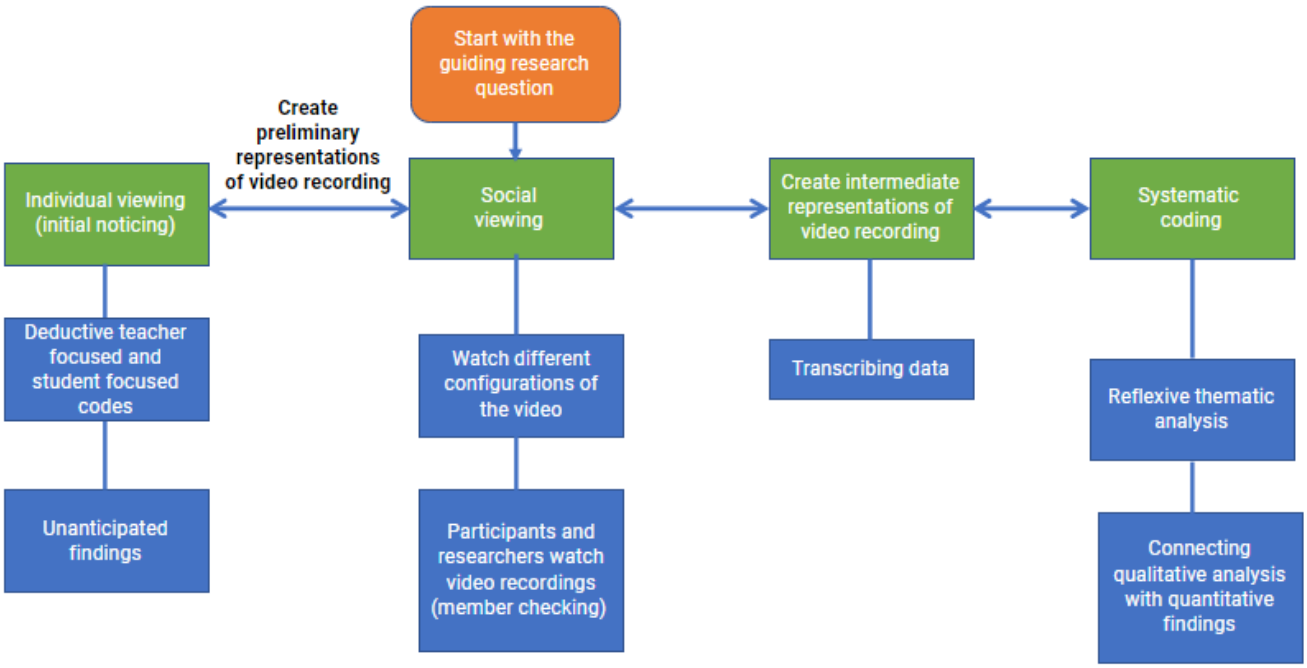

Figure 4. 3 Iterative video analysis process

To analyse (and interpret) the video data, we firstly considered our overall research question that guided the current study: "What are the promising practices that foster curiosity and creativity in the classroom?" Each researcher individually viewed the videos in a period of initial noticing. During this initial noticing process, we each created preliminary representations of the video recordings by identifying instances from our codebook as well as mapping any unanticipated findings. Following this individual initial engagement, we met as a research team across sessions of varying lengths (~ 1.5 hrs per session) over a 9-month period to socially view the videos. We watch the videos in 3-minute intervals across different configurations, including, watching videos with and without the audio, listening only to the audio, without any visualisation sound, and watching videos in a normal and speeded manner, and watching the videos with a focus on either the teacher, the student and the interactions between teachers and students or students and students. In addition, video clips were watched in a forward and backward manner to identify shifts in behaviour. These recommendations for socially viewing videos were obtained from the '*Learning how to look and listen: Building capacity for video-based transcription and analysis in social and educational research conference*' held in November 2016 (https://www.learninghowtolookandlisten.com/). In specific instances, there were aspects of the video that were unclear (e.g., poor audio recording); therefore, during the interviews with participants, we watched these areas with either student or teacher participants to improve our interpretation of the video data. We also described instances of the video recording to participants during the interviews which helped to clarify participants' cognitive processes during specific instances of classroom interaction. Following, this, each researcher created intermediary representations of the video recordings by transcribing the video data. These transcriptions were based on our teacher focused and student focused deductive codes, as well as any unexpected findings of interest, and therefore, the video recordings (see Appendix A in Derry et al., 2010 for an extended discussion on types of approaches to transcribing video data). Finally, we engaged in a process of collaborative reflexive thematic analysis through NVivo, and the qualitative findings were then cross-checked with the quantitative data.

5. Key Findings

5.1. Qualitative Findings: Themes and Promising Practices

In this section we present five themes for promising practices (aimed at fostering curiosity and creativity) from analysis of classroom videos, teacher interviews and student responses and work in class sessions. The themes are: 1) Diverse Feedback Pathways, 2) Self-Regulated Learning, 3) Nurturing an Inquisitive Mind, 4) Facilitating Collaboration and 5) Choice over Self-Expression. Each theme includes a group of sub-themes and related promising practices which are highlighted at the end of each sub-section.

5.1.1 Diverse feedback pathways

Interactions that support, challenge and extend students' thinking and learning

Classroom practices demonstrated a range of interactions– teacher to student and student to student – in the feedback process. Of note, there was a high frequency of teacher to student feedback, particularly aimed at improving the student's verbal and text-based productions.

> One thing you should know is … every character should have something in that story. You don't just mention their names ... you have to describe them, what did they do? That makes the story interesting … this is very, very important. So, it's not about having a lot of characters. (Teacher 11, Ghana)

> You know using different beats, clicks and then tapping on your feet... you have to create music out of it. It's called body percussion... you just have to create sounds and I'm sure you did it in your music lessons (Teacher 16, India)

> … that's not an appropriate [spoken] word ... We can replace it with a different [spoken] word (Teacher 9, Sweden)

> … It says create a puppet, it never said use an existing puppet. Create a sock puppet. This entire activity is about creation and using your creativity (Teacher 17, India)

> We are thinking about this [further areas that student needs to address as part of the task requirements] as well, the concepts, what is this tool? How does it work? … So you've already said how it works [and] how does this help us … [but] why has this tool been invented? That's this part here.(Teacher 21, Denmark)

Feedback was also explicitly targeted at ensuring that students were engaging in more divergent ways of thinking.

> There are a couple of different ways you can do this... there are a couple of ways to show your thinking (Teacher 7, Sweden)

> So, 50, 100 years from now, think carefully, what do you think will be in the system? How will it benefit the society? How will it be used? And remember it could be an old thing that you want to improve upon (Teacher 11, Ghana)

> Can you do this one [math task] in another way? (Teacher 14, Germany)

> Can you find any halves where the whole isn't a rectangle? Have a think. Or the two halves are different shapes? (Teacher 15, Germany)

> Let's have diversity, let's do different tasks, let's see how everybody thinks differently (Teacher 16, India)

In a reflective interview, Teacher 9 explained the different ways she encouraged students to develop their creative thinking and to consider alternative perspectives or processes:

> So, encouraging them if they are on one track, then probing them towards the other. This could also happen, or this could be extended in this way, so I think always challenging and building upon their thinking. (Teacher 9, Sweden)

The data suggests that students across each context were actively engaged in the feedback process, primarily through peer-to-peer feedback; this was encouraged by teachers: "Anyone can help *student name* with this? What does pandemic mean?" (Teacher 17, India). In other instances, teachers noticeably paused after student presentations and invited classmates to provide feedback to their peer: "[student name], you have a comment?" (Teacher 6, Sweden).

The students in this class engaged enthusiastically with this opportunity to give feedback – most tended to phrase their feedback as a positive comment, often this comment was followed by a question to help their peer improve:

> So, I liked the idea of the ball, it was very cool, and my question is, how much time did it take you to make this? And, if you had more time, would you add people coming in asking if they can play? (Student, Sweden).
>
> I like that you put the statistics to the side, like how many people are not homeless in America, and how many people are homeless (Student, Sweden).
>
> I like your drawing, it looks really cool...I have a question, where did you get the idea to do all of this? (Student, Sweden).

This final example is particularly interesting as the student displays an inquisitiveness into the process of creation, rather than just a comment or question about the creative product. The interaction of curiosity and creativity is discussed throughout this report, and this is a good example of where a student inquires about the process of creation, recognising that even though the process of creation is not easily observable in the product, it is nonetheless interesting. This question seemed to arise authentically (as the teacher allowed students to ask about whatever they wished regarding the creations), but it is notable that fostering curiosity in the creative process and product of others, not only allows students to engage more deeply with creativity but also exposes them to different ways of thinking, processing and expressing information.

Promising practice: Use feedback to support students to reflect on and engage with both the creative process as well as the creative product

- Teachers displayed particularly effective feedback interactions when they sought to extend or challenge what the student had initially thought: 'Let's have diversity, let's do different task, let's see how everybody thinks differently' (Teacher 16, India) and 'Can you do this one in another way?' (Teacher 14, Germany). In both examples, the class went on to create or develop diverse and creative outcomes or solutions: the teachers explicitly drew attention to the fact that diverse processes (in the case of Teacher 14) or diverse outcomes (in the case of Teacher 16) were valuable.
- It was also particularly effective when teachers explained how their feedback in addressing the creative process, would affect the creative product e.g., 'you have to describe them, what did they do? That makes the story interesting' (Teacher 11, Ghana). The way that teachers crafted their feedback to integrate positive yet constructive criticism (which specifically combined showing appreciation as well as ways to improve), is also echoed in the children's peer feedback: 'So I liked the idea of the ball, it was very cool, and my question is how much

time did it take you to make this? And, if you had more time, would you add people coming in asking if they can play? (Student, Sweden)'. This theme of the importance of positive, process-orientated feedback ran through out the data and is further explored in the next section.

Positive feedback and creating safe spaces

Teachers also provided feedback, which fostered a safe space within which students were able to express their own ideas. For example, in response to a student who was timid in sharing their view, Teacher 7 (Sweden) empathised with this student by stating: 'That's normal. I have the same feeling actually. I'm quite nervous myself. You're doing a great job. I'm really happy with how you are doing'. In other instances, teachers directed their feedback at specific actions of the student, in relation to the learning activity: 'I like the fact that you've understood the properties of 3D shapes and you're using them' (Teacher 17, India). This was also identified by Teacher 20 (Denmark) in encouraging students to participate in the classroom activity: 'Everyone's ideas are valid... and I want everyone to be able to contribute their ideas'.

Teachers also discussed using feedback to acknowledge student contributions and ensure that the classroom was a safe and accepting space for sharing ideas. For example, in a discussion about shapes and learning to find halves during a maths lesson, a student commented on the interesting shape of a hexagon. The teacher responded by saying:

> I like what [student name] just said. [Student name] say that to the whole class … I agree, it's so interesting. The shapes are so different and yet they're all one half. (Teacher 15, Germany)

In a reflective interview, when asked about the role of feedback and praise in his teaching, Teacher 8 responded:

> It's very important that they know that they are heard, …sometimes you do feel that you're making an effort in your own way, and if it's not acknowledged one time, maybe you can tuck it in and move on with your life. But if it comes multiple times and from different people. It will be very difficult to bounce out of it, and if they feel that even in this setting, that they're accepted, maybe they will deal in a more positive way with something else. With this happening at home or in another context, so at least here in the school, I can give them the possibility to speak up, to be heard and discuss their ideas, not necessarily impose their ideas in this group, but yes to feel that. (Teacher 8, Sweden)

Teacher 8 was heard to use this affirming feedback multiple times throughout the video recordings: this was especially noticeable when a student proposed an idea or opinion that was different from others in the class. For example, when a student explained why his opinion was different from that of others, the teacher said:

> 'So, you say that basically, that alternative there, does not apply so much in your case. I agree and I accept that' (Teacher 8, Sweden)

The teacher uses his feedback to encourage an accepting and safe space for the students to express diverse and often contrasting opinions and models an open-minded and listening attitude encouraging students in his class to do the same. In terms of creating a safe environment teachers emphasised the role of trust:

> Trust in the teacher and also trust, knowing that they're not going to be a laughed at or ridiculed. So then they should be confident in that 'whatever I say, there's no right and wrong and I will be accepted'. (Teacher 9, Sweden)

Other teachers helped build this safe space by emphasising there were no 'correct' answers but they are interested in the student's individual contribution:

> 'There are no wrong and right answers. It's just *your* thoughts' (Teacher 18, Netherlands)

To confirm this safe space, this teacher never dismissed a contribution but instead, if they wanted to extend or develop an answer that was given, this teacher valued the original answer and gave feedback as a question, to allow the student to come to their own conclusion. See for example:

> OK, now that's a great answer, but I would just like to ask. He was saying that knowing our personalities, and being aware of our hobbies, that can help us learn. Is that what we've also been doing in our art lessons?...Is there another way, or another title that we could use also to bring in what we've been doing within our art lessons? (Teacher 18, Netherlands)

By validating the original answer and giving this feedback as a question, all the students could engage and consider how the idea could be extended. The original idea was not dismissed, but instead the teacher invited the class to consider an alternative answer ('is there another way') or to build on the original answer 'also to bring in..'). In this way the teacher followed through on their previous sentiment of 'no wrong or right answers', and gave feedback in a way that engaged the full class in the process of extending or adapting the idea and considering alternatives.

There was an interesting example of a teacher helping the students to give positive and supportive peer feedback and making that process fun, framing the feedback as a 'thank you letter': In this activity students had designed a board game, written a booklet of 'Rules and How to Play' and designed the board and playing pieces.

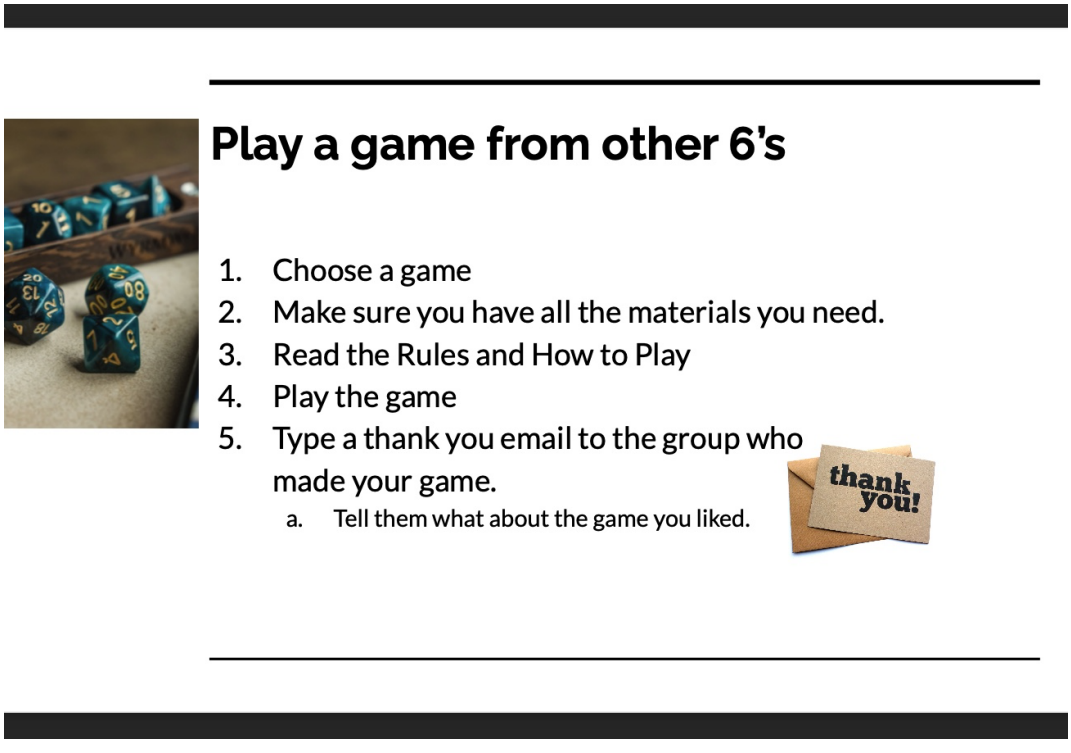

Figure 5.1 Student activity giving feedback on student designed board games (Teacher 18, Netherlands).

Promising practice: use positive and encouraging feedback to create a space where divergent thinking is valued.

When supporting divergent thinking it is important to recognise that students may not always feel confident in sharing ideas that are different from their peers, different from what appears in textbooks and media, or indeed that contradicts or deviates from what has been already been said in class.

- Pre-empt this diversity when setting up the task: 'let's see how everybody thinks differently' (Teacher 16, India);
- Use feedback to highlight the value of different, diverse and divergent perspectives and ensure all ideas are welcomed as valuable e.g. 'There are no wrong and right answers. It's just *your* thoughts' (Teacher 18, Netherlands)
- Reassure those that are not confident and model open-mindedness e.g. 'I agree and I accept that'. (Teacher 8, Sweden)
- When seeking to improve or extend a contribution, it is helpful to value the original idea and use questions, so that the students learn how to extend and develop ideas independently, rather than just being given a correct answer. e.g., 'that's a great answer, but I would just like to ask ...' (Teacher 18, Netherlands)

It is also important to never dismiss an idea that is too far 'outside the box' without asking the student about the rationale behind the idea, how they developed it, the perspective they hold or indeed evidence informing the idea. Helping them articulate how their context, experience or perspective has influence the idea is a helpful process for the individual, as well as a useful insight for the rest of the class into how people think differently and come up with different ideas.

Valuing student contributions and co-creating knowledge

Teachers also used feedback to acknowledge individual contributions and to highlight what might be important themes for the lesson

> That's wonderful you mentioned trade and it's very very important, I'll come back to the trade... *name of student* you have mentioned something that really started made me try to wonder and think about trade. And I think *name of student* also mentioned the same thing, trade. (Teacher 13, Ghana)

Here the teacher acknowledges individual contributions and models how the contributions of others sparks his own curiosity. The teacher calls the students by name, so that they recognise that the teacher is referring to their contribution. This teacher was also very specific about what element he was giving feedback on:

> OK that's a very good perspective... Okay valuable things, you mentioned most valuable that's very good. (Teacher 13, Ghana)

This teacher would highlight the element of the student contribution that would be useful for the upcoming discussions, ensuring that the knowledge being built throughout the lesson was co-created through various contributions, not just through teacher contributions and reflected different people's perspective, not just his own.

Similarly, Teacher 10 in Sweden, used her feedback to highlight the value of student contributions. After each student contribution she repeated what was said, and raised the value of different contributions:

> 'Did he wash his hands before cutting it? [repeated student question] Very relevant question in these COVID times!! [feedback highlighting the value to the class] (Teacher 10, Sweden)

She also acknowledged non-verbal contributions such as drawing techniques to divide fractions of a cake:

> 'So, what I did was I used your technique *name of student *. I cut it in half, and then I did a little like just carefully with a knife, and I saw that turn out a little bigger, and then I kind of adjusted it, like you did, with the eraser'. (Teacher 10, Sweden)

In this example, the teacher acknowledges and values the process that the student went through regarding their reflection on and adjustment of the drawing as they went along. In this classroom, students not only contributed to the co-creation of knowledge but also to *how* the knowledge was co-created. For example, one student noticed that it was taking a long time for the teacher to write each student's idea onto the board and suggested an easier way to share:

> **Student:** *Name of teacher*, it would be just much easier if we all sticked it there [pointing at the board] and then you would read our [post-it notes], out loud!
>
> **Teacher 10:** Good suggestion, yes!!

This was a post-it note activity where the teacher individually acknowledged each student contribution by writing on the board but as suggested, the contributions could be acknowledged also by reading the post-it notes aloud. Interestingly, this teacher would occasionally flip the teaching roles and ask the students to give her feedback and instructions on her Maths processes. She did this either by posing her own questions:

> OK so we have 12 players that will come for this dessert. So how can I cut out the two cakes? What pieces should I do? (Teacher 10, Sweden)

Or by acknowledging and sharing student questions with the class:

> Very good question. What percent did they get? (Teacher 10, Sweden)

Or even through allowing the class to guide her and give her feedback through the process of making an estimation. The children led the estimation process by calling out the 6 times table, with one student pausing to point out that the teacher had written 'X' x 6, instead of 8 x 6. Another student paused the discussion to point out that 17 x 6 (102) was closer to 100 than the original suggestion (16x6 = 96). In each case, the teacher acknowledged the feedback the class gave her and changed what she was writing on the board accordingly. It is interesting to note the collaborative way that the students contributed instructions to guide the teacher through the estimation, and also how they constructively offered feedback if the teacher made a mistake, which in turn led the class to extend their thinking to a more accurate estimation.

It was particularly powerful when teachers used feedback to make connections and link different ideas through to later discussions. For example, one teacher used a picture to begin a discussion about prehistoric trade. He had the students focus on a particular object that was in someone's hand in the picture. Some students thought the object was a dinosaur's tooth and one student thought it was an object of trade because of its value. The teacher responded by saying:

> OK that's a very good perspective … you mentioned most valuable, that's very good'. (Teacher 13, Ghana)

In an interview about this lesson, Teacher 13 elaborated on the reason for asking why this specific item might be used for trade and the significance of the student's comment:

> So, they will be thinking, and they will be talking and then trying to connect what they already know, their prior knowledge, to what they are currently seeing. And I think that it was a very good strategy for them to think because a lot of them, but 'I think it's a dinosaur's tooth' – 'I think it's this' and one

person mentioned something about the fact that it's valuable and precious, which is one thing that I wanted to focus on. So once valuability came in, I was very excited. OK, so then it's not any other object at all that in prehistoric times people used to trade but there were specific objects that were of great value and were precious. So I think that - then even after the video, their conversation extended and then we looked at the picture again and someone was saying - oh, even looking at the people who were in the picture, they were dressed differently. Has it got to do with the fact that they were rich, they were Royals? And so their conversation extended, and I think using pictures is one way of really promoting curiosity in the classroom and that really did justice to it.

Promising practice: use feedback to explicitly draw attention to the value of student contributions and ensure student contributions, ideas and questions form a large part of knowledge co-creation.

- When giving feedback it is important to be specific about *what part* of the contribution is helpful/good/well-articulated or indeed *why* it is good/helpful/well-articulated.
- By modelling positive, specific and useful ways of giving feedback it sets a safe and collaborative atmosphere and also gives students the language and ideas for how they in turn can give their peers and the teacher useful and collaborative feedback.
- Use feedback to make connections and model how to link contributions to what is said in later discussions.

Reflection and self-generation of feedback

A final finding in relation to feedback was the way that teachers used group and individual reflections to help students generate their own feedback on pieces of work. These reflections enabled students to comment and feedback on the product of their creativity (Figures 5.2, 5.3 and 5.4) and also on the process of creation (Figures 5.5).

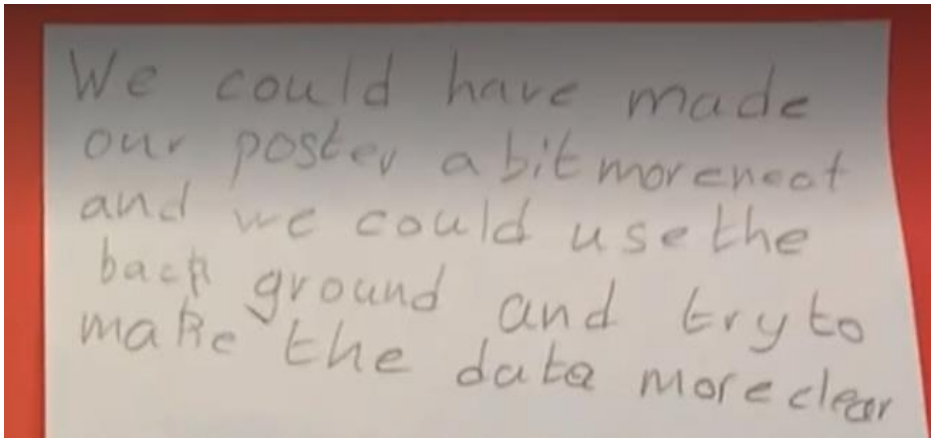

Figure 5.2[1] Group reflection on poster creation, Netherlands. This post-it note was displayed under the poster

[1] Transcription of Fig. 5.2: We could have made our poster a bit more neat [neater] and we could use the background and try to make the data more clear [clearer]

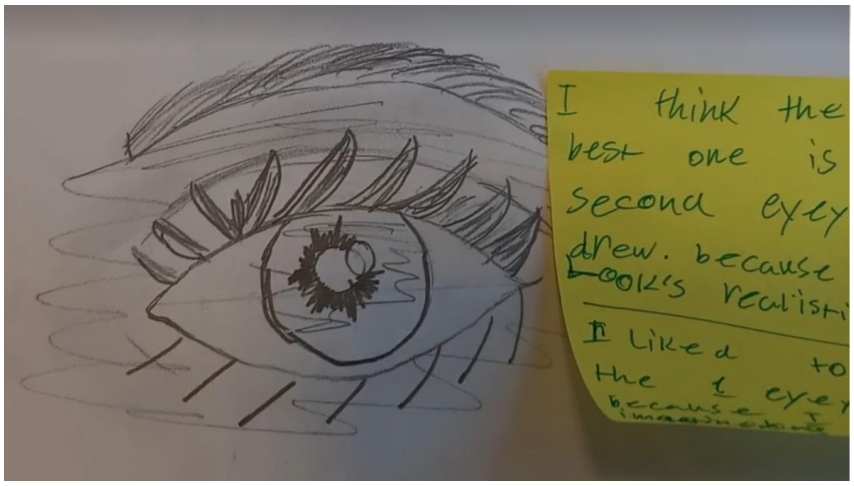

Figure 5.3[2] Individual reflection on sketch of an eye, Netherlands (picture cropped for anonymity).

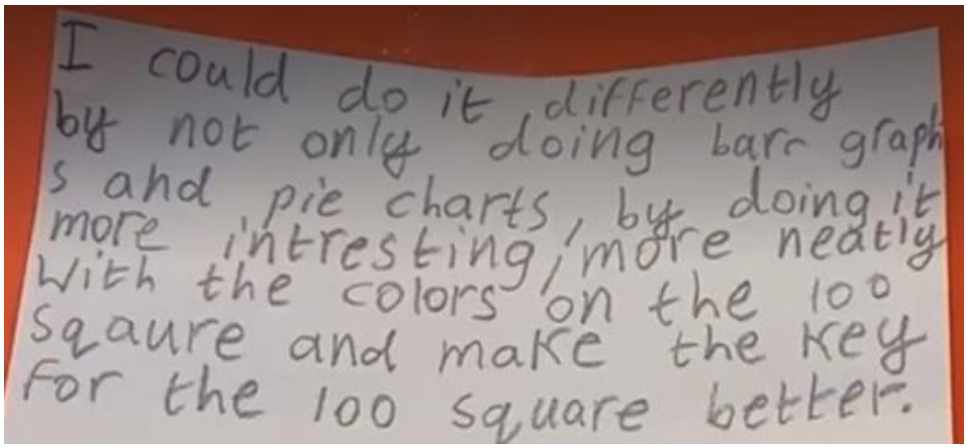

Figure 5.4[3] Individual reflection on poster showing population data, Netherlands.

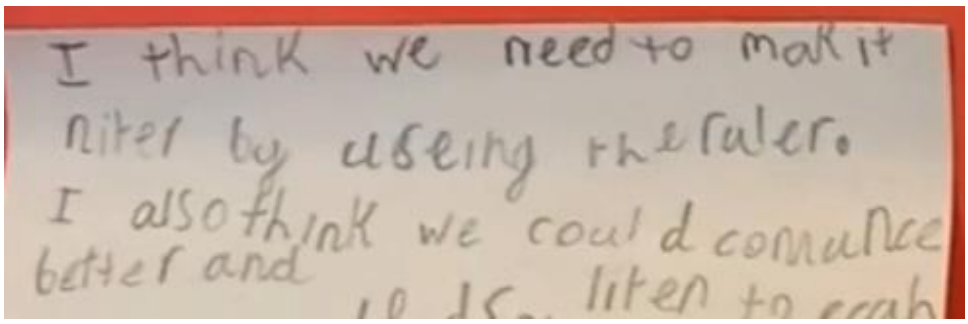

Figure 5.5[4] Individual reflection on group work about the process of creation, Student, Netherlands. (Cropped for anonymity purposes)

Teacher 5 (France) noted that if a student was struggling to write or spell their reflections, then the teacher would put aside 2 minutes near to the end of the class to allow the student to quietly verbally

[2] Transcription of Fig.5.3: *I think the best one is [the] second eyey [eye] [that I] drew because [it] looks realistic.*
[3] Transcription of Fig. 5.4: I could do it differently by not only doing barr [bar] graphs and pie charts, by doing it more interesting, more neatly with the colours on the 100 square and make the key for the 100 square better.
[4] Transcription of Fig.5.5: 'I think we need to mak[e] it niter [neater] by using the ruler. I also think we could communicate better and li[s]ten to each other.

reflect with the teacher and the teacher would transcribe the self-generated reflective feedback into the student's exercise book, so that they could revisit the reflection in their next lesson, as well as read over the feedback in their own time at home.

Promising practice: Support the self-generation of feedback about creative process and creative products

- It is important to support students to generate their own feedback on both the creative process and the final product. Support them with language that will help them articulate what went well in the process and what could be improved. It may be helpful to use supportive questions to facilitate this reflection. For example, 'What challenges did you face? How did you communicate? What would you change?'.
- When reflecting on the product, it is helpful to encourage positive self-reflection as well as enabling them to reflect on ways they could improve: the feedback should include a rationale behind how and why it could be improved - see Figure 5.5 for illustrative example of both product and process critique – the student comments on how they could improve both the product and the process).

5.1.2 Self-regulated learning

The last four decades, classroom pedagogy across the globe has increasingly focused upon how to support students to become self-regulated learners which means being proactive learners who can solve problems we yet have not experienced (Brandmo et al., 2020; Hopfenbeck, 2011). Self-regulated learners know how to set goals, plan how to solve tasks, and they are motivated to find solutions also when faced with challenges, in fact they are persistent and good at time management (Dignath van Ewjik et al., 2013; Jansen et al., 2019; Schunk & Green, 2018). In the current study, analysis of the video data and interviews demonstrated that self-regulation was prioritised by participating teachers across the nine countries. More specifically, we observed teachers facilitating self-regulatory strategies such as goal setting, planning and time management when facilitating students 'curiosity. In the next sections, these findings are outlined.

Setting goals

Some self-regulation strategies were used to gain student's undivided attention to listen carefully to a set of instructions or help them focus on specific tasks, or goals. In other instances, we observed the use of external input, such as music, to help students to focus. For example:

> Hands down, eyes on me. (Teacher 15, Germany)
>
> Hands on top. [Students place their hands on their heads and say 'Everybody stop!'). (Teacher 8, Sweden)
>
> Please focus on your work rather than focusing on others (Teacher 16, India)
>
> Who wants to do mindfulness? (Teacher 16, India)
>
> By now, you should be listening to the music … let's stay focused … now I'm going to stop the music. I use that as a tool to help us stay calm (Teacher 21, Denmark)
>
> Teacher performs a rhythmic sequence of claps and students repeat the claps (Teacher 2, Italy)

One teacher also discussed how important it was to support the children into a focused and calm mindset at the beginning of each teaching session:

> I do a lot of just calming down after break and lunchtime, and even in the mornings, when they come in, they love seeing their friends and having a chat, but we start the lesson off really calm. We do that

> small task for Maths or various other bits and pieces, after lunch we do a mindfulness session, just to get them into that sort of learning space. So, they understand that ok, all my problems outside are outside, and I come in and this is my learning space. That definitely helps. (Teacher 15, Germany)

Setting goals for classroom behaviours and norms was also evident in teacher videos. One example of this is the development of 'Essential Agreements,' or class rules co-constructed by students and their teacher. Students repeat the following agreements before a class session. 1) I will follow directions quickly. 2) I will put up my hand to ask for permission to talk. 3) Take note and do my research 4) I will always make smart choices 5) I will make my dear friends and teacher happy. When asked to talk about these agreements in an interview, the teacher explained:

> Once the child knows what is expected of them, they stick to it throughout the entire lesson because I have had lessons whereby, I didn't start with the essential agreements and then I had to be reminding students. Then yes, so while they stand, they teach it to their friends, and it keeps them in check and they know exactly what is expected of them throughout the lesson, so it becomes very easy and then it becomes a self-assessment for the child as well. (Teacher 13, Ghana)

Some teachers wrote specific prompts to help students to think about their goals, and also to reflect on their creations afterwards.

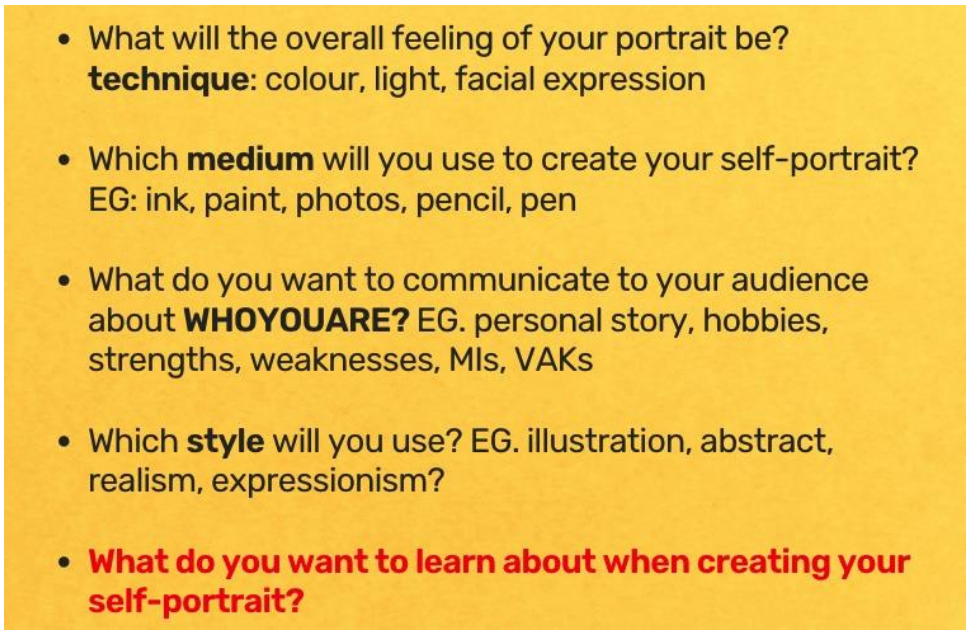

Figure 5.6 Projected slide supporting goal setting and reflection created by Teacher 18 (Netherlands)

Promising practice: help children to set goals about how they will focus, learn and interact with those around them.

- Find different ways to help students gain awareness of their own focus, learning and interactions. Try engaging the class in physical movements, such as asking them to repeat a rhythmic sequence of claps to gain their attention or use a phrase that sparks a physical movement such as 'Hands on top, everybody stop'. Not only does this bring the students' attention back to the teacher but it means they need to put down any writing, painting or building equipment they have in their hands, in order to clap or join in.

- Co-create classroom agreements or rules that remind students of how they will interact with those around them: find fun and memorable ways for students to engage with these agreements, such as adding dance movements to help them remember, or repeating them to a partner as a game at the beginning of the lesson. This may save time from needing to intervene to improve interactions and could also help the children be more aware of how they interact, and which interactions work well for their learning (and which ones do not).
- Create space and time for students to find a way to plan and set goals that works for them as an individual. Help them learn how to break down tasks into manageable chunks, so that starting is not too daunting: some students may find a short mindfulness exercise useful to help them focus, others may wish to start a task with a creative element such as a small picture, flow diagram of steps, or developing their own 'headline' to summarise what they plan to do.
- Try starting the lesson with a quiet reflection or a guided mindfulness session (there are lots of apps or websites that have short accessible sessions). These do not need to be long (1-2mins can work well): teachers report this can help students notice where their mind or focus is being drawn, and this pause may help them get into a mindset where they feel ready to listen, learn and contribute. Calming music can also be a useful way to focus after the busyness of break or lunchtime.

Planning

An important part of the planning process involved encouraging students to plan before commencing their creative outputs. Planning was implemented in multiple ways. Teachers also engaged students in a process of planning what to do if they encounter any difficulties with their creative productions.

> First, plan what you want to create... you can first plan what character you want to create, you can also research if you want (Teacher 16, India)

> You are going to plan a story based on the introduction. We all know how to write a story...the elements of a story, ok, so we are not going to waste our time...because we have done that a lot of times … after the plan, that's when we are going to write it properly on Google Docs (Teacher 11, Ghana)

> When you get stuck on what to write, start with a picture (Teacher 19, Norway)

Sometimes the teachers asked the class indirectly to help them remember the need to think ahead and plan:

> **Teacher 5**: What should you always do, before you start delving into what you need to do?
> **Student:** To think about what we are going to do! (Classroom of Teacher 4 and 5, France)

Teachers also encouraged students to actively engage in and monitor their own thinking and working processes.

> Please make sure to think about key words that you have seen in the problem. Does anybody have an example of a keyword that you have already noticed? (Teacher 7, Sweden)

> … You have to give yourself time to think about it. So, don't just start, have a think...try to draft something down. Give it a name. What problem will it solve? Ok, is it something that is already existing, or you [are] trying to create it? So, these are the things that you should be thinking about (Teacher 11, Ghana)

> See if you can find any more which aren't rectangles. Really challenge yourself. (Teacher 15, Germany)

Explain to us - how do you know that they are halves? (Teacher 14, Germany)

It's fine to have a bigger group ... but I'm going to be watching to see if you're really working and staying on task … I see some people are really losing focus. I want you to stay on task. (Teacher 21, Denmark)

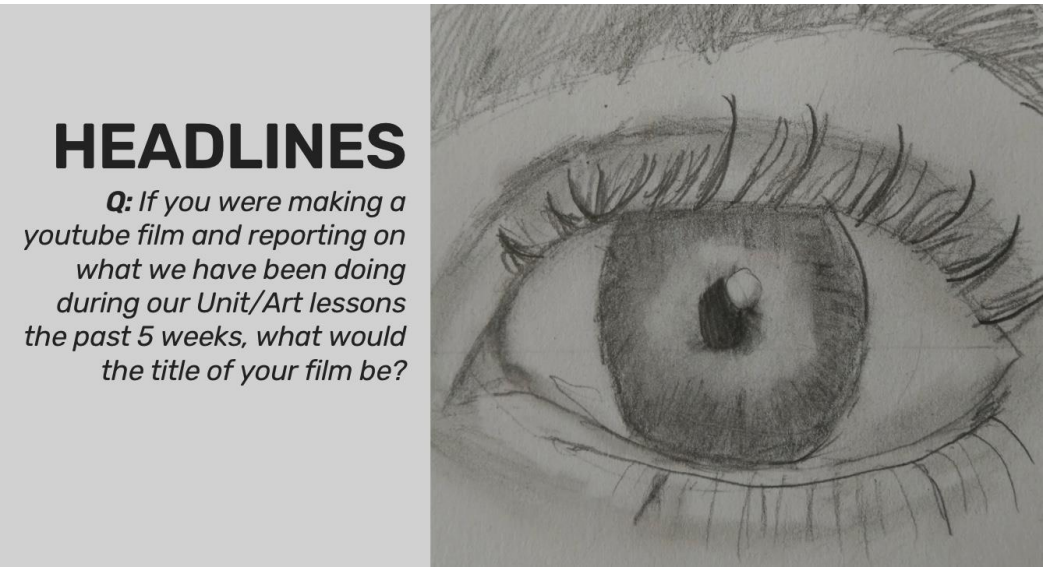

Figure 5.7 Projected slide supporting students to create 'Headlines' to capture initial ideas in their heads slide created by Teacher 18 (Netherlands), image drawn by student (Netherlands).

Promising practice: help children to plan how they will achieve the goals that they have set

- Create space and time for students to find a way to plan that works for them as an individual. Help them learn how to break down tasks into manageable chunks, so that starting is not too daunting: some students may find a short mindfulness exercise useful to help them focus, others may wish to start a task with a creative element such as a small picture, flow diagram of steps, or developing their own 'headline' to summarise what they plan to do. Headlining encourages children to develop a catchy phrase to capture the ideas in their mind when they think about the proposed topic and can be useful for visualising creative thinking.
- In addition, mind-mapping can be used as it allows students to write down any ideas without needing to worry about using complete sentences or needing to order ideas in a linear way.

Making mistakes to foster task monitoring and persistence

An unexpected finding was that several teachers implemented various activities that fostered persistence among students. These activities were underpinned by the principle of appreciating mistake making, which helped students to better monitor both their input and output. In specific instances, deliberate mistakes were also strategically embedded within the learning session. During the interview sessions teachers provided a wealth of examples to reflect these instances.

We have highlighted this as an unexpected finding: firstly, because it was not originally part of the codebook, and secondly, due to how regularly it was mentioned by teachers and students in classroom videos and interviews across all the different countries. The emphasis that students and teachers placed on the role of mistake making, and the rationale articulated by teachers as to why mistake-making was important was striking in the data.

> I think everyone learns through experiences, and we really don't have the privilege to make all mistakes ourselves and learn through them. So sometimes we have to learn through the experiences of others (Interview with Teacher 9, Sweden)
>
> I wonder, if you think of creativity as a concept, I wonder whether there are mistakes at all? Can you make mistakes when you are being creative? That is part of being creative isn't it, making mistakes…maybe that is creativity, trying things in a different way (Interview with Teacher 15, Germany)
>
> As a teacher, one does make mistakes … in front of students … I would sometimes make a deliberate mistake just to see if they are spotting things ... I actually sometimes I do make accidental mistakes, and so if we got a culture where it's OK to make mistakes, then it puts the students at ease … If I've made a genuine mistake, I kind of admit it (Interview with Teacher 19, Norway)
>
> I'm very humble, like making mistakes and I think that's important to show the students that it's OK. I also make mistakes and we all learn from that and we can help each other. Rather than getting upset or anything, so that we're all learning together and I really like that they even suggest things: 'Oh, maybe we should do it this way' (Interview with Teacher 10, Sweden)
>
> Don't [erase] anything, remember I said just leave it ... it doesn't matter [if it is written wrong], just leave it (Teacher 21, Denmark)
>
> I think there needs to be a balance of offering or providing work, which children can make mistakes, but don't make too many mistakes, because if children make too many mistakes they lose interest, but if you can get that level right – when you do, you realise , that ok maybe they make and they realise 'oh I could do it this way' and then when they succeed that second time, they become even more engaged and curious. I think it's super helpful. It's almost like a stepping-stone to engaging children more (Interview with Teacher 15, Germany)

It is important to examine the role of mistake-making and curiosity: making mistakes can often alert students to the fact that they have an 'information gap' or engage them in new ways of exploring.

Promising practice: modelling productive and exploratory mistake-making

- Model and encourage low-stakes mistake-making where the children have the opportunity to experiment, extend their thinking, puzzle through dilemma, and try new pathways without worrying about achieving the 'correct' answer the first time.
- It can be helpful to pick tasks and questions that have either multiple answers or multiple pathways to achieving the answer.

Time Management

Finally, teachers encouraged students to continuously monitor their time during the development of their creative outputs. Some teachers had physical reminders of time within their teaching and learning session, including the use of physical timers (e.g., Teacher 7, Sweden and Teacher 15, Germany). Other teachers actively verbalised the time that they allocated to the completion of the activity and

> You've got 10 more minutes to work on it (Teacher 16, India)
>
> Hands on top of your heads. I want to do a time check just so you are aware. We have probably 7 more minutes of working time left. (Teacher 14, Germany)
>
> Keep [the] time limit in mind ok and I want you to be really creative, so you have half an hour. Can you finish 3 activities in half an hour, or do you want to combine them and create something new? (Teacher 17, India)

> Okay, with your learning partners, you have 20 minutes to find as many halves as you can. (Teacher 15, Germany)

> I'm going to give you 3 more minutes to write that sentence down … I'm going to put 3 minutes on my clock … Don't worry about other people, only focus on yourself for now (Teacher 21, Denmark).

> You have one minute left to share your observation with your group and then we are ready to move on. (Teacher 2, Italy)

It is important to note that this careful use of time-monitoring is also reflected by the students in the classroom videos. One student reflected on time-management when using 'Scratch' (a coding program) to create a short animation about children's rights. When asked what skills he used in the lesson he reflected:

> There is one thing in self-management that I used, time-management. I was basing my project on the amount of time I had, I was predicting that I would be able to do it in like 20 minutes (Student of Teacher 6, Sweden)

Similarly, students from the Netherlands commented on the value of not rushing but taking their time and breaking down tasks into smaller steps. One student reflected that their creation 'looked a bit rushed'.

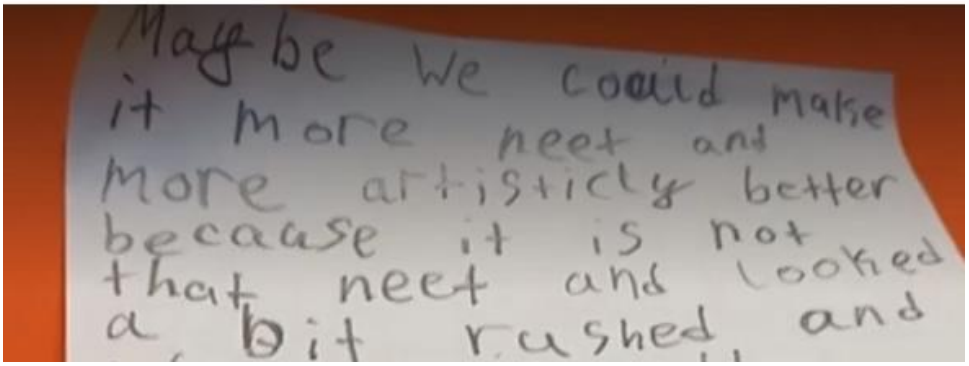

Figure 5.8[5] Student reflection the process of creating a poster showing population data (Netherlands*)*

Another student described the importance of taking his time when learning and creating:

> So, I think, how I learnt how to draw an eye, was by looking in steps how to do it, taking my time. Just trying new things...Taking my time, it doesn't matter if you make a mistake, because you learn from mistakes. (Student of Teacher 18, Netherlands)

This final comment about learning from mistakes links to another key theme that was evident in the teachers practice and was echoed by the reflections from the students.

Promising practice: Communicate structured timeframes and reminders so that students can independently manage their focus and activity within these timeframes.

- Use spoken, written and visual reminders to support the students in beginning, progressing and completing their tasks. The structure that the teachers provided enabled opportunities for the students to manage their attention and focus.

[5] Transcription of Fig. 5.8: Maybe we cooud [could] make it more neet [neater] and more artisticly [artistically] better because it is not that neet [neat] and look a bit rushed.

5.1.3 Nurturing an inquisitive mind

Encourage students to ask questions

Teachers implemented a range of activities to nurture students' inquisitiveness. One prominent way of achieving this was through question asking. Several teachers posed 'what if', 'how' and 'why' questions throughout their teaching and learning session, which required students to engage in thoughtful cognitive exercises. Teachers' questions were embedded at various points throughout the lesson, including at the beginning of the lesson (e.g., question starters), while students were developing their creative products, during group discussions and at the end of student presentations.

> Why is it a hexagon? Convince us. (Teacher 15, Germany)
>
> Can I have you think about something? What if I ask you to combine shapes together? (Teacher 14, Germany)
>
> Why are they trading? ... If it's a dinosaur's tooth, why are they trading? If it's a jade, why are they trading? … So what can we say? What understanding because they did not take any – why didn't they take maybe a dog's tooth or a chicken's beak or something of that sort? (Teacher 13, Ghana)
>
> ...Why did you choose to use the butterfly method? …. If we pulled apart all of the substances containing all of the atoms in the universe and put them into separate piles, how many would we have? … Good question, how do we know that? That is a good question and that is something that we should write for the wonder wall (Teacher 7, Sweden)
>
> How can I cut the cakes, what pieces should I do? [in relation to a fraction activity in Maths class] (Teacher 10, Sweden)
>
> Now my question is, how did you choose the steps? What was the thought behind choosing your steps and the practice that you did? (Teacher 17, India)
>
> There's so much of it, and yet it is very precious to humans … what [do] you think it could be? (Teacher 19, Norway, Student activity on Padlet, riddle provided for teacher for students to solve).
>
> Do you think the maps these days on Google maps, for example, or in your car are better than this [non-digitised] map? … How? (Teacher 21, Denmark)
>
> How has this [Mars rover] helped the scientists know more about Mars? So, if this tool [Mars rover] wasn't here, what would we not know? Why are they putting this on Mars? (Teacher 21, Denmark)
>
> Why do you think it [science project] is not exploding anymore? (Teacher 2, Italy)
>
> They said that when they put salt, for example, into a glass of water, nothing really happened. Do you agree? Don't you agree? Why? (Teacher 2, Italy)

Teachers also encouraged students to ask their own questions. In this context, the types of questions that teachers encouraged were distinguished by whether they were asked inwardly or outwardly. In relation to inward questions, teachers encouraged students to reflect on the lesson and question themselves about the learning activity. To this end, teachers also modelled their own inward questioning about specific topics in their lesson, as well as the outcomes of their own curiosity.

> Can I have you think about something? What if I ask you to combine shapes together? (Teacher 14, Germany)
>
> Let's ask ourselves, 50 years from now, hundred years from now, what do you think people will be inventing? (Teacher 11, Ghana)

> I want you to look at these objects and ask yourself, "what shapes do I see in this object?" (Teacher 12, Ghana)
>
> *Student name* mentioned something … that really made me try to wonder and think about trade (Teacher 13, Ghana)
>
> You have to reflect at the end, so use your thinking hats whenever you are questioned. [Ask yourselves] Why are you doing this? Why did you pick this? (Teacher 16, India)

By contrast, outward questioning involved encouraging students to pose questions to either the teacher or to their classmates. This involved prompting students to ask general questions, as well as more specific questions, which were aimed at identifying and filling information gaps and developing their language skills.

> Did anybody have any wondering questions that they want to share?... Anything that they were really curious about? (Teacher 7, Sweden)
>
> What does it say on the back [of an object]? It's kind of small but usually they say the [name of the] ingredients (Teacher 7, Sweden)
>
> Does anyone have any questions for them [classmates who delivered an oral presentation]? (Teacher 9, Sweden)
>
> Any questions before [we] wrap up? Any questions? (Teacher 13, Ghana)
>
> How could you check? … Ask your teammates to help you. (Teacher 15, Germany)
>
> That's [question-asking] something that I am developing because it's all part of language development. I wanted to try an embed into the final few minutes of a typical artefact book reading, writing, sharing session. I wanted to students to ... ask question about their own writing. It's a good way to ensure that they are engaged. (Teacher 19, Norway)

Promising Practice: Model and encourage students to ask both 'inward' and 'outward' questions to help students reflect and also identify and fill knowledge gaps

- Model and encourage wondering about what is unknown during a lesson to increase curiosity.
- A helpful activity that facilitated question-asking was seen in Teacher 10's Math lesson: when watching a video about cutting a pizza into fractions, students were encouraged to write down on a post-it note one thing they noticed, and one thing they wondered (see Figures 5.9-5.11 below).

These ‘wonderings’ the students wrote on their post-it notes varied from the very practical:

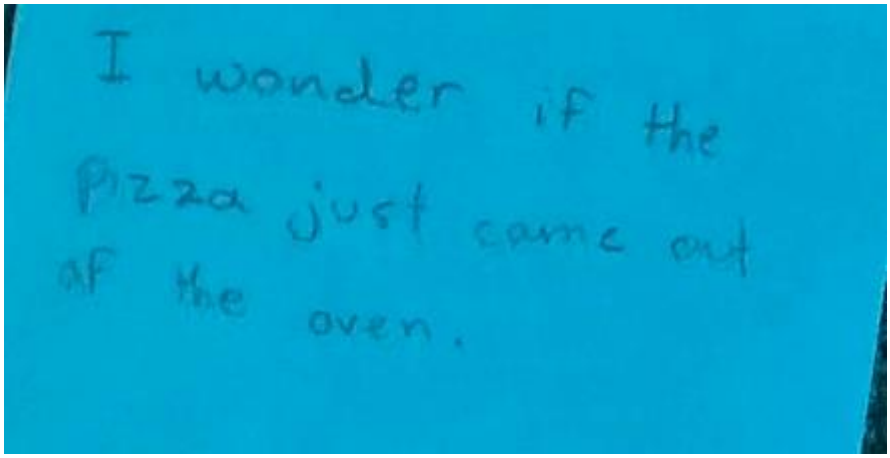

Figure 5.9[6] Student post-it note showing what they ‘wondered’ (Sweden)

Two additional abstract wonderings:

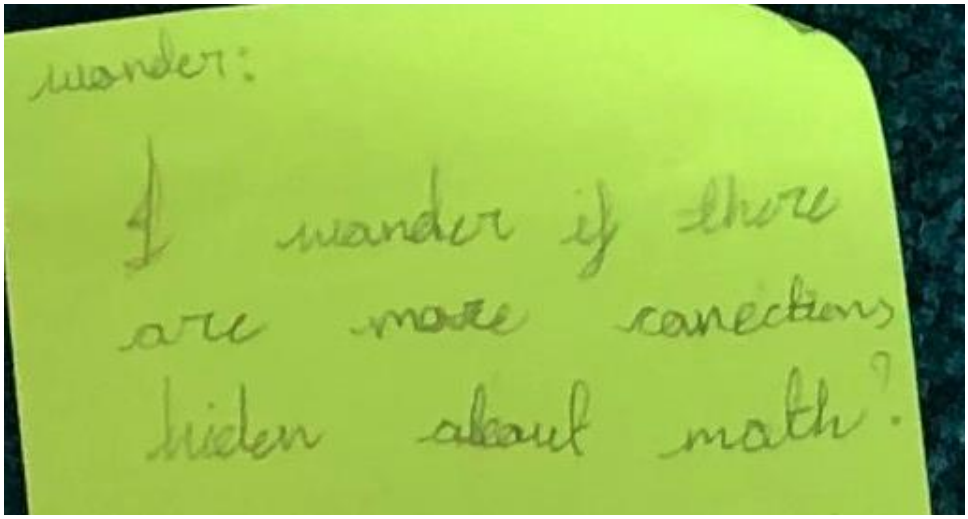

Figure 5.10[7] Student post-it note showing what they ‘wondered’ (Sweden)

[6] Transcription of Fig. 5.9 : *I wonder if the pizza just came out of the oven*

[7] Transcription of Fig. 5.10: *I wonder if there are more conections [connections] hiden [hidden] about math?*

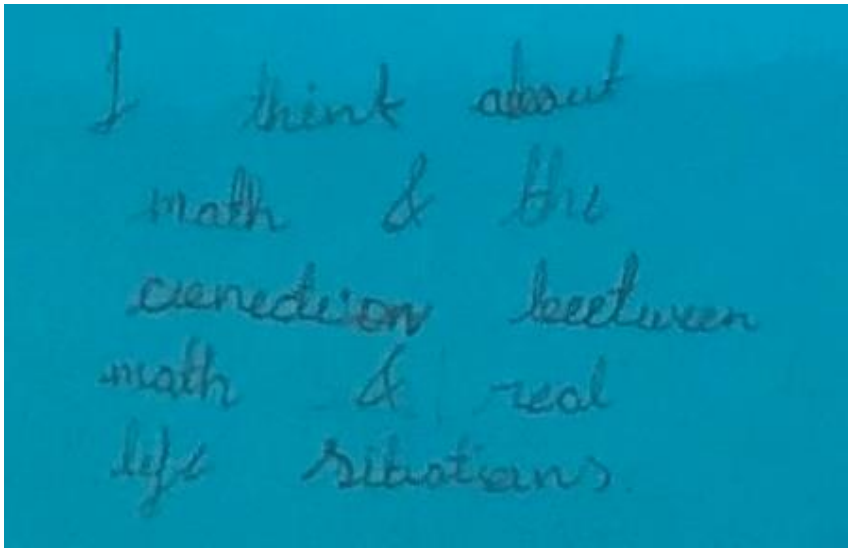

Figure 5.11[8] Student post-it note showing what they 'wondered' (Sweden)

This final reflection about the 'connection between Math and real-life situations' illustrates an important theme in promising practices relating to curiosity: students indicated high levels of question-asking and engagement when discussions explicitly linked what was happening in the classrooms to the world outside the classroom. In interview, Teacher 10 explained that this task was inspired by the work of the Maths teacher and academic Dr Dan Meyer who places an emphasis on helping children be curious about Maths.

Encourage students to wonder, identify knowledge-gaps, and consider connections to the outside world

Teachers utilized strategies to help students identify and fill knowledge gaps. Sometimes this was in the form of a peer-to-peer discussion, and at other times, teachers initiated a review of prior knowledge having students share what they remember from previous learning.

> Remember we've been talking about exploration … What are the things we have talked about so far about exploration? CONFER. (Teacher 13, Ghana)
>
> What happened in the primary era? (Teacher 1, Italy)
>
> Rich math tasks strategies. Let's remind ourselves what strategies we use when we do rich tasks … Okay. I'm going to ask [student name and student name] first of all because I heard some interesting conversations going on. What are some of the strategies that we use when we do rich math tasks? (Teacher 15, Germany)

In the two teacher quotes below, we see examples of filling a knowledge gap and these are also examples of individualised learning strategies as they involve relating a topic to students' lives. The first teacher links the subject of international trade to students' everyday lives in the classroom by

[8] Transcription of Fig. 5.11: *I think about math and the conection [connection] beetween [between] math and real life situations.*

allowing them to explore and find out the origins of items in the classroom. The second teacher uses a discussion about shapes and links it to familiar objects in and outside of the classroom.

> We are going to look at the items in the classroom so if you look at your sheet, you have item and the country of origin so you're going to look for the item and write the item down and the country it's coming from. You have to find out where exactly the labels are and then you write them down. (Teacher 13, Ghana)

> I want you to look carefully around at any objects you see and tell me what do you really see in the classroom? … I want you to look at these objects and ask yourself, what shape do I see in this object? ... So now these shapes that we've mentioned, do we normally see them around? Where do you see these shapes? (Teacher 12, Ghana)

In interview, Teacher 10 discussed the role that she felt she could play in helping nurture the children's curiosity as well as supporting them to identify knowledge gaps and interest:

> I think it is our aim and mission all the time in a PYP school, that the students are engaged and curious. And I think if we see that they are not very interested in something, we try to steer it in a different direction. And then, what I use myself in my practice, is to always pick up on the little things that they share, or mention, or see. (Teacher 10, Sweden)

This teacher discussed how they used every opportunity to ignite their curiosity, even 'wondering' or 'noticing' out loud:

> When we were walking to swimming, and we saw this construction going on, and there were some pipes, and we were learning about systems at that time. So I just stopped and said 'oh I'm wondering what part of what system this is?'. I think just by showcasing what I'm thinking about, I feel it really inspires the students to do the same. (Teacher 10, Sweden)

In interview, another teacher also talked about the importance of curiosity and utilising the 'I see, I think, I wonder' strategy which also allows students to discuss what they already know and what they wonder. (Teacher 21, Denmark)

It is interesting that the importance of creating a safe psychological environment also arose in terms of nurturing curiosity as well as was seen in Section 5.1 for fostering creativity:

> That you understand individually the students' own drives towards their curiosity and that you, provide them with an environment where they feel like it's OK, to be in tune with their own questioning, and their own understanding, and their own wanting to know more about what they're learning about. So that there's also opportunities for them to inquire into that... I think, understanding or helping the children to understand that they are the drivers behind their own understanding of the world, and how they make sense of it, and ultimately that obviously goes back to education. (Teacher 18, Netherlands)

Promising Practice: Model and encourage wondering about what is unknown during a lesson to increase curiosity

- Provide opportunities for students to make connections between the lesson and their everyday lives to increase curiosity
- Incorporate peer-to-peer discussions during lessons to help students identify and fill knowledge gaps and share ideas
- Provide opportunities for students to review prior knowledge to help students identify and fill knowledge gaps

5.1.4 Facilitating collaboration

Preparing for collaboration: articulating purpose

In order to engage students in collaborative activities, teachers often gave a clear articulation of the purpose of the activity. Sometimes this purpose was shared verbally with the students:

> Now this task has a specific goal: **that you will be able to give arguments to support your opinion** and you will need to make informed decisions about relationships and consent. We're going to practice on our social skills, so then OK and what will happen? You will be getting some post-Its... If you need to move during the activity, please do. There will be a little bit of movement actually.. you will have two alternatives that you will have to choose from, but **you need to support your opinion with your example** … depending on your choice you will make the teams – you will see two choices on the screen, one on the left, one on the right, if you feel that you belong on the right one, you can move there and discuss with other people that have the same opinion as you, but **you need to write down your explanation**…it is not about win or lose, **it is about your opinions**. (Teacher 8, Sweden).

The text in bold highlights that the teacher repeated the core objective throughout his instructions for the collaborative task. In other classrooms, the purpose of the collaborative activity was shared on the board and a student was invited to read the objective aloud:

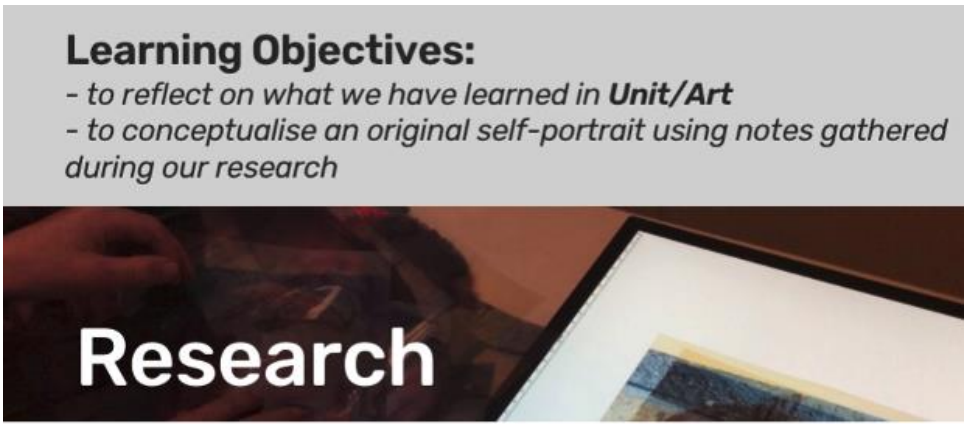

Figure 5.12: PowerPoint slide from classroom in the Netherlands

Preparing for collaboration: inciting curiosity

Many teachers began collaborative work with quiet individual reflection before moving to grouped work. This reflective individual work often functioned to engage the students by inciting curiosity in what was to follow:

> So today we are going to do a lesson on exploration. We're going to look at that as part of our new unit. OK, what I've done is on our tables we have got pictures of tools used by explorers, different tools, what I want you to do first is once you get up and this is a silent gallery walk. So we don't need to talk. I want you to go around and just look at all the different tools ….Walk around, have a look, make sure you go to all of the different stations. Just looking, have a good look at each one. Don't just walk past them. Have a quick glance. Have a good look. Start to think about what it is.
> Start thinking about how it might have been used. (Teacher 20, Denmark)

> OK, so I want you to look at this picture, as you're looking at it, I want you to see what halves do you see? So look at it and you're going to see how many different halves do you see in this picture? ...Quiet thinking time, go! (Teacher 14, Germany)

The students then often used this thinking time to generate ideas before moving into groups to share and collaborate.

Promising practice: articulating purpose and inciting curiosity

- Give a clear articulation of the purpose of the activity and organise a short pause or task to help children engage with this purpose, explore their own curiosity in the task and begin to develop their own ideas.
- To incite curiosity in the collaborative task and in the perspectives of others it can be helpful to start a task with individual quiet idea-generation: this can allow students to develop their own opinions on the content and ideas for how to engage in the activity, and to help them think about how they could contribute to the group. This also can help build their confidence as it gives them time to consider what they as an individual will contribute and how they plan to interact. An example of this could be a silent gallery walk where students move around the classroom looking at objects, pictures or words placed on the different desks in the classroom.

Preparing for collaboration: organising groups

There was a real diversity in the ways that teachers chose groupings, but what was interesting is that there was always a rationale behind who might be grouped, whether the children could choose and how many students were in each group.

> You can choose to work alone … you can work in pairs and you can work with a small group (Teacher 6, Sweden)
>
> You could be working together, right? This is up to you (Teacher 7, Sweden)
>
> So, if you feel that you want to be incredibly smart, please move to this side of the class and you can discuss your opinion with others but please use 'group talk' (Teacher 8, Sweden)
>
> This is what we are going to do, you're going to work in pairs … you're going to choose who you want to work with. The two of you should pick one of the introductions. You should agree on the one that you want to work on (Teacher 11, Ghana)
>
> I will normally say, if we're picking partners then you always have the option to work by yourself. (Teacher 14, Germany)

However, there were some instances where teachers used a combination of spontaneous and planned groupings based on an understanding of each student's ability to work together with particular classmates. For example, one teacher explained:

> You know teachers. We kind of have an idea of who we want together so some of it was like these kids will work fine no matter who I put them with. Some of it was I really don't want these kids together. It was a little bit of planned grouping and spontaneous at the same time. (Teacher 14, Germany)

In another instance, the weather even played a role in student groupings:

> It was a really really hot afternoon and I could feel if I put the wrong people together, it could escalate into an argument really quickly and so I thought you get to pick. And it was the afternoon on a long day and I just thought it would be nice if they got to spend some time with someone they don't normally get to work with. (Teacher 14, Germany)

Promising practice: Preparing for collaboration and organising groups

- Give a clear articulation of the purpose of the activity and organise a short pause or task to help children engage with this purpose, explore their own curiosity in the task and begin to develop their own ideas.
- Use grouping to develop students' curiosity in new ways of working: either carefully select groups so that children learn to work with a diversity of collaborators, and experience multiple ways of working.
- It can also be helpful to make opportunities to give students agency over how they interact: allowing them to make choices about who they work with, and how they work with them.
- Model and encourage flexible, reflective, and responsive behaviour to show students ways to engage with the actions of others and adapt their behaviour and ideas accordingly. For example, modelling how to change your mind, how to let new information inform group decisions, and how to come to a compromise.

Encouraging students to appreciate collaborative processes

The nature of agency within collaboration varied across contexts, both in requirements and number of collaborators. For example, there were surface level collaborations which included students sharing with each other without the expectation of producing a tangible collaborative output. In these instances, students were able to share as much or as little as they wanted. By contrast, other teachers encouraged students to collaborate at a deeper level with the aim of developing a shared creative output. Collaborations also varied in the number of students, including a range of think-pair-share and larger group activities (3 to 5 students per group).

Shorter collaborative processes began with the sharing of ideas, perspectives and knowledge:

> Before you get up and then start working on it, in your table group, as you are seated, I want you to just quickly share your idea. [Share] What is it that you are thinking to do and how that will show that children are equal. (Teacher 6, Sweden)

> Take a minute to just share with your partner the things you wondered, and the things you noticed (Teacher 10, Sweden)

> Why is it that a lot of items are coming from China? … I'd like you to discuss it. Ok, confer... discuss with your friends (Teacher 13, Ghana)

> You can talk to the person next to you for about 20 seconds, 30 seconds. Where can you see one half? (Teacher 15, Germany)

Collaborative processes that had a tangible output demanded the navigation of more complicated interaction and the sharing of decisions:

> Who are the main characters in the story?... what is the setting? So, what you have to do, the three of you [group members] have to agree. You have 2 characters or five characters? That is why you're working in a group so that you can discuss (Teacher 11, Ghana)

> I want you to sort the shapes that I will give you... You are going to write your own headings and then you and your partner will be telling where the shapes will go (Teacher 12, Ghana)

In the Netherlands, groups collaborated to make a board game in Maths. Below is an illustration of how students 1, 2 and 3, spoke as they collaborated as they designed the board game (see Figure 5.13 for example of the kinds of board games produced):

Student 1: What should we do for this?
Student 2: But don't forget that you have to do the other side as well.
Student 3: Guys, should we also make it so you get coins?
Students 1 and 2: Yes!!
Student 1: Yes coins, because otherwise there's barely any point, and then you write down, and then you have like a mini scoreboard maybe, for how many points?
Student 2: Yeah, should I make the scoreboard?
Student 3: Each time you land on a tree you get a coin.
Student 2: So it's like a coin tree!
Student 1: And maybe for this box we can make like an actual origami box?
Student 2: Can I do something, so here how many coins should we put?
Student 3: Do you guys know that we're making this for other classes and our class as well?

Figure 5.13 Maths board game designed by students in the Netherlands

In this final interaction, students not only share decisions, but they also give different ideas and choosing what to follow through, they also volunteer to work on different sections, and even remind each other of the different elements of the task (drawing on the other side) and the purpose of the task (for other classes and their own class to play).

Promising practice: Engaging students in the collaborative process

- Emphasise that diverse ideas are important and that there are multiple ways to reach the intended goal: use this to introduce the importance of compromise and group decisions. Model and encourage the use of language such as listening, sharing, explaining, turn-taking, reflecting, agreeing (and even disagreeing). This enables students to discuss and share the responsibilities of the creative task, and manage and negotiate the contributions, knowledge and expertise of the group.
- Provide opportunities for different types of collaboration.
- Help students to use reflection to make invisible learning processes visible. It is helpful to allow students to experiment with how they like to reflect (some may prefer to discuss their reflection, write it, voice-record it or draw it. In terms of collaboration, it is useful to give students time to reflect on and write about how well the collaboration went, why, and how it can be improved.

Facilitating collaborative peer-interaction

Teachers often gave explicit instructions to ensure the children shared responsibility in the group:

> I would like your poster to be nice and colourful. Do I want one person to do all the writing? (Class all responds 'No!') Is anyone in charge of the group? (Class all responds 'No!') Everyone's ideas are valid. (Teacher 20, Denmark)
>
> While somebody is writing form … somebody needs to explore causation and change, and you can do this and share the ideas. So, you don't wait for everybody. You can take turns. (Teacher 21, Denmark)

Teacher 18 (the Netherlands) designed an activity to specifically support students to reflect on how they collaborated and how they could improve this. The class collaborated on a collective class portrait (Figure 5.14) and had a follow up activity to reflect on the collaboration (Figure 5.15).

Figure 5.14 Collective class portrait (the Netherlands)

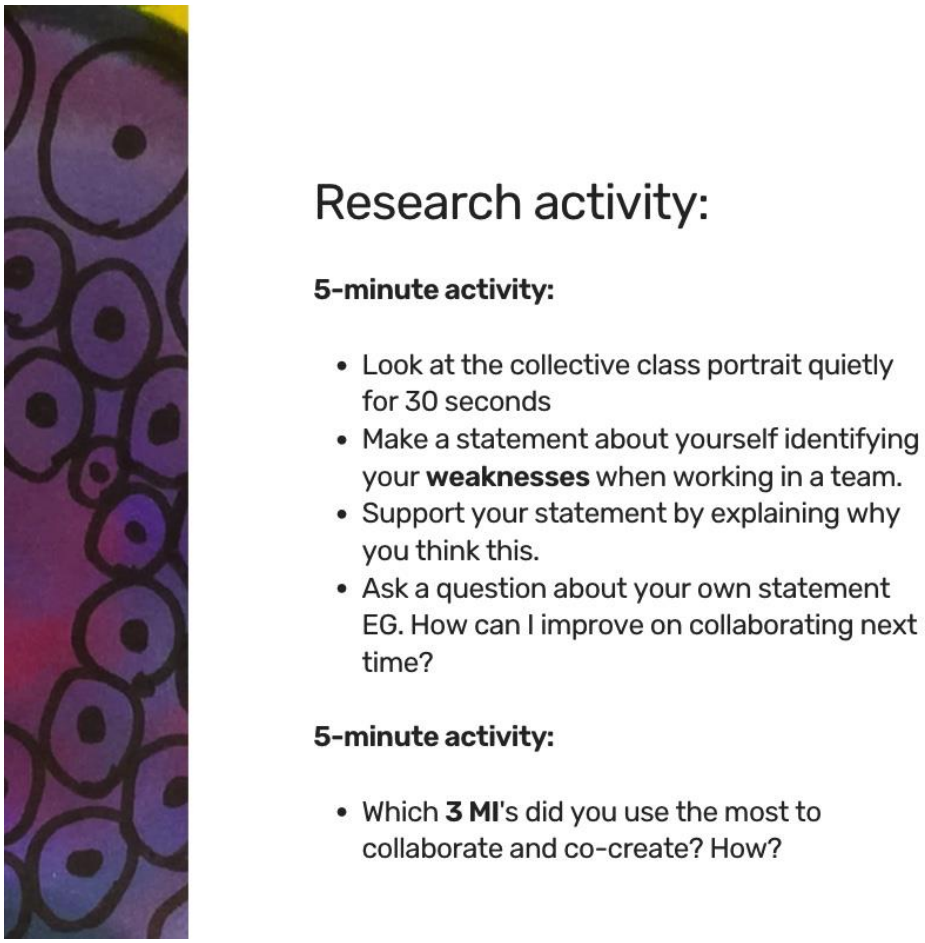

Figure 5.15 Reflective activity on the collective class portrait (the Netherlands)

The teacher asks the students to consider the three MI's (Multiple Intelligences) that they used the most to collaborate and co-create. This class had been learning about Gardner's theory of Multiple Intelligences (Gardner, 1993) to help the understand more about themselves as learners. This teacher

discussed the way that creativity manifests in both collaboration and independent learning in the classroom:

> So what does creativity in the classroom mean to me, as a teacher? They have the opportunity to think outside the box, come up with their own solutions, go off in their own way and investigate what they want to investigate, that they are curious about themselves, but also about the people around them. It's not just an individual process, of course. Learning to collaborate, communicate and solve problems with each other. Being curious about each other. Yes, I think creativity in the classroom is facilitating opportunities or giving opportunities for them to solve problems, I think for the most, and coming up with their own unique way of solving problems. (Teacher 18, The Netherlands)

Throughout the classrooms, communication was highlighted as key when it came to meaningful collaboration. When reflecting on collaboration and group work two pupils noted:

> **Student 1**: I think my partner and me, we used communicating skills and thinking skills. So the communicating skills, it was to think and speak to each other like what we're going do, and who will work on the first and the second thing. And the thinking skills is to think what we are going to do and how we are going do it.
>
> **Student 2**: Communicating skills, because me and my partner were communicating what to do. We did one thing, both of us did one thing at the same time (Students of Teacher 6, Sweden)

By contrast it was noted that when there was a break-down in communication, then collaboration broke down and teamwork did not function:

> **Teacher 18:** How do you think your lesson is going?
>
> **Student:** I didn't think that went to well because everybody threw their balls out of their boxes, and when I said they were out, they wouldn't listen. So then I had to go further, and they wouldn't listen because it was too loud, because everyone was shouting. So I didn't think that went too well. But I think in the next game will go a bit better.
>
> **Teacher 18:** How can you improve it?
>
> **Student:** I can improve it by making the instructions clearer, and I think the next game will actually be a lot easier for them.
>
> **Teacher 18:** Let's see how it goes, yes, good job!

Finally, it was also noted that sharing responsibility of the task at hand was an effective way of ensuring creative collaboration was productive. For example, in France, the class of Teachers 4 and 5 used colourful blocks to create a three-dimensional setting for a story. At the end of the lesson, they reflected on the collaboration, one student explained how they came up with the idea and how they worked together to create different elements:

> We were just mixing up brainstorming many ideas, and then *Name of student* had the great idea to make a bridge. And I remember before when I had some activities in summer, I had seen how to make a bridge and we had some special materials, so I got some little ideas to make the bridge. Then we each added a small idea…. *Name of student* made the top of the bridge …*Name of student* suggested we can make a double one, that we can actually walk inside! (Student of Teachers 4 and 5, France)

Figure 5.16 Students co-created a bridge out of colourful blocks

Promising practice: incorporating a sense of shared responsibility and community

- It is important to give clear instructions relating to the purpose and process of any collaborative work. Engaging children to be curious in the content, the collaborative process and the views and ideas of their peers is also key.
- Choosing groups that will allow for meaningful interactions can be useful, but it is also helpful to make opportunities to give children agency over how they interact, so allowing them to make choices about who they work with, and how they work with them.
- Helping children to share the responsibilities of the task is central to productive group work and making sure that the purpose of the task and the diverse ways of reaching the task objectives are articulated, allows children to generate ideas and problem solve in order to achieve the objective.

5.1.5 Choice over self-expression

Modelling and valuing multiple modes of expression

Teachers often explained how creativity could look very different for each individual student and teachers discussed the different ways that choice, confidence and self-expression were interweaved into student creativity:

> Creativity, it's very individual. I think it can be something that can be displayed in many different facets and it's to do with imagination. I think having a good imagination allows you to become creative and being able to think outside of that expectation or 'the box' as people call it. And having the confidence to do that. And creativity comes back down to confidence... I see in the kids that I teach that they're very reluctant a lot of them to be creative, because they don't want to step outside the box. They don't want to be seen as being different. They don't want to make a mistake; they don't want to be seen to do the wrong thing by their peers. And I see it as my job to build the confidence to make those choices and to make those decisions to let their creativity come through. And their creativity can be how they express themselves when they're standing up and talking in front of the class. It can be how they write using the language that they know. It can be the books they choose to read, the art they choose to draw, and as I said, many, many different ways they can express it, but it's having the confidence to do that and to engage their imagination. (Teacher 20, Denmark).

The importance of diversity in modes of expression (linked to differentiated learning) was echoed throughout the teacher's interviews:

> I guess it is trying to see things from a broader perspective and it doesn't always have to be one way...when students demonstrate what they have learnt, we try to let them do it in many different ways, so it could be like a role play or PowerPoint or making an iMovie. (Teacher 10, Sweden)

Choice over modes of expression

In both virtual and non-virtual learning environments, teachers also encouraged agency through providing creative demonstration opportunities. Figure 5.17 illustrates an example of how a choice board activity was used to accomplish this within the virtual learning space. Through this activity, teachers emphasised to students that: "It's a choice board, which means anybody can choose any task" (Teacher 16, India). This activity accommodates the interests of a variety of students: "We have a diverse set of students. Their likes are different so it's important to give them a choice board to really bring out the engagement." (Teacher 17, India). Within this activity, teachers did not limit the number of tasks with which students could engage. For example, in response to a student's question about whether they were able to select three activities, Teacher 17 (India) inquired by asking the student the following: "Can you finish 3 activities in half an hour, or do you want to combine them and create something new?"

Figure 5.17 Choice board activity within the virtual learning environment Teachers 16 and 17 (India)

This resulted in a huge diversity of expressive modes, including dance, the building of a reading corner, the creation of people and puppets, mime, drawing and wring of posters and invitations to a play as well as many creative ideas articulated verbally as the children shared ideas with their peers and the teacher as they were developing their creation:

Figure 5.18. Creative outputs visible in the video data from the student choice board activity of Teachers 16 and 17 (India)

One student made an acrostic poem (Figure 5.19) outlining about the importance of safe social practices during corona virus:

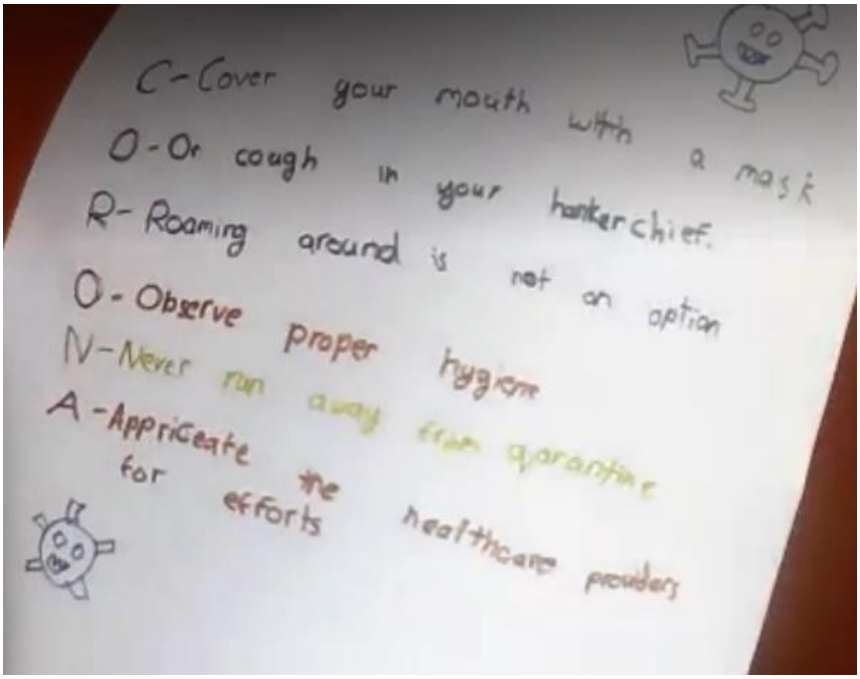

Figure 5.19. Student creation of an acrostic poem (India)

A similar finding, in relation to creative demonstration opportunities was also identified within non-virtual learning environments. Even within the individual expressive modes there was great diversity

of the way children expressed their creativity. In Teacher 9's classroom, children performed small scenarios about permission and consent looking at themes such as trespassing, borrowing and stealing: even though the students all had opportunities to perform the children seized this opportunity in different ways – one used his skateboard to enact a scene about trespassing that was directly relevant and related to his hobbies, some used puppets to act the different parts in the scenario, others folded paper to make glasses, and moustaches to distinguish between the different characters. The teacher used these different expressions to draw out the shared themes of trust and respect. Furthermore, in Teacher 6's classroom, a student felt nervous to present but still wanted to share his ideas, and so pre-recorded short voice clips (this can be done on a phone, laptop, tablet or voice-recorder) so that he could speak confidently whilst he showed his PowerPoint, knowing that he had pre-prepared his ideas in advance.

In addition, a specialist teacher who worked with students with learning differences echoed the similar sentiments in relation to possible accommodations required to foster their creativity:

> It would depend a lot on what their challenges are and what their strengths are so you know it could be just as simple as allowing them to give a verbal answer on a test and not having to write it down, because maybe it's the ... physical act of handwriting [that] is overwhelming or fatiguing for them … I have several students who get so caught up in the spelling … they could write a long, wonderful story, super creative, full of lots of details. But ... if you're only accepting what they write on a paper, you might only get two sentences because they're almost paralysed by the fact that they can't spell the next word, and so then they just stop … So you know, giving different ways to show what you know is a huge strategy (Teaching specialist, school in Europe, country retracted for purpose of anonymity)

Teacher 19 in Norway provided students with the opportunity to engage in creative writing using artifact books (see Figure 5.20 for example of student work), which provide a long-standing record of student work and creative developments. Indeed, in an interview with this teacher, in reference to the development of the artifact book idea, he noted that "it took me 9 months at least what to decide on what to call it [the artifact book] … because prior to that, it was always called the diary." This reflects the life-long learning characteristic of Teacher 19, which was something that appeared to be embedded in the ethos of students' engaging with their own artifact book. Finally, both Teacher 20 and 21 from Denmark ensured that through their lesson on exploration, students not only had the opportunity to ask questions about different objects (e.g., submarines as shown in Figure 5.21, but also other objects including the Mars Rover and a telescope) that they selected from several options, but after engaging with these objects, they had to provide their "creative connections". This meant that students had to ensure that they considered the real-world application of these objects.

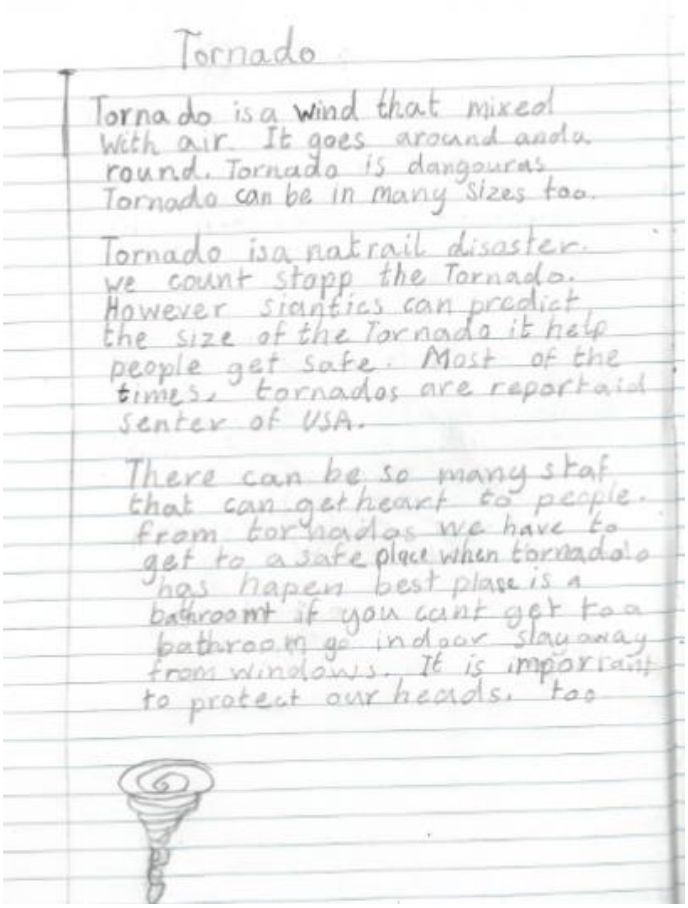

Figure 5.20. Student creation of a short story on tornados, which was presented in their artefact book (Norway)

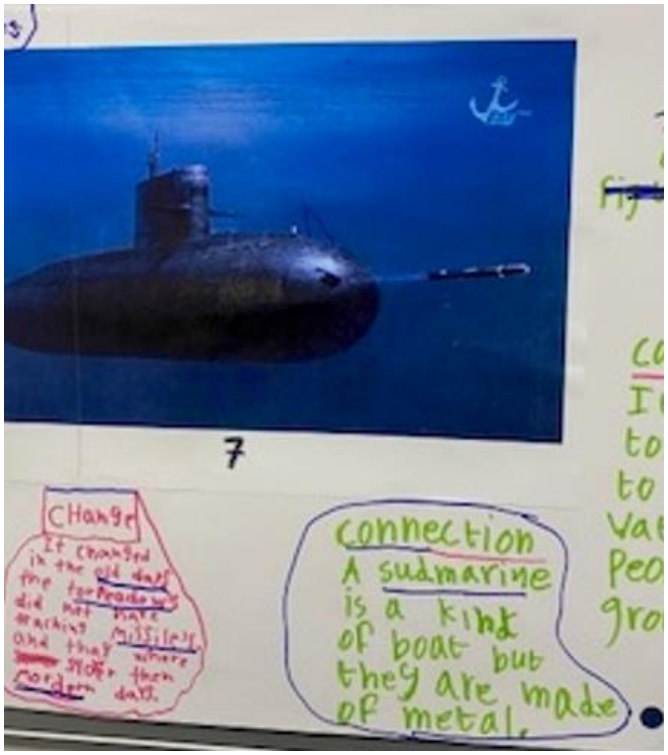

Figure 5.21. Students used different visualisations such as submarines to develop their own creative connections (Denmark)

The importance of choice was also echoed throughout the teacher interviews. Small expressions of choice were emphasised as really important in helping the children focus and engage with the creative tasks. Teachers reflected on giving the children choice over the tools they would write with (pens, pencils, colours) and what they would write on (mini whiteboards, paper, or in some cases the classroom tables!):

> I was introduced to it [providing student with autonomy in choosing whether to write on paper or on the table when solving problems] by another teacher here at our school … she encouraged me to let students choose to work that way because she felt like it really increases their engagement and just gets them a little bit more motivated to get going (Teacher 7, Sweden)

One teacher reflected on the importance of giving choice over where in the classroom they chose to work and their body positioning:

> So children don't necessarily learn best when they are stuck at their desks: learning at different levels, learning lying down, standing, sitting, leaning...I asked our janitor just to cut two tables, so we had these short tables so kids could sit on the floor when they work …I used to do a lot about choosing your learning space … how does a child know best how to maximise being creative and curious – what helps my body be ready for that learning and curiosity. (Teacher 15, Germany)

Promising practice: Acknowledge the value of students' own expressions

- Explicitly draw attention to the value of the content of student expressions, and how the children produce and communicate their learning.

Opportunities for autonomy in choice and taking risks.

Teachers integrated multiple opportunities for students to make choices and decisions in order to help them learn how to make good decisions. These expressions of choice covered not only what tools to work with, where to work with but also who to sit and work with:

> I let the children choose where they sit in the class each week. So each week they come in and they're allowed to choose a seat wherever they want to sit. The only rules that I have around that are they not allowed to sit with the same people that they sat with the week before, and they can't sit on the same table. So that means they have to move around and find new people to sit with and work with…if I can get them to, by the end of the year, to understand that it's OK not to sit with my best friend, because I'm still going to see them at recess and lunchtime and after school and whatever. Or maybe once every now and then I'll sit with them, but I've got the strategy in place to deal with any distractions that come along. It's going to be more powerful for them, going forward into the later years, than just me simply sitting them away from their friends… And then you make sure that when they do have a good week, you praise them and you say 'Listen, I see what you've done this week. You made a good choice. You've sat where you sat in a good position and you've been able to learn', and you highlight any little wins they have, and you're always looking for a positive in the situation. (Teacher 20, Denmark)

This relates closely to our theme of collaboration and emphasises that allowing children to make decisions, enables them to learn more about not only how to make better decisions, but also about how best they can work, and what strategies work for them as an individual and as part of a group.

It is also interesting that there are also techniques that allow freedom over self-expression to even be integrated into more traditional modes of self-expression:

> I think we need to empower students and we need to allow them that freedom. In writing, for example. I think if a student gets a paper back and it's been all marked up. I mean, you know they feel a weight...

> Many days I just let the children write, and I say, 'I'm not going to mark it because this is just for you to be free to put down whatever ideas you would like to do'. I said 'It doesn't need to be written in a certain way. You can put it in whatever form you like'. And does that mean we'll never look at the piece and mark it? No, you're going to choose one piece that you're really interested in improving. And with that one, you know we're going to look at the grammar and the spelling and edit it and really bring it to a place where we can share it with the world. But writing should just be pleasure, and if it's not creative for them, and they don't enjoy it, then writing becomes a task… I mean the results are amazing. Whereas before when it's so structured and it's a grammar lesson, it's painful for them to write one paragraph, and then you have kids and they're writing like 5,6,7,8,9. One wrote 15 pages, they're just really enjoying writing and the ideas are flowing. (Teacher 4, France)

Teachers would often introduce the task with broad and open-ended tasks, to allow students to experiment and discover what might be possible with the materials that they were given:

> 'You can make anything that you want with these shapes' (Teacher 12, Ghana).

Figures 5.22 and 5.23: Students created different images with the shapes they had been learning about earlier on in the lesson (Student of Teacher 12, Ghana)

Promising practice: Integrating opportunities for choice, decision-making and risk-taking

- Focus on supporting each individual's confidence, through giving choice over how, where and when they shared their views and creations with the class, so that students felt in control of

their own learning. For example, pre-recorded short voice-clips can support those that still want to share but are not ready to speak directly to the group.

Linking creative self-expression to curiosity

There was one particular example that integrated creativity and choice over expression into a curiosity-focused task, enabling students to be creative in how they identified their knowledge gaps, and then how they then expressed their findings. Teacher 18's class in the Netherlands opened with clear articulation of instruction and purpose:

'Formulate questions in groups for students about COVID, with the purpose of collecting data'.

The students generated their own questions and their teacher supported them to think more broadly:

- *How did COVID affect our personal environment?*
- *How did COVID affect our local environment?*
- *How did COVID affect our global environment?*

The students developed google forms to send to pupils at the school to collect data. Then there was a clear visualisation of the steps (Figure 5.24).

Figure 5.24 Teacher 18's PowerPoint breaking down the steps to handling and displaying data.

The resulting expressions ranged from illustrations to hand signals, to collections of objects to show percentages. For example, one group used their hands showing eight out of ten fingers to show 80% of students who responded to the survey were afraid to go to a different country.

Promising Practice: Choice over modes of expression and space

- Teachers emphasised the importance of giving students diverse and multiple opportunities for self-expression: teachers integrated opportunities for students to act, build, dance, mime, write, craft, move, paint, sketch, doodle and many more. The key element was that teachers gave children choice over how they explored, reflected and communicated during their learning.
- There was also a key focus on confidence, through giving choice over timing and positioning, making sure that students could pick how, where and when they shared their views and creations with the class, so that students felt in control of their own learning and how they shared what they had learnt with others.

5.1.6 Summary of findings

The following five boxes summarise the five themes, subthemes (in bold and blue), and their associated promising practices (in italics).

Summary Boxes of Themes and Promising Practices

Theme 1: Diverse Feedback Pathways
Sub-theme: Interactions that support, challenge, and extend students' thinking ***Promising practice: Use feedback to support students to reflect on and engage with both the creative process as well as the creative product*** 1. Use feedback interactions as opportunities to extend and broaden how children think, exposing children to diverse perspectives and new ways of thinking. 2. Avoid dismissing ideas and opinions without engaging with the rationale or explanation behind an idea – this will only narrow perspectives and lose the nuance and value of complexity 3. Use peer, teacher, and self-generated feedback to support students to reflect on both the creative process as well as the creative product. **Sub-theme: Positive feedback and creating safe spaces** ***Promising practice: Use positive and encouraging feedback to create a safe space where divergent thinking is valued*** 4 Pre-empt this diversity when setting up the task 5. Use feedback to highlight the value of different, diverse, and divergent perspectives and ensure all ideas are welcomed as valuable. 6. Reassure those that are not confident and model open-mindedness. 7.When seeking to improve or extend a contribution, it is helpful to value the original idea and use questions, so that the students learn how to extend and develop ideas independently, rather than just being given a correct answer. 8.Use constructive and supportive feedback that indicates how an idea can be developed transformed or improved. **Sub-theme: Valuing student contributions and co-creating knowledge** ***Promising practice: Use feedback to explicitly draw attention to the value of student contributions and ensure student contributions, ideas and questions form a large part of knowledge co-creation*** 9.When giving feedback it is important to be specific about *what part* of the contribution is helpful/good/well-articulated or indeed *why* it is good/helpful/well-articulated. 10.By modelling positive, specific, and useful ways of giving feedback it sets a safe and collaborative atmosphere and gives students the language and ideas for how they in turn can give their peers and the teacher useful and collaborative feedback. 11.Use feedback to make connections and model how to link contributions to what is said in later discussions. **Sub-theme: Reflection and self-generation of feedback** ***Promising practice: Support the self-generation of feedback about creative process and creative products*** 12. Provide students with the time, language and means to regularly reflect (e.g., What challenges did you face? How did you communicate? What would you change?') 13. Allow children to experiment with how feedback is produced and used, some may respond better to feedback that is generated by others or self-generated, some may prefer written, verbal or pictorial ways to engage and remember, the key element is that they engage with the feedback and take the ideas forward. 14. When reflecting on the product, it is helpful to encourage positive self-reflection as well as enabling them to reflect on ways they could improve: the feedback should include a rationale behind how and why it could be improved.

Theme 2: Self-Regulated Learning

Sub-theme: Setting goals

Promising practice: help children to set goals about how they will focus, learn, and interact with those around them.

1. Find different ways to help students gain awareness of their own focus, learning and interactions. Try engaging the class in physical movements, such as asking them to repeat a rhythmic sequence of claps to gain their attention or use a phrase that sparks a physical movement such as 'Hands on top, everybody stop'. Not only does this bring the students' attention back to the teacher, but it also means that they need to put down any writing, painting, or building equipment they have in their hands to clap or join in.
2. Co-create classroom agreements or rules that remind students of how they will interact with those around them – find fun and memorable ways for students to engage with these agreements such as adding dance movements to help them remember or repeating them to a partner as a game at the beginning of the lesson. This may save time from needing to correct interactions and may also help the children be more aware of how they interact, and what interactions work well for their learning (and which ones do not).
3. Try starting the lesson with a quiet reflection or a guided mindfulness session (there are lots of apps or websites that have short accessible sessions). These do not need to be long (1-2mins can work well): teachers report this can help students notice where their mind or focus is being drawn, and this pause may help them get into a mindset where they feel ready to listen, learn and contribute. Calming music can also be a useful way to focus after the busyness of break or lunchtime.
4. Create space and time for students to find a way to set goals that works for them as an individual.

Sub-theme: Planning

Promising practice: help children to plan how they will achieve the goals that they have set

5. Create space and time for students to find a way to plan that works for them as an individual. Help them learn how to break down tasks into manageable chunks, so that starting is not too daunting: some students may find a short mindfulness exercise useful to help them focus, others may wish to start a task with a creative element such as a small picture, flow diagram of steps, or developing their own 'headline' to summarise what they plan to do. Headlining encourages children to develop a catchy phrase to capture the ideas in their mind when they think about the proposed topic and can be useful for visualising creative thinking.
6. In addition, mind-mapping can be used as it allows students to write down any ideas without needing to worry about using complete sentences or needing to order ideas in a linear way.

Sub-theme: Making mistakes to foster task monitoring and persistence

Promising practice: modelling productive and exploratory mistake-making

7. Model and encourage low-stakes mistake-making where students can experiment, extend their thinking, puzzle through dilemma, and try new pathways without worrying about achieving the 'correct' answer the first time. It can help to pick tasks and questions that have either multiple answers or multiple pathways to achieving a solution.
8. It can be helpful to pick tasks and questions that have either multiple answers or multiple pathways to achieving the answer.

Theme 3: Nurturing an Inquisitive Mind

Sub-theme: Encourage students to ask questions

Promising practice: Model and encourage students to ask both 'inward' and 'outward' questions to help students reflect and identify and fill knowledge gaps

1. Model and encourage wondering about what is unknown during a lesson to increase curiosity.
2. A helpful activity that facilitated question-asking was seen in Teacher 10's Math lesson: when watching a video about cutting a pizza into fractions, students were encouraged to write down on a post-it note one thing they noticed, and one thing they wondered and shared these with the class.

Sub-theme: Encourage students to wonder and consider connections to the outside world

Promising Practice: Model and encourage wondering about what is unknown during a lesson to increase curiosity

3.Provide opportunities for students to make connections between the lesson and their everyday lives to increase curiosity.
4.Incorporate peer-to-peer discussions during lessons to help students identify and fill knowledge gaps and share ideas.
5.Provide opportunities for students to review prior knowledge to help students identify and fill knowledge gaps.

Theme 4: Facilitating Collaboration

Sub-theme: Preparing for collaboration: articulating purpose

Promising practice: Preparing for collaboration and organising groups

1.Give a clear articulation of the purpose of the activity and organise a short pause or task to help children engage with this purpose, explore their own curiosity in the task and begin to develop their own ideas.
2.Use grouping to develop students' curiosity in new ways of working: either carefully select groups so that children learn to work with a diversity of collaborators, and experience multiple ways of working.
3.It can also be helpful to make opportunities to give students agency over how they interact: allowing them to make choices about who they work with, and how they work with them.
4.Model and encourage flexible, reflective, and responsive behaviour to show students ways to engage with the actions of others and adapt their behaviour and ideas accordingly. For example, modelling how to change your mind, how to let new information inform group decisions, and how to come to a compromise.

Sub-theme: Encourage students to appreciate collaborative processes

Promising practice: Engage students in the collaborative process

4.Emphasise that diverse ideas are important and that there are multiple ways to reach the intended goal: use this to introduce the importance of compromise and group decisions. Model and encourage the use of language such as listening, sharing, explaining, turn-taking, reflecting, agreeing (and even disagreeing). This enables students to discuss and share the responsibilities of the creative task, and manage and negotiate the contributions, knowledge, and expertise of the group.
5.Provide opportunities for different types of collaboration.
6. Help students to use reflection to make invisible learning processes visible. It is helpful to allow students to experiment with how they like to reflect (some may prefer to discuss their reflection, write it, voice-record it or draw it. In terms of collaboration, it is useful to give students time to reflect on and write about how well the collaboration went, why, and how it can be improved.

Sub-theme: Facilitating collaborative peer-interaction

Promising practice: Incorporate a sense of shared responsibility and community

6.It is important to give clear instructions relating to the purpose and process of any collaborative work. Engaging children to be curious in the content, the collaborative process and the views and ideas of their peers is also key.
7.Choosing groups that will allow for meaningful interactions can be useful, but it is also helpful to make opportunities to give children agency over how they interact, so allowing them to make choices about who they work with, and how they work with them.
8.Helping children to share the responsibilities of the task is central to productive group work and making sure that the purpose of the task and the diverse ways of reaching the task objectives are articulated, allows children to generate ideas and problem solve to achieve the objective.

Theme 5: Choice over Self-Expression
Sub-theme: Modelling and valuing multiple modes of expression ***Promising practice: Acknowledge the value of students' own expressions*** 1. Explicitly draw attention to the value of the content of student expressions, and how the children produce and communicate their learning. **Sub-theme: Opportunities for autonomy in choice and taking risks.** ***Promising practice: Integrating opportunities for choice, decision-making and risk-taking*** 2. Focus on supporting everyone's confidence, through giving choice over how, where and when they shared their views and creations with the class, so that students felt in control of their own learning. For example, pre-recorded short voice-clips can support those that still want to share but are not ready to speak directly to the group. **Sub-theme: Linking creative self-expression to curiosity** ***Promising practice: Choice over modes of expression and space*** 3.Teachers emphasised the importance of giving students diverse and multiple opportunities for self-expression: teachers integrated opportunities for students to act, build, dance, mime, write, craft, move, paint, sketch, doodle and many more. The key element was that teachers gave children choice over how they explored, reflected, and communicated during their learning. 4.There was also a key focus on confidence, through giving choice over timing and positioning, making sure that students could pick how, where and when they shared their views and creations with the class, so that students felt in control of their own learning and how they shared what they had learnt with others.

5.2 Conceptualising Creativity and Curiosity

In interviews we asked 92 students and 22 teaching staff how they defined creativity and curiosity and how they practiced these in their daily lives. In student interviews we tended to inquire about both the noun (creativity) and the adjective (creative), so that the concepts were not so abstract, and students could explain how they would conceptualise someone as curious or creative. We then followed with questions about the kinds of activities that make them feel creative and curious, and the sorts of things they do when they feel this way, so that they might share their own experiences of feeling curious and creative.

> **Researcher:** What does it mean when someone is creative?
>
> **Student:** It means that they have a lot of ideas that are little bit like out of the box, but that aren't really, they are not so standard, like they're a little bit different, and they are creative, they are a little bit different from other ideas...I feel creative normally when I can experiment, and I can be a little bit free to test and see what's happened when I do different things.
> **Researcher:** What does curiosity mean? What does it mean when someone curious?
> **Student:** It means that they like to discover new things and they ask a lot of questions to get the answers...Normally I feel the most curious when I study a new subject and I get to ask a lot of questions and understand how it works... I ask like how does it work? How do you use it? Why is it important? Just things to know a little bit more about that subject.
> (Student, Italy)
>
> **Researcher:** Have you ever heard of the word creativity before?
> **Student**: Yes, it is the most used thing that usually describes me, according to, you know the *Name of School* community. It means being able to do something in a new or an unusual way. Oh my, that sounded like it came from the dictionary!
> (Student, Sweden)

Student: In my opinion, if somebody is curious, it means they want to know stuff. And they also want to like get deep into the topic. I think that's a good thing, if somebody is curious because then more people know more stuff. And then yeah, everybody will know quite a bit and then everything works well, pretty well.
(Student, the Netherlands)

Even when students did not feel they could articulate the exact definition they were keen to share examples and ideas and would often find creative ways to describe what they meant

Researcher: So we've spoken about curiosity and being curious, so, we're going speak about another word called creativity. Have you heard that word before?
Student: Yeah..
Researcher: And what do you think that word means?
Student: That word means a lot to me. I use it a lot, so, it's basically expressing your imagination in your head. You put everything you're thinking in your head on to the paper or your book and you just make things which are unexpected. Try and make it interesting and, I don't really know the definition of the word, but like these are examples.
(Student, Ghana)

Student: For me, when someone is curious, is when they look at something in a different way, and they say 'What if this happens to it? 'Will it be like this or this or this?'. There are so many different possibilities (Student, France).

Student: Curiosity is, when you are curious about something. Let's say somebody says 'I'm drawing this but it's a surprise so don't ruin it!'. And you think 'I'm so curious, I want to know what's the surprise, I want to know what it is!'
(Student, Italy)

Student: I think being curious means more like an intent to like learn more, an intent to like understand your surroundings basically.
Researcher: What do you do when you want to find out information?
Student: First what I would, what I would do is, wait, it matters like what topic is like is History or Science?
Researcher: Any topic you want, I guess it depends on the topic, but yes, that's a good, that's a good question!
Student: I'll show you like history for example. First, I would like if I wanted to like focus more on World War One. Then I would first like search up what caused it, and then like where it took place, like the setting, and then I would like search up all the battles and stuff and then I'd like check for people's opinions. (Student, Sweden)

Student: Creativity is like that you like that you have imagination, when you do a drawing that you put in a little bit of imagination that you draw rainbows, flying cows.
(Student, Netherlands)

Some students used interesting metaphors to describe the abstract nature of creativity and curiosity:

Student: Being creative to me means questioning how you are going to do something. It starts with the root, so simply the first question. The first question you find about more about it, and once you find out more, you get creative, you think a lot, and question yourself, and try to find the answer. It all starts with one seed, and the seed grows and grows until it flowers with your own creative idea.
(Student, Germany).

Researcher: So we've been speaking about creativity and curiosity. So imagine that you are the teacher for one day and what would you do to help the students in your class be more curious? What are some of the things that you would do?
Student: Oh, I will try to ask. I would try to tell them about something which is, you know something which they haven't learned about. For example, let's say it's kindergarten and I asked them that. Oh, do you know about this? They'll be curious to learn, thirsty to learn about that. And then when they, and then when they see it, when they learn more about that, they want to learn more and more. So just like that, curiosity gets inspired, just like a candle.
(Student, India)

It was also interesting to see what the children perceived as promising practices for fostering curiosity and creativity

Researcher: I would like you to imagine that you were a teacher for one day and you can make any changes in the classroom or to the teaching. What would you do to help students be more curious?
Student: I would have one random research hour every day...Where you can just think of anything and just research about it.
Researcher: That sounds brilliant. It's a very good idea, and imagine that you're a teacher again. And what would you do to help students be more creative?
Student: I would have one arts hour, but you can't use any paint, pencils or erasers. Or even paper!
(Student, Sweden)

Researcher: Imagine that now you are the teacher, you can teach anything you want... Is there anything that you would change or that you would teach to help the students be more creative?
Student: For me, for students to be more creative, is to learn my students how to use recycling materials, and why. And second, to change it make the people understand how to be caring and responsible.
(Student, Italy)

Researcher: Imagine that you are the teacher for a day of your class... What are some of the things that you would do to ensure or to help the students be more curious?
Student: I would actually make them...a student come and ask me a question, I'll not just tell him the answer. I will hint him or her and all time make him or her find out their self. To make them more curious, so not everything will be simple for them, not the answers will come like just like that.
Researcher: OK, and how would you ensure that they are more creative?
Student: I will make them write more stories and I will not tell them what to write it about, I'll just make them write whatever they want so they can express all their creativity.
(Student, Ghana)

Teachers also shared reflections that ranged from practical conceptualisations to more abstract considerations.

Creativity is broader than just being good in Art. It's also thinking of alternative ways of dealing with things and appreciating the alternative ways. I mean even in Maths, if there are two or three ways that you can solve a problem that are more advanced. Yes, this shows creativity or alternative thinking. So, I can see it in many different domains. I mean it's also how you connect the ideas together, and you see that what you have learned, (Teacher 8, Sweden)

Okay, so to my understanding. I think curiosity is being able to have the freedom to explore, to know more and to lead your own exploration, sometimes to be guided in your own exploration. That is what I believe. And then to do this, sometimes you have to start with asking questions. So some questions will guide how you're going to explore. How your curiosity is going to play out. So that's how I understand it... It enables learners to take ownership of their learning and to think so that is how I see curiosity. That's how I see it. ...So once we have created an environment that is enabling that is enabling

curiosity, what you have to do as a teacher is just to facilitate, to guide. The rest depends on the learner. The learner is in charge here, which is why you notice that you become like you are in the background and the child takes the centre stage and the child can explore, do whatever they want and then after that comes the curiosity. Then more thinking comes, more questions come up whilst they are given that enabling environment and yes then by so doing, they take ownership of their learning. It is like they are at the forefront. They are - like driving a car and they are in the front seat controlling the steering wheel. That's how I understand it.
(Teacher 13, Ghana)

5.3 Quantitative Findings

5.3.1 Creativity Task: Guilford Alternate Uses Task

The creativity task yielded 534 responses, and together, the group, comprising three raters, provided a total of 1,602 ratings. Using a 1 to 3 scale (1 = Not at all creative, 2 = quite creative, 3 = highly creative), three research team members rated all responses according to the rubric developed for this study. Table 4 provides examples of student responses to each object (key, pen, chair), for each corresponding anchor. Initially, the team reached 92% agreement, with the team's rating reflecting disagreement on 32 of the total number of ratings. The team discussed rating discrepancies for ~2-hours and clarified until 100% rating agreement was achieved. Skewness scores[9] for these data ranged from 0.45 to 0.76, well within the suggested limit of ±2 (Field, 2013; Gravetter, 2014). Similarly, kurtosis[10] values ranged from -0.93 to -1.22, well within the suggested limit of ±7 (Field, 2013; Pallant, 2013).

Students, on average, obtained ratings that corresponded with the anchor "quite creative" for each of the three items (see Table 4 for descriptive statistics). Responses across the items indicated general agreement that students were thinking creatively, with responses to the use of a 'chair' being rated as containing the highest percentage of creative uses responses.

Table 4. Descriptive statistics of creativity score ratings for each of the three objects (3-point scale, n = 179)

Item	Mean	SD	Skewness	Kurtosis
Key	1.71	0.80	0.57	-1.22
Pen	1.63	0.77	0.76	-0.93
Chair	1.76	0.77	0.45	-1.20

[9] This is a statistical measure that identifies whether scores in the data deviates significantly from a normally distributed dataset.
[10] This is a statistical measure that identifies whether there are extreme scores present in the dataset.

EXAMPLES OF STUDENT RESPONSES TO THE CREATIVITY TASK

	1 = Not at All Creative	2 = Quite Creative	3 = Highly Creative
	• Opening doors (Student 2, age 11)	• You can use it to cut a rope. • You can use it to unlock a door. (Student 108, age 10)	• To open a door. • I can use it as a necklace • To find an answer • To solve a mystery (Student 58, age 11)
	• To write (Student 60, age 10)	• Unlock the door. • Lock a door. • Cut a paper (Student 52, age 10)	• It can be used to write, draw, underline. • It can be used as a weapon. • It can be used to clean deep corners. • The fiddling of a pen relieves stress. • It can be used to play games during boring lessons. • It can be used as a dart. • Pens can be used in fake drum sticks. (Student 103, age 9)
	• You can sit down on the chair (Student 119, age 8)	• It's a chair. We sit on it and we can use it as a step stool. (Student 23, age 11)	• It can be a teleporting chair that looks like a normal chair but if you say a code then the place you want to go then it will teleport but if you are a hybrid you can see the controls. (Student 26, age 9)

Figure 5.26. Examples of student's responses in the creative task.

Figure 5.27 illustrates the percentages of creative responses based on the 1 – 3 creativity rating scale. Students were more creative than not creative in their responses for 1 of 3 the three objects, with the largest percentage of creative responses being attributed to different uses of a chair (56 % highly creative or quite creative combined, compared with 45% of responses rated as not at all creative).

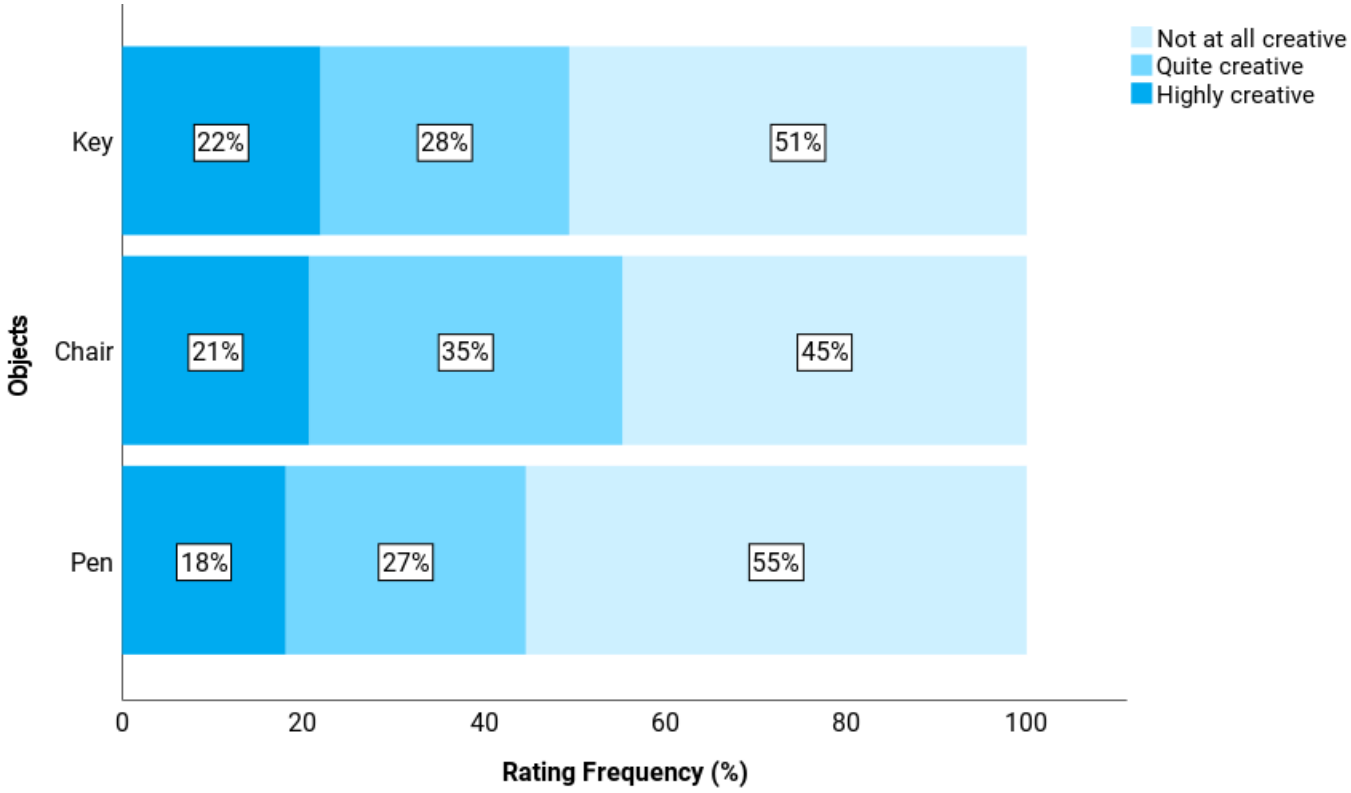

Figure 5.27 Rating of student responses to creative uses of a chair, pen and key

5.3.2 Students reported views on their curiosity

Descriptive statistics, including means and standard deviations, for student ratings of their own level of curiosity are presented in Table 5. Responses across the items indicated general agreement that students were curious, with mean scores ranging between 2.76/4 to 3.70/4. The questions with the highest mean responses were 'I enjoy learning about new topics' (3.70/4; SD = 0.52) and 'I enjoy finding out how things work' (3.69/4, SD = 0.53). Finally, skewness scores for these data ranged from 0 to -2.05, with skewness scores generally well within the suggested limit of ±2, except for one score (When I go anywhere, I enjoy looking for new things to do produced a skewness score of 2.05) (Field, 2013; Gravetter, 2014). Similarly, kurtosis values ranged from 0 to 5.54, well within the suggested limit of ±7 (Field, 2013; Pallant, 2013).

Table 5. Means and standard deviations of student's perceptions of their own curiosity as measured by the Epistemic Curiosity Questionnaire (n = 193)

Item	Mean	SD	Skewness	Kurtosis
1. I enjoy learning about new topics	3.70	0.52	-1.96	5.54
2. I enjoy thinking about lots of things, because then I learn more about all sorts of new things	3.55	0.63	-1.33	1.81
3. When I am in a new situation, I enjoy learning as much as I can.	3.51	0.64	-1.08	0.64
4. When I go anywhere, I enjoy looking for new things to do	3.64	0.67	-2.05	4.12
5. I enjoy asking a lot of questions to learn more about the things around me	3.45	0.71	-1.33	1.84
6. I enjoy finding out how different things work	3.69	0.53	-1.70	3.29
7. When I see a word that I do not know, I look it up or ask someone what it means	3.52	0.73	-1.51	1.76
8.I t bothers me when I cannot find the answer to a question that I do not know	3.17	0.92	-0.84	-0.24
9. When I talk to someone and they get excited, I want to find out why they got excited	3.32	0.89	-1.21	0.59
10. When I want to know something, I put a lot of work into finding the answer	3.48	0.69	-1.27	1.35
11. I am afraid that my classmates will think I am a nerd if I ask a lot of questions in class	2.76	1.28	-0.32	-1.62
12. When I do not know something, I always want to find out the answer	2.84	1.16	-0.52	-1.21
13. I spend a lot of time trying to figure out things that I find confusing	3.32	0.76	-1.04	0.90

The extent to which students perceive themselves as being curious is presented in Figure 5.3. The largest proportion of students reported that they enjoy learning about new topics (99% agreed a lot or agreed a little combined). This was followed closely by "I enjoy finding out how different things work" (98% agreed a lot or agreed a little combined), as well as "I enjoy thinking about lots of things, because then I learn more about all sorts of new things" (95% agreed a lot or agreed a little combined).

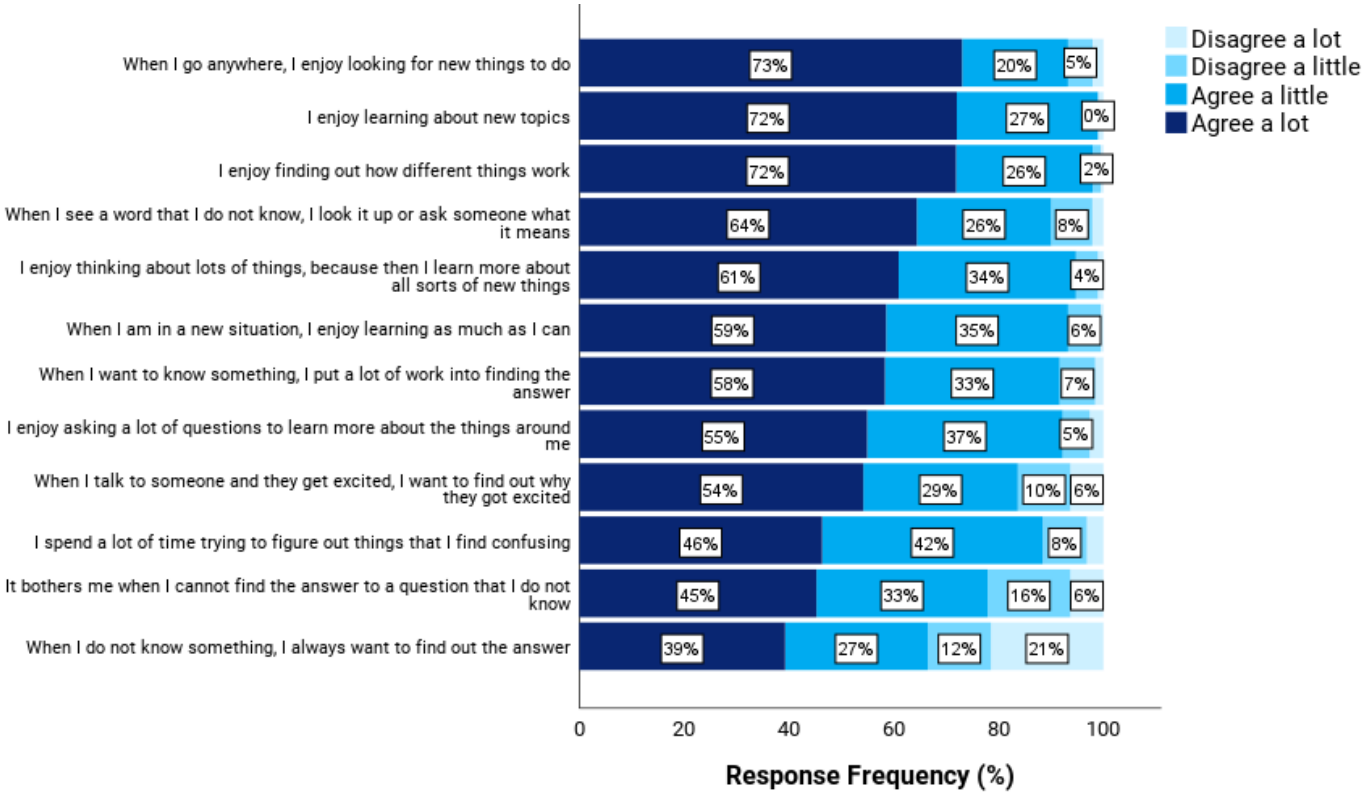

Figure 5.28. Students' perception of their own level of curiosity

5.4. Connection between qualitative and quantitative findings through the lens of the identified promising practices and the IB learner profile

In Section 5, based on thematic analysis of the qualitative data, we presented 5 themes, each with a related group of promising practices that foster curiosity and creativity in the IB PYP classroom. Analysis of the qualitative data was based primarily on teacher data from videos and interviews, with insights from students, as appropriate, that will be extended in this section, as a way of strengthening the connection between the quantitative and qualitative data. Moreover, as discussed in our methodology section (see Section 4), including multiple sources of data in video-based research is recommended as a way of strengthening the interpretation of findings from video observations. In Section 5.3, we presented quantitative findings of the ways in which students perceive themselves as curious learners, and student performance on a creative thinking task. In this section, we demonstrate how both qualitative and quantitative data are related, with a view of providing a more refined understanding of the promising nature of the identified practices. Given the embedded mixed methods design of the current study (see Section 4), in connecting the qualitative and quantitative data, we considered our main purpose of employing this design, which was the ability to achieve completeness in our data and for purposes of corroboration (albeit suggestive) that the identified practices are “promising”.

To connect the qualitative and quantitative findings, we carefully examined the strategies employed by teachers in each promising practice. Then, we identified instances of students’ performance in the quantitative task that suggest the manifestation of the implementation of these identified promising practices. In addition, we cross-checked these instances with what student participants articulated in the interviews and the videos, as well as relevant student artefacts. Across the countries, we observed

that students did, in fact, exhibit (via video, student interview data and student artefact data) and report (via the objective student curiosity and creativity tasks) a range of behaviours which signalled the promising nature of the practices that teachers were implementing in the IB PYP classrooms. As the study is situated within the context of IB PYP classrooms, we present these instances of curiosity and creativity related student behaviours, with reference the IB learner profile attributes (IBO, 2013). We were also guided student-focused deductive codes, developed as part of this study (see Appendices 4-7).

Inquirers

Student numerical scores on the curiosity questionnaire demonstrated that they exhibited the 'inquirer' attribute of the IB learner profile. In relation to being an inquirer, the learner profile describes this as "developing skills for inquiry and research", which helps to encourage lifelong learning (IBO, 2013). Students scored highly on the curiosity questionnaire (See Section 5.3) and responses across the items indicated general agreement that they perceived themselves as curious learners, with mean scores ranging between 2.76/4 to 3.70/4. Importantly, the highest rated items by students in the curiosity questionnaire were "I enjoy learning about new topics" (3.70/4) and "I enjoy finding out about how different things work" (3.69/4). Moreover, students generally agreed with the statement "I enjoy asking a lot of questions to learn more about the things around me" (3.45/4). These numerical ratings corroborate the findings in the student video and interview data, particularly in relation to inquiring behaviours (e.g., question-asking, researching on a range of topics) reported and exhibited by students (see series of quotes below). Importantly, together, these findings support the view that the strategies identified in Section 5 in relation to the *nurturing an inquisitive mind* promising practices, are potentially effective in fostering student curiosity.

> I researched for the PYP exhibition about pollution, and I researched what you can do to you know help the environment and going to the local park was a really good thing to do. (Student, Sweden, interview)
>
> How [was] the world created? How [was] the entire universe was created? ...How did the 92 elements just be there? (Student, Sweden, video)
>
> That's called a jade. I researched it yesterday and I found the name (Student, Ghana, video)
>
> What comes into my mind according to my research yesterday and I think from some other educational source (Student, Ghana, video)
>
> I have to question, why is a lot of things made in China? (Student, Ghana, video)
>
> That lesson was very fun because we could ... understand how it [a lot of different things] works, and its consistency and different things about it, and it was very interesting. (Student, Italy, interview)

Interestingly, curiosity, as measured by the epistemic curiosity questionnaire that was developed for this study, aligns with students' own conceptualisation of curiosity. As a reminder, the questionnaire measures the desire for new knowledge and solving problems as well as the desire to eliminate information gaps. Similarly, interview data demonstrated that students conceptualised curiosity as an enthusiasm for discovering new or unknown areas, and a desire to want to find out information or fill gaps in knowledge.

> It [curiosity] means that they like to discover new things and they ask a lot of questions to get the answers (Student, Italy, interview)
>
> It's like you want to learn more about it ... if you're really, really interested in [a topic] and then you want to learn more about it so when you be curious, you actually are like digging in for more information. So, it's like you want more information because you don't know about this thing. So usually when you know

don't know about something and you really want to know about it. That's when you called yourself curious (Student, India, interview)

[Curiosity] Means like you, you wanna research something and you want to find what it what it's about and what it is (Student, Norway, interview)

Curiosity to me means …. it's the desire to know something like to strongly desire something (Student, Ghana, interview)

Communicators, Thinkers & Open-minded

Within the IB, the communicator attribute is linked to students expressing themselves creatively in different ways, including collaborating with other individuals and listening to their perspectives. Similarly, the open-minded attribute encourages students to value diverse perspectives, while the thinker attribute ensures that students' think creatively when presented with complex problems (IBO, 2013). Together, the strategies underpinning the *diversifying feedback pathways*, *facilitating collaboration* and *choice over self-expression* promising practices align with the development of these three IB attributes.

Student video and interview data demonstrated the ways in which students exhibited creative thinking, with students generating a range of divergent responses to the use of common objects. Moreover, students perceived that a central component of the creative process involved the generation of new ideas in different ways. Students also emphasised the importance of using their [creative] thinking capabilities to generate creative solutions, as well as highlighting the importance of choice over expression during the creative process.

I feel like the man somehow found the dinosaur tooth... so that the other person could use it as a weapon (Student, Ghana, video)

I try new ways to maybe like do stuff ... I could do like different ways, like find different ways (Student, Sweden, interview）

I think creativity means like when … you can get old things, like old books or … you can get trash and reuse them … reuse things and try to be creative and explore and use other things to create new things in our imagination (Student, Denmark, interview)

Creativity can come from different types of things, so I would let them [student] choose [what they want to do]. (Student, India, interview in response to a question regarding how to foster creativity among students)

I would tell them [students] to please think … what could be more creative like how many ways do we have? (Student, Germany, interview in response to a question regarding how to foster creativity among students)

It's [creativity] like when you … do something that nobody expects and like whatever you think you can do … I would give them a little bit more time on choose time ... you get to do whatever you want to do (Student, Norway, interview)

We have to use our thinking skills to find a problem that needs solving and [use] creativity just so we can make up something out of the ordinary (Student, Ghana, video)

It means that they have a lot of ideas that are little bit like out of the box … I feel creative normally when I can experiment, and I can be a little bit free to test and see what's happened when I do different things. (Student, Italy, interview)

The above findings, in relation to student creative expressions, were corroborated through the findings of the Guildford's Alternate task (quantitative creativity measure) administered in the current study. On average, students' responses were scored as quite creative, based on a 3-point rating scale (ranging between 1.63 to 1.76), with 1 being not creative at all and 3 being highly creative. For example, when asked to think about the different uses of a key, students noted that this object can be used as: "the hands of a clock" (Denmark), a way to "open your mind" (Germany) and as "a necklace" (Ghana). In relation to a pen, students noted that this object can be used as: a way to "relieving stress" (India) or to "make music" (The Netherlands) through fiddling with the top of the pen as well as "you could take out the ink and put a thin breadstick in and use it as a food dispenser (France). Finally, in relation to the use of a chair, students noted that this object could be used as: "a shield" or for "building castles" (Norway), a pathway for teleporting to another place (Sweden), as a metaphor for focus (Italy). These findings support the creative responses that were exhibited and reported in student video and interview data, respective. More critically, these findings suggest that strategies that teachers are implementing within the *diversifying feedback pathways* (teachers actively provided explicit feedback to students that encouraged divergent thinking) *and choice over self-expression* (teachers actively implemented tasks, such as the choice board activity, in which students could exercise their own creativity) are likely to be promising in fostering creativity, and in particular, creative thinking.

Importantly, part of exhibiting creativity, according to the description of the communicator attribute within the IB learner profile, is to "collaborate effectively, listening carefully to the perspectives of other individuals and groups.", which also aligns with the open-minded attribute (IBO, 2013). For students to listen carefully to the views of others, arguably they must first exhibit some level of curiosity about what others have to say. Through the video and interview data, students demonstrated a range of attitudes and behaviours that signalled that they were curious about learning about the views of others, including valuing these different perspectives.

> Why do you think a lot of things [are] made in China … it's fine if you don't know (Student, Ghana, video)

> It [creative solution] was a little hard to decide, because I wanted one thing and then we had to debate on which one would be better. And then he [student's classmate] came up with the idea of doing both of them, but as a comic ... we started brainstorming on the idea and then finally like came up with the idea to just make like a comic. (Student, Sweden, interview)

The findings from the curiosity questionnaire corroborated this finding and more specifically, that students were curious about the perspective and experiences of others, as they responded with high agreement (mean score of 3.32/4) to Item 9 on the curiosity questionnaire: "When I talk to someone and they get excited, I want to find out why they got excited."

Reflective and knowledgeable

The reflective attribute is characterised by the ability to think carefully about one's ideas and perceptions about oneself, including strengths and weaknesses, to advance learning outcomes. Inherent in this process is the ability the think about one's own thinking (e.g., metacognition) and to learn from mistakes. Similarly, being knowledgeable includes reflecting upon and exploring knowledge across different domains and developing a conceptual and contextualised understanding of this knowledge. These attributes, as demonstrated in the quotes below, are likely to emerge from the group of identified strategies employed by teachers in the *encouraging self-regulation* and *diversifying feedback pathways* themes.

> Sometimes it's about your perspective or something. Like think about math. How can it help you in your future life, and how much do you want to actually like put effort in it? (Student, Netherlands, interview)
>
> I was actually asking myself, why you were recording only Math? (Student, Germany, interview)
>
> We also we also had to … consider that we were giving it to maybe a younger audience or like our class and some people in our class … they like reading, of course, but... it's easier for them to just look at a couple words and then look at the, the um pictures, because they can understand it better ... So, we had to take that in consideration and we also had to take into consideration our time, so we really had to focus. But other than that, I think we did really think about our decision and then I think we did quite [a] good decision in the end. (Student, Sweden, interview)
>
> Knowing your personality and hobbies, helps us learn how we learn and who we are (Student, Netherlands, video)
>
> I found some stuff hard since I don't know how to spell that good and it's and I don't have that much good handwriting (Student, Norway, interview)
>
> When they [student's classmates] do something wrong, I only say then that was a good try and they could do more tries (Student, Germany, interview)

To this end, that students generally agreed with the statements in the curiosity questionnaire relating to their perception of themselves as reflective explorers of new information and experiences corroborates the above-mentioned findings in relation to students' expressions and behaviours towards the acquisition of knowledge.

In other instances, students engaged in critical reflection in the context of their classmate's creative output. The below example from video data in a Ghanian classroom demonstrates an example of this point. Students were curious to find out more about their classmate's view and organically discuss the solution to the problem of kidnapping, including reflecting on possible limitations of the solution, a finding that is corroborated with students' high agreement on Item #9 of the curiosity questionnaire: "When I talk to someone [e.g., classmates] and they get excited, I want to find out why they got excited." (3.32/4)

> Student 1 (commentor on the solution): Do you need a fingerprint to enter your own car?
>
> Student 2 (creator of the solution): No, it's like Face ID
>
> Student 1 (commentor on the solution): But when you put fingerprint someone can take a play doh (suggesting a limitation in the solution as a play doh can be used to replicate fingerprints)
>
> Student 3 proposes (commentor on the solution): A chip in your hand
>
> Student 2 (creator of solution): There needs to be a sensor
>
> Student 4 (commentor on the solution): Anyone can use voice and capture your voice
>
> Students also thoughtfully considered the knowledge that they have previous acquired and applied strengths in this previous knowledge to help them to extend their current learning.
>
> Students used their background knowledge of word meaning and prefix to decipher what prehistoric trade means. (Student, Ghana, video)

5.5 Revisiting Definitions and Frameworks

In the research literature, the multitude of definitions of creativity and curiosity is ever crescent and complex. However, it is essential to emphasise the practical and educational focus of this research and the importance of working definitions and frameworks that allow for meaningful exploration and knowledge development. As ACER (Scoular & Ramalingam, 2021,) articulates 'a practical definition and framework of creativity is one that will help to inform curriculum, pedagogy and assessment' (p.1): they emphasise that whilst much of the psychological and conceptual research into curiosity and creativity as an independent and abstract variable was very interesting, the definitions that emerged from this kind of research had limited practical application to support rich and meaningful learning in educational settings (Heard & Anderson, 2021, p.2). Furthermore, previous research rarely suggests transparent frameworks and practical strategies that account for the fluctuating and contextual nature of these states of curiosity and creativity, the diversity of learners in the classrooms, the challenges of restricted resources and time that teachers often face, and the inequity of opportunity that has been acutely magnified by the pandemic (UNESCO, 2022).

We began the research defining these two skills with short accessible definitions:

Curiosity is the strong desire to fill a gap in knowledge and the associated information-seeking behaviour (Loewenstein, 1994; Pekrun, 2019; Shin & Kim, 2019).

Creativity is coming up with new ideas and solutions or the creation of a novel or useful product (Plucker et al., 2004; Rhodes, 1961; Vincent-Lancrin et al. 2019).

These working definitions evolved throughout the study, we used interviews to explore with teachers and students what creativity and curiosity looked like to them and how these two skills related to their everyday lives (Section 5.2). The diversity in our findings, both in terms of the practices and the conceptualisation of the skills, has emphasised the importance of multi-perspective, practical and contextually relevant conceptualisations of creativity and curiosity that give students and teachers the tools and language to communicate about, reflect on and develop these key skills. It is important then to consider what role frameworks can play when there is such diversity in the conceptualisations of these key 21st Century skills. We emphasise the recommendations of ACER (Heard & Anderson, 2021; Scoular & Ramalingam, 2021) in advocating for the use of frameworks as springboards for reflection, evidence-gathering and dialogue. When teachers ask their students what creativity and curiosity means to them, what elements of creative and discovery processes they would like to learn about, practice, develop and strengthen this enables a shift away from fixed-mindset thinking (such as who is creative and who is curious), towards productive conversations about what helps students feel curious and creative in different lessons and at different times in their lives.

How do these promising practices relate to the ACER frameworks?

The two frameworks developed by ACER (Heard & Anderson, 2021; Scoular & Ramalingam, 2021) are practical tools for complementing the promising practical suggestions in this research, by providing useful tools for self-reflection to enable learners to engage with, develop and reflect on, the processes and practices necessary to develop, extend and express their creativity and curiosity. For teachers these also offer powerful reflection tools, as well as functioning as useful frameworks that they can use to structure and develop their feedback practices, so that the students and teachers both develop and share a language around curiosity and creativity, as well as sharing an understanding of the different elements of curiosity and creativity, and which practices can support students to develop and extend their own curiosity and creativity independently.

For example, ACER's Curiosity Framework (Heard & Anderson, 2021) allows students to reflect on elements of curiosity such as focusing their curiosity (Dimension 1) and defining knowledge gaps (Dimension 2) and the associated skills necessary for sustained engagement, identifying confusion or information gaps, as well as for engaging in efficient search skills, critical thinking, and evaluation (Heard & Anderson, 2021, p.25-28). This framework also might enable teachers to design their feedback practices around the elements highlighted in these frameworks and thus use diverse feedback pathways to help students receive written, oral and peer feedback on these elements necessary for curiosity to flourish. Similarly, the creativity thermometer (Scoular & Ramalingam, 2021, p.24), and curiosity thermometer (Heard & Anderson, 2021, p.22) provide a self-reflection tool written in accessible language, that students could use as a prompt to reflect and develop their own sense of what supports them to develop these skills and what opportunities they might want to seek out to develop different elements of the process and identify where they would like to improve.

ACER (Heard & Anderson, 2021) expresses the hope that 'the curiosity thermometer will enable teachers to discuss openly with learners how curious they've been in their learning so as to better understand how curiosity affects learning and how it may also be enhanced.'[11] (p.18). This is very valuable as it enables teachers to learn from the students about what is relevant and meaningful for each individual and, unlike rigid and prescriptive tools or frameworks, it also allows teacher to adapt their teaching to be contextually relevant so that as they interpret different elements of the framework and thermometer, they can use their professional judgement and contextual knowledge and can integrate these into their practice. It is exactly this flexibility that we also aspire to communicate in relation to our promising practices, we hope to illustrate a diversity of promising practices so that teachers can try out different ones in their context, respond to the diverse learners in their classrooms, adapt the practices to be culturally and contextually relevant and can develop new elements and new ways of working that facilitate open dialogues between students and teachers about what is curiosity and creativity and how can we collaborate to make these flourish.

[11] As a practical note, if the language is too difficult in the thermometer for younger age groups, (or there may be new words for students with English as an additional language), this thermometer can be a useful springboard to engage in class conversations sharing knowledge about what different words mean; these conversations need to be facilitated carefully, so that no one is made to feel they do not know enough, rather discussions should enable diverse voices to co-construct knowledge around creativity, and to foster meaningful discussions around what creativity looks like for different people.

6. Discussion of Main Findings

This study utilised a deductive analytical approach in the examination of teacher self-generated classroom videos and teacher and student interviews to answer our research questions. In addition, we embedded the findings from the quantitative tasks that aimed at objectively evidencing student levels of curiosity and creativity. The main research question is:

How do International Baccalaureate teachers foster curiosity and creativity among primary school students?

The sub-questions which explore different aspects of the main question are:

- What are the observable promising practices that teachers use for fostering curiosity and creativity?
- Which observable practices align with the literature, and which are novel?

We identified five themes in the data, with examples from video recorded classroom discussions, teacher and student interviews, and student artifacts presented in Section 5. Each theme includes a group of related promising practices. The themes are: *Diverse Feedback Pathways*, *Self-Regulated Learning, Nurturing an Inquisitive Mind, Facilitating Collaboration* and *Facilitating Choice in Expression*. In the next section, we discuss these themes in relation to the research questions and previous literature. We further highlight the elements of these themes that were unexpected or unanticipated (specifically mistake-making and the students' engagement with peer, teacher and self-generated feedback). We explain that these elements where unexpected due to the way they manifested in our data: we discuss how our findings either emphasise or challenge what is in previous research and explore the way that these findings illuminate new elements of each of these themes.

6.1 Promising Practices for Diverse Feedback Pathways and Self-Regulated Learning

Self-regulation and creativity

There is early research exploring the way that self-regulation might relate to creative action (Ivcevic & Nusbaum, 2017; Zielińska et al., 2022). Ivcevic and Nusbaum (2017) argue that 'the success of transforming creative ideas into accomplishments substantially depends on effective self-regulation processes' (p.343), and propose a model of self-regulation in creativity as two sets of processes:

> (1) Revising and re-strategising
> Regulating process expectations, adjusting approach, managing ambitious goals.
> (2) Supporting and sustaining creativity.
> Planning and organisation, persistence in the face of obstacles and managing emotions. (Ivcevic & Nusbaum, 2017, p.347).

The first aligns closely with our promising practices relating to supporting adjustment of behaviour through reflection: see for example the reflective post-it notes written by children from the Netherlands in Section 5 strategising how they will adjust their behaviour for their next poster making. The second set of processes in terms of planning, persisting and managing emotions was also evidenced in our videos: it was interesting to see examples in our data of how teachers balanced the importance of planning, with how to respond when something happened that was unplanned: for example when unplanned mistake making occurred, teachers modelled not to see this as a barrier,

seeing this as an opportunity to learn and how to managing emotions played out in the voices of teachers and of mistake making: teachers reflected in this in interview

> I also make mistakes and we all learn from that, and we can help each other. Rather than getting upset or anything, so that we're all learning together, and I really like that they even suggest things: 'Oh, maybe we should do it this way' (Interview with Teacher 10, Sweden)

This modelling of productive responses rather than getting 'upset' was also paired with visible persistence in the videos: we were able to see this teacher making and modelling mistakes in maths, and the children making mistakes and responding to them productively. Teacher 10 would often suggest the use of materials where mistakes could easily be made and then addresses such as mini-whiteboards or building blocks, so that mistakes were not permeant, but could still form part of the learning process.

This also speaks to a point of learner diversity, as in many cultures and contexts mistake-making (and the associated risk-taking), is not encouraged, and may even punished. It is important to note that in global classrooms students had diverse perspectives from previous school systems, one teacher reflected that they had taught previous classes where students had moved countries, coming from a school system that allowed physical punishment (this practice is now illegal in 63 countries but that leaves much room for improvement globally). Even though punishment of such kind is explicitly contradicts the rights stated in the United Nations Rights of the Child (United Nations, 1989) for both freedom of expression (Article 13) and protection from violence (Article 19), teachers may need to be mindful of the different home and school systems that children may have experienced, and teachers must ensure the classroom is a safe space, where all students can have equal opportunity to take creative risks and learn more about the creative process in so doing.

Self-regulation and curiosity

There is already much debate over how self-regulation might relate to curiosity. Hidi and Renninger (2019) argue that curiosity leads people to engage in either sustained or 'short-lived' information searches to reduce uncertainty and address a knowledge gap (Jirout et al., 2018; Jirout & Khlar, 2020; Markey & Loewenstein, 2014;); Hidi and Renninger (2019) differentiate this from interest by suggesting that with interest, the search is more broad and general, rather than seeking specific or particular knowledge, and is primarily seeking information that can be related to existing understanding and knowledge structures (p.837). These information searches require specific inquiry skills and learner attributes which are articulated explicitly in ACER's curiosity framework (Heard & Anderson, 2021):

They identify that the personal attributes of a curious learner pursuing a sustained inquiry include:

- *persistence*
- *confidence*
- *self-efficacy*
- *open-mindedness*
- *willingness to make mistakes (risk taking) (Heard & Anderson, 2021, pp. 6-7)*

And identify the self-regulating inquiry skills that underpin inquiry as follows:

> ***Inquiry skills -****Learners need to know how to:*
>
> - *ask good questions that are worth pursuing;*
> - *find and use resources effectively to learn more;*

- *be organised and plan time well;*
- *explore and consider different perspectives;*
- *think critically and explain or justify conclusions. (Heard & Anderson, 2021, p.6)*

These skills and attributes relate closely to our findings around supporting self-regulating learning especially practices that related to supporting planning and reflection. These skills were also eloquently illustrated by the students:

- *ask good questions that are worth pursuing (Heard & Anderson, 2021, p.6);*

Researcher: What does curiosity mean? What does it mean when someone curious?
Student: It means that they like to discover new things and they ask a lot of questions to get the answers...Normally I feel the most curious when I study a new subject and I get to ask a lot of questions and understand how it works... I ask like: How does it work? How do you use it? Why is it important? Just things to know a little bit more about that subject. (Student, Italy).

- *find and use resources effectively to learn more (Heard & Anderson, 2021, p.6);*

Researcher: What kind of activities do you do when you feel curious?
Student: Normally I see. Well, I like reading a lot, so I either if it's if it's not in a book then I search it up like research. Or if I or if it's in a dictionary for me to find out how it what a word means, or a thesaurus like or syllabus, and like that or I search it up, or I try because if it's something that I've heard of but I don't know what it means, I try to make a small other words that I know. Like comprehensive, I know comprehension, so then I can understand it like that. (Student, Netherlands)

- *be organised and plan time well (Heard & Anderson, 2021, p.6);*

There is one thing in self-management that I used, time-management. I was basing my project on the amount of time I had, I was predicting that I would be able to do it in like 20 minutes (Student, Sweden)

- *explore and consider different perspectives (Heard & Anderson, 2021, p.6);*

Student: For me, when someone is curious, is when they look at something in a different way, and they say 'What if this happens to it? 'Will it be like this or this or this?'. There are so many different possibilities. (Student, France)

- *think critically and explain or justify conclusions (Heard & Anderson, 2021, p.6).*

I'll show you like history for example. First, I would like if I wanted to like focus more on World War One. Then I would first like search up what caused it, and then like where it took place, like the setting, and then I would like search up all the battles and stuff and then I'd like check for people's opinions. (Student, Sweden)

The expressions of students captured in the interview data seem to echo the self-regulated inquiry skills as identified by ACER (Heard & Anderson, 2021). However, it is important to analyse these further and explore how teaching practice, especially feedback, sought to support students in the development of these self-regulatory practices and how these practices might in turn foster some of the skills behind curiosity and creativity.

Diverse Feedback Pathways and Self-Regulated Learning

Previous research has examined the role of a range of factors, including feedback and self-regulation, particularly their role in advancing curiosity and creativity (Lee, 2019). Before discussing the ways in which feedback and self-regulation have been implemented as promising practices within the current research, it is prudent to position these constructs within the broader context of assessment, given

that previous research demonstrates the importance of connecting teaching and learning processes with assessment processes (Biggs & Tang, 2010). Moreover, in the current study, we identified that several teachers adopted formative modes of assessment while engaging in their teaching and learning sessions.

Scholars often present assessment from three perspectives – assessment of learning, assessment for learning, and assessment as learning (e.g., Baird, et al., 2017; Yan, 2021). Assessment of learning is summative and usually conducted at the end of the learning process (Harlen, 2007). In contrast, assessment for learning is formative and happens during the teaching and learning process, often on multiple occasions (Black & Wiliam, 1998; Wood, 2018). Finally, assessment as learning relies heavily on the concept of metacognition, in that students gain a greater level of understanding of themselves as learners, thereby taking more responsibility for their current and future learning (Earl, 2013). Assessment has been heavily influenced by several multi-disciplinary factors, and its outcomes have been instrumental in influencing an array of contemporary teaching and learning strategies. However, the disquiet with the current assessment framework, world over, is that it contradicts the very nature of what educational institutions and stakeholders hope to achieve, which includes curious and creative learners (Anderson, 2014; Bellanca, 2010; Egan et al., 2017). In the next section, we present feedback and self-regulated learning as a solution to this problem. Based on an amalgamation of the findings of the current and previous research, this is followed by a series of guidelines and recommendations, which highlight potential strategies aimed at facilitating curiosity and creativity within the classroom. In addition, consideration is given to the most optimal context and time with which these practices can be naturally incorporated in the typical education cycle.

Constructively Aligning Diverse Feedback Pathways

Previous classroom research positions feedback as one of the most powerful influences on students' learning outcomes (Boud & Molloy, 2013; Brooks et al., 2019). Feedback, when delivered in a way that is constructively aligned with the intended learning outcomes (ILOs), serves to ensure that students are achieving the expected learning goals. Feedback should be aimed at helping learners to understand the ILOs, understand where they stand in relation to the ILOs, understand how to bridge the gap between where they are and where they need to be, and understand how they can become self-regulated learners (Carless, 2006; Sadler, 2009). Moreover, extant research, including several meta-analyses, show that feedback plays a fundamental role in learning, with previous scholars advocating for a feedforward effect of feedback, although, it should be acknowledged that feedforward is usually employed within the context of higher education (Black & Wiliam, 1998; Hattie & Timperley, 2007; Hounsell et al., 2008; Sadler, 2010). Nevertheless, there is a consensus that feedback should be provided in a way that will assist learners to improve their learning gains on both current and future tasks, including making the ILOs clear (Black & Wiliam, 1998, 2018; Boud & Molloy, 2013; Hattie & Timperley 2007; Hopfenbeck et al., 2015).

Indeed, one of the ILOs of the teaching sessions in the current study, as well as in classroom settings, more generally, is to ensure that students are adopting approaches to strengthen their curiosity and creativity (IBO, 2013). In the current study, it was observed that feedback was geared towards achieving some of the key intended learning outcomes of the PYP; these ILOs were often underpinned by the intended attributes of all IB learners, as presented in the IB learner profile (IBO, 2013). To this end, we identified that the provision of feedback aligned with 4 of the 10 attributes of the IB learner profile by ensuring that students – met the content knowledge of the unit (knowledgeable), exhibited creative thinking (thinker), felt safe to express their views (risk-taking), and provide peer to peer feedback (communicators) and self-feedback (reflective).

In relation to the knowledgeable and thinker attributes of the IB learner profile, teachers in the current study provided evidence of the feedforward effect of feedback. Teachers ensured that students' were knowledgeable about the expectations of the assignment as well as ensured that they engaged their divergent thinking skills. The latter point is especially relevant to the current study, with previous meta-analyses demonstrating the importance of divergent thinking for creative outcomes (Said Metawaly et al., 2017). There exists a range of pedagogical approaches that have been identified as effectively fostering divergent or creative thinking among students. One primary way of achieving this, as we observed in our data, was through targeted questioning to extend students' thinking processes. Moreover, that students were thinking creatively was further evidenced by the findings of our alternate uses task. Generally, students demonstrated that they are divergent thinkers, and were quite creative in their perception of the different ways in which common objects could be used. Together, this notion of fostering divergent thinking through question-asking also links explicitly to our promising practice of nurturing inquisitive minds, and the role of question-asking is addressed in further details in the section on *'Promising practices for nurturing an inquisitive mind.'*

In relation to the risk-taking attribute, that feedback was used as a mechanism in the current study to create a safe space, aligns with previous research on approaches to fostering curiosity and creativity. Indeed, the student voice was respected, and students were confident in expressing their own perspectives. The theoretical underpinning of the self-determination theory provides an explanation for the importance of this type of positive feedback, such that if the learning environment creates feelings of incompetence, students tend to become demotivated (Deci & Ryan, 2012). Moreover, the work of Pekrun (2019) is pertinent within this context, particularly, in relation to the role of academic emotions, which are emotions that are tied to the school context. Within this context, if students feel afraid to formulate and express their views, or if they are berated for making a mistake, they are less likely to be curious learners and engage in fewer opportunities to expand their creative thinking (Tulis & Fulmer 2013). By contrast, creating a safe classroom environment, in which students feel comfortable with mistake making and productive failure encourages creative risk-taking, has been previously associated with creative outcomes (Kapur, 2015; Henrikson et al., 2021).

Finally, the reflective and communicator IB attributes were reflected in the findings of the current study through teachers encouraging students to provide feedback to others and to oneself; both strategies are well-evidenced ways of fostering curiosity and creativity (Csíkszentmihályi, 1996; Igweonu, 2010; Kampe, 2019; Zhang et al., 2021). More specifically, though the outward nature of these strategies differs, the processes that underpin them engage students in deep learning and perspective taking, as we observed in the current study, which has been previously linked to higher levels of creativity and curiosity (Han et al.,2021). Indeed, central to education and learning is Bloom's taxonomy such that the goal is for students to be able to comprehend, interpret, and apply information (Anderson, 2014). However, a common problem with the feedback process is that students are not afforded the opportunity to engage in this deep learning process; they instead engage in surface and rote learning, where their primary concern is with their numerical grade (Welsh & Dehler, 2013). One of the primary factors contributing to not achieving deep learning stems from not having the opportunity to 'close the feedback loop' (Sadler, 2009, 2010). This represents what Pan (2009) refers to as a backwash or washback effect of assessments, which encourages teachers to complete the syllabus in a timely manner, by teaching only what is expected to appear on the test. The argument here is not that students are not achieving. However, if student achievement is viewed from the perspective of Bloom's taxonomy (Bloom et al., 1956) such that students are expected to engage in creating (e.g., creative thinking), then current approaches to teaching are often ineffective in facilitating these skills.

Indeed, a parallel relationship between the teaching, learning and assessment approach and the ILOs is required, which is not underpinned merely by knowledge, but how this knowledge is created, and applied (Biggs & Tang, 2010). Despite the importance of feedback, it is an ongoing challenge for educators to provide detailed, individualized feedback (Nichol, 2010). Perhaps, through strengthening the process of individualised feedback, we will possibly observe a larger percentage of students engaging in more divergent ways of thinking, as in the current study, we identified that for all the objects, there was evidence of a high percentage of non-divergent thinking. However, solving this problem is important because it is a laborious task that relies heavily upon human input. Consequently, there is an opportunity for future research to close this gap, particularly with a focus on how teachers might utilise technology to achieve greater efficiency in the feedback giving process.

Connecting Feedback with Self-Regulated Learning

In their book, *How People Learn*, psychologists Bransford and colleagues (1999) proposed three principles that are likely to underpin effective approaches to learning. Principle 1 states that learning is enhanced when learning opportunities are tailored to the learner's current levels of attainment. Principle 2 states that learning is more effective when it leads to a deep understanding of the subject matter. Finally, Principle 3 states that learning is more effective when learners are supported to monitor and take responsibility for their own learning. Though all these principles are important, it is principle three that lends itself to discussion around the promising practice of self-regulated learning, which will be the focus of this section. Interestingly, scholars (e.g., Hawe & Dixon, 2017) agree that self-regulation helps students to realise the benefits of feedback, which will also be addressed in the subsequent sections, in relation to the ways in which this connection likely fosters curiosity and creativity.

The concept of self-regulation, although nuanced, generally refers to the ways in which people change their thoughts, behaviours and emotions to achieve a predefined goal (Inzlicht et al., 2021). Several models of self-regulation have been postulated by previous research (e.g., Kruglankski et al., 2002 who developed the goal systems theory; Berkman et al., 2017 who advocates choice models; Baumeister, et al., 2018, who advocate for the resource model of self-control). However, the models that are the most relevant within the context of our findings are the cybernetic control model (Alexander & Brown 2011; Carver & Scheier 1998) and the dual systems model (Kahneman, 2011). The first model comprises a feedback loop with four points: (a) a goal; (b) information about where an individual is in relation to that goal; (c) a monitoring mechanism to address any conflict in goal achievement and (d) a system in place to achieve the desired state.

Similarly, in the dual systems theory, there are two systems: System I is responsible for quick and often automatic response, whereas System II is responsible for more controlled processing of information (Kahneman, 2011). Central to the dual systems theory is that behaviours are the product of both these independent systems. Importantly, researchers often strive to answer what enables a person to move from rapid uncontrolled responses to more thoughtful controlled responses during the process of goal achieving, with scholars highlighting the role of errors as an important factor in this transition (Kool et al., 2017). How might this previous research on self-regulation explain our current findings? Figure 6.1 provides an overview of the ways in which the findings of the current study reflect the principles advanced by an amalgamation of both models, in relation to the connection between feedback and self-regulation. Teachers in the current study commenced their sessions with a goal or ILO. The process of achieving these goals often involved back-and-forth feedback, between teachers and students, usually with three configurations: teacher-student, student-teacher, and student-student. In addition, teachers welcomed mistakes (which may also be the consequence of disrupted attentional processing) within the classroom, which according to the dual systems model is important for students

to pause and enact more controlled responses to achieving their goals (Kahneman, 2011). Nevertheless, both models advance the idea of regulatory systems that help to transition us closer to an intended goal, in this case of the current study, the ILO. To this end, teachers encouraged a range of self-regulation strategies, including consistent reminders of the time remaining time for an activity, silent gallery walk (an aspect of this involves reflecting and planning about next steps), and mindfulness activities to re-focus cognitive processes. Alongside implementing these regulations, teachers constantly provided feedback to ensure that there was alignment between the ILO and the regulation system. Ultimately, through this process, students played an active part within the self-regulatory and feedback process. Indeed, previous research provides evidence to support the proposition that, by engaging in these processes, students can close the gap between their current state and the desired state (i.e., achieving the ILO), which is also a defining characteristic of curious learners in that they are strengthening their skills in information gap filling (Cohen, 2017; Heatherton & Wagner, 2011; Inzlicht et al., 2021; Markey & Lowenstein, 2014).

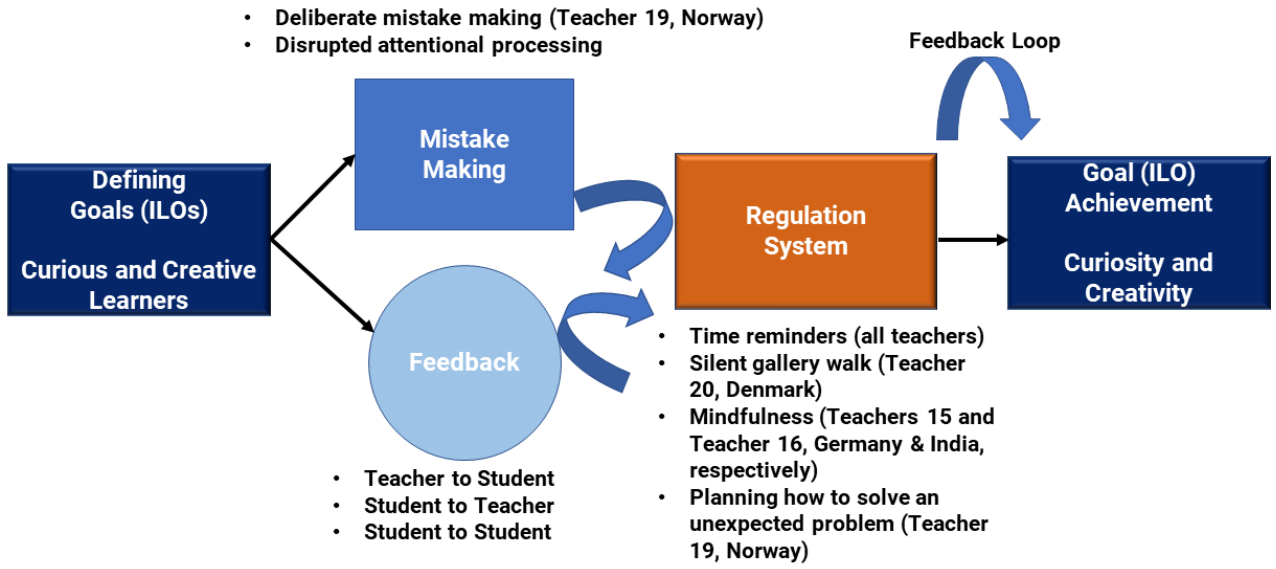

Figure 6.1. Application of the dual systems model and cybernetic control model to self-regulatory and feedback processes in the promising practices study; ILOs = intended learning outcomes

Indeed, contrary to the aim of assessment of, for and as learning, students are excluded from the feedback process, though, oftentimes, this exclusion is unintentional. As such, assessments have not often been designed in a way that permits learners to develop their metacognition or awareness of their own learning, which previous scholars have argued enhances self-regulated learning (Hoseinzadeh & Shoghi, 2013; Neuenhaus et al., 2018). Underpinning the importance of metacognition in the education process is Vygotsky's theory of social cognitivism, which acknowledges the significance of social-cultural influences (e.g., teacher-student relationship) upon cognitive development (Schunk, 2014). However, the type of social interaction that dominates the current

educational landscape is often structured and teacher-led (Stigler & Hiebert, 2009). While structure is important, instruction that is consistently teacher-led may suppress the development of a student's creativity, problem-solving skills, and discovery learning and overall, self-regulation (Bruner, 1961). In fact, when learners become more aware of their learning (metacognitive knowledge) and best strategies to regulate their own learning (metacognitive regulation), this maximises their potential of reaching the summit of Bloom's taxonomy (Anderson, 2014). However, Mayer (2004) found that guided discovery instruction is more effective than pure discovery methods. This finding has been consistently replicated, thus solidifying the usefulness of a teacher-led discovery learning (Alfieri et al., 2011). Although the argument that students' learning is enhanced by pure discovery learning is convincing, the view underpinning this approach needs to consider the potential impact that assistance may have in linking new information to an applicable knowledge base. Furthermore, Vygotsky's theory on dysontogenesis, a social view on disability, provides a backdrop to understanding the need for a directed approach among students with learning disabilities (Gindis, 2003). Relying on his concept of the zone of proximal development, Vygotsky explained that the process of directed instruction serves as a vehicle to strengthen weaknesses in development through social interaction. Therefore, directed learning allows a struggling student to have greater access to resources through assistance, which was also observed in one of the schools with access to a specialist who helped to differentiate instruction in a way that was meaningful for students with learning difficulties. Overall, the influence of student-teacher relations cannot be ignored as education occurs within this social context. Moreso, this leads students to have a better command over the processes that allow them to set goals, monitor strategies for achieving these goals, including the ability to engage in efficient time management during the learning process. Therefore, as identified in the current study, learning processes geared towards curiosity and creativity would benefit from being dynamically designed such that the process implements discovery learning that is not too restrictive but not too permissive.

Importantly, the relationship between feedback and creativity is not always straightforward, with scholars highlighting that this relationship depends on several factors, including the characteristics of the learner (Fodor & Carver, 2000). In the initial stages of considering the provision of feedback, Yorke (2003) opines that it is firstly important to be aware of the psychology behind the provision and receipt of feedback. Not considering these characteristics is likely to lead to a host of other micro problems, including students not being able to readily understand the information and thus implement it to improve their learning (Higgins et al., 2001). Although Principle 1 of Bransford et al. (1999) proposal is important in that it identifies the fundamental role of the learner's attainment levels, it fails to consider other important learner characteristics, including personality traits or cultural and social background. Furthermore, Carless (2006) explains that feedback is a social process, implying that it can be construed in different ways by those on the receiving end. But feedback is sometimes delivered in discourse (e.g., written or oral language or even images) that is unfamiliar to the learner. One characteristic that was relevant in the current study was the student's diverse backgrounds, including their social and cultural experiences, and although the IB programmes are often viewed as exclusive (e.g., Lakes & Donovan, 2018) there is a growing trend of diversity within PYP classrooms (Walsh & Cassinader, 2019). Previous assessment designs have not sufficiently considered a learner's culture and social background. In fact, it is argued that understanding personality is deeply rooted in the context of culture and social upbringing (Felder & Brent, 2005; Reid, 1987). For example, previous research show that learners from specific cultures (e.g., where English is a second language or a bilingual environment), may be pre-disposed to learn in a different way, compared with less heterogeneous language populations (Rienties et al., 2015). This in turn may influence the ways in which feedback is interpreted and how curiosity and creativity are exhibited. Moreover, acknowledging these background factors will assist teachers with delivering more personalised

feedback to students to enhance their self-regulation, more specifically, and their curiosity and creativity, more broadly.

Teaching with and for diversity

Within our research sample we were fortunate to have a significant diversity of social, cultural, economic and historical contexts, and an even greater diversity of practitioners and learners. This diversity is important as firstly in represents the reality of the variety of educational contexts and that teachers may find themselves in, and secondly it emphasises the reality and value of diverse learner populations within schools, classes and even individual groupings. The interesting point of these practices was that teachers consistently emphasised the value of different and diverse ideas, thought processes, experiences and opinions.

The literature on how teachers respond to, include and engage diverse learner populations is growing rapidly (e.g., Ainscow, 2020; Florian & Black-Hawkins, 2011; Kumar, Zusho & Bondie, 2018). Research in this field has highlighted guidance on how to support the inclusion of refugee populations such as recognising behaviors expressing trauma as well as resilience (Ghosh et al., 2019), caution to reflect on how some behaviours may be misinterpreted as disruptive or inappropriate in the new cultural or social context but may be perceived as normal in different contexts (Guo-Brennan & Guo-Brennan, 2019). Similarly, there is important new research on how to develop culturally responsive classrooms where teachers and peers create an environment where cultural differences are valued and valuable to collaborative learning (Civitillo et al., 2019; Kumar et al., 2018). Kumar and colleagues (2018) review earlier work on student motivation (e.g., Ames, 1992; Maehr & Zusho, 2009) and suggest that:

> 'students would be better served if teachers engage in instructional practices that are meaningful and challenging, actively solicit student participation in classroom decisions, minimize social comparisons, and adopt criterion-referenced rather than norm-referenced evaluation techniques' (Kumar et al., 2018, p.90)

However, there is a real dearth in the literature for how teaching practices that facilitate curiosity and creativity can be adapted to be inclusive, culturally relevant and meaningful to a diverse population of learners. In our findings, multiple ways of responding to learner diversity were illustrated, particularly diversity in culture, personality and ability levels:

> It could be just as simple as allowing them to give a verbal answer on a test and not having to write it down because maybe it's the physical act of handwriting is overwhelming ... for them ... I have several students who get so caught up in the spelling. They have amazing ideas. They could write long wonderful stories, super creative... but if you are only accepting what they write on a paper, you might only get two sentences, because they are almost paralyzed by the fact that they can't spell the next word … Giving different ways to show what you know is a huge strategy [when considering learner diversity]. Having their own little dictionary [is another one strategy] ... I use whiteboards all the time in the classroom and say [to the students] "Do you already know some of the words that you want to use that you are worried about the spelling?" And I just write them down [and say] "you don't have to worry about that part, you can focus on the ideas; these are here for." A lot of times it's presenting the expectations in smaller chunks... sometimes it's just giving them more time … Other kids maybe have more technical support where they talk to the computer, and it types for them or using predictive text or using spelling checks … and then obviously supporting them to be able to access all accommodations is really important. (Teaching Specialist, Denmark, interview)

> When there are tests [that students do not know about yet], that would also be kind of be unfair because [testing] a lot of things that they don't know is a little unfair for some of the kids that do not know about it. (Student, Denmark, interview)

> The artefacts session is a double session ... but within that [session] there are other activities as well. All the students have individual bespoke word learning with spelling lists (Teacher 19, Norway)

Teacher 18 (Netherlands) emphasised the importance of the children learning about how they learn, explore and create best, with references to the theories of Multiple Intelligences (Gardner, 1993).

> We've been using our VAK [visual, auditory and kinesthetic] … [and] MIs [multiple intelligences] (Students, The Netherlands, video)

> How does your personality relate to your VAKs and multiple intelligences? (Teacher 18, The Netherlands, video)

> **Researcher:** Imagine you are a teacher, and you can change anything about the classroom, what activities you do, what topics are studied, what would you do to help students be more curious?
> **Student:** So what I would do is, I would like, first of all I would get table groups that they can really work well with, and I would also like investigate which VAK, they have: like visual, kinesthetic or auditory, so I can learn them and in a kinesthetic way, so like moving around; auditory or visual like that they stay on their chair and that they are independent. (Students, The Netherlands, Interview)

The findings above suggest that flexible and responsive teaching practice is key to supporting all learners to have equal opportunities to express their creativity and curiosity and to find ways that help students learn about how they like to learn, create and be curious. This aligns with previous literature on inclusive practice and universal learning design (Ainscow, 2020; Florian & Black-Hawkins, 2011). Inclusive practice could take the form such as Teacher 18's engagement with the different way that students learn and supporting students to engage in the process of how they learn. Or it could be enacted through the supportive structures interweaved by Teacher 19 (Norway) or the support of the teaching specialist in Denmark to ensure all students can access the same opportunities and the same community of learning. Similarly, through practically implementing the multiple intelligences theory (Gardner, 1993), as did Teacher 18, teachers within the current study demonstrated considerations around creating a more inclusive classroom environment. This aligns closely with Florian and Black-Hawkins (2011) who suggest:

> Inclusive pedagogy requires: 1. A shift in focus from one that is concerned with only those individuals who have been identified as having 'additional needs', to learning for all—the idea of everybody (not most and some); 2. Rejection of deterministic beliefs about ability (and the associated idea that the presence of some will hold back the progress of others); and 3. Ways of working with and through other adults that respect the dignity of learners as full members of the community of the classroom (p.818).

Our findings in relation to diverse feedback pathways and encouraging self-regulation, align closely with contemporaneous guidance such as the Education Endowment Foundation's recently published general guidance on metacognition and self-regulated learning (EEF, 2021a), and on teacher feedback to improve pupil learning (EEF, 2021b). For self-regulated learning, our findings echo the recommendation to 'explicitly teach pupils metacognitive strategies, including how to plan, monitor, and evaluate their learning' and to 'model your own thinking to help pupils develop their metacognitive and cognitive skills' (EEF, 2021a, p.3). For feedback, our research aligns with their recommendations 1 to 3: '1. Lay the foundations for effective feedback; 2. Deliver appropriately timed feedback that focuses on moving learning forward; 3. Plan for how pupils will receive and use feedback' (EEF, 2021b, p.3). However, our research extends the general guidance by specifically exploring in what ways these teaching practices might foster, nurture and extend each individual's creativity and curiosity, and illustrating how teachers perceived that by helping students develop metacognitive skills of self-regulation such as planning, reflecting on and evaluating their learning, students may learn how to nurture and develop their own curiosity and creativity.

6.2 Promising Practices for Nurturing an Inquisitive Mind

One of the key attributes in the IB learner profile focuses on developing students as inquirers. Scholars have described inquisitiveness as 'a tendency to question' (Watson, 2015a,b; Smith & Fusaro, 2021). In relation to the theme 'Nurturing Inquisitiveness', our findings were that teachers utilised peer-to-peer discussions, initiated reviews of prior knowledge, connected lessons to students' everyday lives, provided opportunities for students to convey what they know, what they think and what they wonder to help them identify and fill knowledge gaps. Teachers also posed 'what if', 'how' and 'why' questions to students. They encouraged students to ask inward questions, which involved students reflecting on a lesson and questioning themselves about the learning activity. Teachers modelled this type of questioning and they encouraged students to ask outward questions addressed to the teacher or to classmates.

Within the theme 'Nurturing an Inquisitive Mind', being able to identify and fill knowledge gaps is key. As discussed in Section 2.1, curiosity involves recognizing a knowledge gap and having a strong desire to fill the gap. According to Shin and Kim (2019) "when individuals feel curious, they engage in persistent information-seeking behaviour" (p.854) to fill that gap in knowledge. We observed teachers modelling and encouraging question asking which was a key finding and aligns with previous literature. Scholars have argued that teaching students to question provides an avenue for developing curiosity (Baehr, 2013, 2015; Watson, 2015a, 2015b, 2018) and the visible manifestation of curiosity is question- asking and exploration (Engel, 2011, 2013; Grossnickle, 2016).

We observed teachers asking questions that promote thinking skills at various levels as outlined by Bloom's taxonomy (Bloom et al., 1956). This taxonomy includes a hierarchy of levels: Level 1: Knowledge, Level 2: Comprehension, Level 3: Application, Level 4: Analysis, Level 5: Synthesis, and Level 6: Evaluation (Bloom et al., 1956). For revisions of Bloom's taxonomy see Krathwohl (2002) and Anderson (2014). The questions we observed teachers asking included knowledge recall and having students share existing knowledge which helped to identify and fill knowledge gaps. An example of this was observed from Teacher 1 in Italy who asked students, 'What happened during the primary era?' This activity provided an opportunity for students to activate and share their prior knowledge in preparation to begin a lesson about the secondary era. We also observed comprehension questions. For example, Teacher 13 in Ghana asked students to interpret what was happening in a picture during a discussion on prehistoric trade. Teachers utilised questions and activities to help students apply and synthesize knowledge. For example, teachers in India provided students with a variety of choices as illustrated in Figure 5.17, Section in 5. Teachers also asked questions that nurtured the development of evaluation skills. Teacher 2 in Italy provided an example of this when she posed the following statement and question during a science lesson: 'They said that when they put salt, for example, into a glass of water, nothing really happened. Do you agree? Don't you agree? Why?' In a follow-up interview, the teacher explained that this allows students to share their ideas, provide explanations and determine if a change in their thinking is needed.

We found that students were encouraged to think about and share their 'wonderment' questions, described by Scardamalia and Bereiter (1992) as "questions that reflect curiosity, puzzlement, skepticism, or a knowledge-based speculation, in contrast to a grouping for basic orienting information" (p.188); these questions are also linked with backward curiosity, which encourages students to search for answers to resolve incongruity between what is known and what is not known (Kashdan et al., 2018). Teachers used the prompt, "I see, I think, I wonder' to elicit responses. As mentioned in Section 2.6, 'I wonder' prompts are also discussed by Barell (2013), in a book published

by the IB, who provides examples of prompts and questions that can be used to model curiosity and help children grow intellectually. 'I wonder' is among the prompts he recommends. Interestingly, our quantitative findings support the idea that Barell (2013) advanced because we found that students enjoyed asking questions, which is a characteristic of a curious learner. For example, in response to the question 'I enjoy asking a lot of questions, to learn more about the things around me', over 90% of students agreed with this statement. Together, these findings align with previous research on question-asking, and suggest that modelling curiosity (e.g., using prompts) are viable ways of strengthening students' curiosity levels.

One of our participant teachers explained why she uses the see- think-wonder prompt:

> When I think of curiosity, I immediately think of the classroom and my kids wondering. So, we do a lot of I see, I think I wonder moments and just the children being able to openly question what we're learning, and even if it's just a simple knowledge question or a skill-based question, but they're just able to understand what's going on and try and build on their understanding by maybe taking on another angle because it's something that they're curious about. (Teacher 21, Denmark)

Rop (2002, 2003) notes the importance of teachers making it known to students that their questioning is valued. The salient message is that questioning is welcomed and encouraged, and students feel comfortable wondering and expressing it outwardly.

Curiosity involves "asking thoughtful and insightful questions" (Baehr, 2016, p.92) and children practice and imitate this skill, leading to habits that nurture curiosity (Baehr, 2015). Teaching students to question provides an avenue for developing curiosity (Baehr, 2013, 2015; Watson, 2015a, 2015b, 2018). However, previous research has shown that children do not ask many questions in school (Biggers, 2018; Clark et al., 2012; Dillon, 1988; Susskind 1979). It has been argued that more opportunities should be provided for students to develop and practice their question asking skills instead of having most questions posed by the teacher (Watson, 2018). Scholars have argued that questioning may increase cognitive engagement through allowing students to work independently and explore the relevance of the topic to their lives (Blumenfeld et al., 2006).

How can schools and teachers nurture inquisitiveness and promote question-asking? Teachers may often worry that too many questions might distract attention, or slow class progress (for example, when there is a lot of material to cover, or the class is working to a tight schedule). It is important to emphasise the value of well-considered and purposeful questions and highlight the role these questions can play in supporting the whole class's learning and curiosity. The curiosity framework presented by ACER (Heard & Anderson, 2021) offers a useful framework to help conceptualise different elements of students' question asking. The subdimension '*Refines questions of value*', offers bullet points to help students and teachers reflect on the quality of questions, the way that the questions are organised or ordered, whether the questions evidence good awareness of current state of knowledge, and whether the questioning forms part of a realistic and feasible pathway for how new knowledge is to be learnt (Heard & Anderson, 2021, p.27). Therefore, a promising practice for teachers would be firstly to support students to reflect using prompts, questioning or a framework that allows them to learn about the different elements of questions-asking: this may help them learn about different ways to make their questions purposeful, valuable and effective. Secondly, that teachers also use a framework (such as the above proposed by ACER) to interrogate the way that they can model and encourage the use of high-quality, well-organised series of questions, that show awareness of what is known (and what is not known), and forms part of a realistic plan or pathway for how new knowledge is to be learnt.

Another promising practice we observed was peer-to-peer discussions. This practice also aligns with previous literature, as research has shown that engaging socially by conferring and sharing questions with others in a group can stimulate the thought process of peers and encourage the co-construction of knowledge, and facilitate social curiosity (Chin et al., 2002; Kashdan et al., 2018). "The questions embedded in the discourse of collaborative peer groups help the scaffolding of ideas, encouraging learners or their peers to reflect on their own ideas" (Chin & Osborne, 2008). This collaborative reflective process can help to identify and fill knowledge gaps and lead to improved ideas or task outcomes as one of our teacher participants explained:

> Not only are we making them build their social skills, we are also making them be open minded to other people's views as well, to be able to skim and scan as they are talking ... I think that here this is what you should do and they take their friend's views, they build upon it and they make it good (Teacher 13, Ghana)

Markey and Lowenstein (2014) discuss the importance of making manageable information gaps salient to students in ways that help them retain material. One of the ways teachers accomplished this was by reviewing prior knowledge with students. Shing and Brod (2016) discuss the importance of reactivating appropriate prior knowledge before presenting new information and providing opportunities for students to make connections between their existing knowledge and any new information being presented.

Markey and Lowenstein (2014) note that curriculum content tailored to student's interest and background increases curiosity, as this provides opportunities for students to make connections between the lesson and their everyday lives. For example, in one lesson where students were learning about exploration, tools of explorers and how those tools have changed over time, we observed students making connections related to some of the tools they had to identify. One student shared his experience of going to the hospital to have an x-ray. This was prompted by him viewing a picture of an MRI machine. The teacher frequently asked students if they were able to make any connections between the tools they were identifying and viewing with their lived experiences. This example of prompting to make connections coincides with the suggestion of Shing and Brod (2016) mentioned in the previous paragraph.

6.3 Promising Practices for Collaborative Creativity

Previous research emphasises that collaboration is a key element of fostering and facilitating creativity (Hesse et al., 2015; OECD, 2017; Ramalingam, et al. 2020; Scoular, et al. 2020). However, an interesting finding in this project was that curiosity seemed to be interweaved into creative processes, to spark and motivate collaboration. In the discussion that follows, the promising practice is highlighted in italics before insights from the literature are synthesised with the findings of our study.

Generating curiosity in the content of collaborative group work

The practice of sparking curiosity in the topic or content of collaborative group work was seen for both small group collaborations, such as in Teacher 20 and 21's 'Silent gallery walk' (Denmark), as well as full class collaborations, such as in Teacher 10's pizza fraction exercise (Sweden), where children watched a video and were invited to 'wonder' individually, before sharing with the class and engaging in collaborative collation of ideas on the board. Teacher 20 expanded on this in interview explaining that he used this 'silent gallery walk' to spark student curiosity in the upcoming collaborative task, and to build student confidence by allowing them time to generate their own ideas before arriving at the group discussions.

These examples relate closely to previous research into the nature of stimuli that evoke and spark curiosity (e.g., Markey & Lowenstein, 2014; Shin & Kim, 2019), as well as research into the interaction between humans and their immediate environment often termed 'proximal processes' (see for example, Bronfenbrenner, 2000; Peterson, 2020), including being curious about other people – social curiosity (Kashdan et al., 2018). This project's data extends this exploration by illustrating the different role that curiosity-sparking stimuli can play in collaborative creative processes. In the videos, curiosity was often sparked through the teachers showing an image, short video clip or even just posing a question and allowing for quiet reflection, which is linked to ACER's (2021b) work on curiosity-drive inquiry. Teachers also explained that the reflection played a dual role, allowing children to develop and follow their own curiosity and allowing children to develop their own ideas, as after the quiet pause children arrived in their groups mindful of their own ideas they had generated, and ready to listen to the ideas of others, rather than launching immediately into the task without the time to consider their own thoughts.

Generating curiosity in the perspectives of collaborators

The practice of generating curiosity in the perspectives of collaborators was seen in both Teacher 18's class debate (the Netherlands), as well as Teacher 8's post-it notes opinion activity and group discussion (Sweden). This was also seen in the way that students in Teacher 4 and 5's classroom reacted to, engaged with and incorporated the ideas of their collaborators (France). Indeed, these experiences also provide the opportunity to foster empathetic curiosity (Kashdan et al., 2018). In fact, in the current study 87% of students agreed with the statement 'When I talk to someone and they get excited, I want to find out why they got excited.', suggesting that students are open to the experiences of learning about the other perspectives. In previous research into collaboration, the role of interest in the perspectives of other's is sometimes explored through a psychological perspective engaging with concepts such as 'Theory of Mind' (Hesse et al., 2015; Sidera et al., 2018), where researchers assess an individual's ability to attribute different mental states to others (Gopnik, & Wellman, 1992) and explore how this affects group work. Other research focusses on a more linguistic perspective and approach, examining how collaborators express and conceptualise their own perspectives and the perspectives of others (e.g., Dehler et al., 2011; Scoular et al., 2020). This current project adds to previous discussions of social curiosity – curiosity about other's thoughts and behaviours (ACER, 2021b; Kashdan et al., 2018), by illustrating how this curiosity and inter-personal motivation can play a key role in the way that children interact with their peers in collaborative creative projects.

Our findings align closely with ACER's Collaboration Framework proposed by Scoular and colleagues (2020); they outline three strands in their collaboration framework: building shared understanding, collectively contributing, and regulating. Their first strand involves communication with others, pooling of resources and information and the negotiation of roles and responsibilities (Scoular et al., 2020, p.3). These three aspects of building a shared understanding were clearly illustrated in our data, alongside evidence of the practices that can support these aspects of collaboration. The most promising practices were seen in the way teachers upskilled students to learn and use communicative language: teachers modelled and encouraged the use of language such as listening, sharing, explaining, turn-taking, reflecting, agreeing (and even disagreeing). This communicative language enabled students to discuss and share the responsibilities of the creative task, and manage and negotiate the contributions, knowledge, and expertise of the group. Furthermore, our data revealed that students used this language to actively engage in asking each other about their perspectives and ideas, showing curiosity about the views of others and exploring how these new ideas could then be integrated into the collaboration.

Incorporating choice into the collaborative process

It was seen in the data that choice during the collaborative process, and reflection after the collaborative process, could support children to learn better and more efficient ways to collaborate creatively. The fact that collaborative processes can enable more creative products and solutions than the work of one individual, has been highlighted extensively in previous research and policy (e.g., OECD, 2021; Warhuus, et al., 2017). However, there has been little evidence to illustrate how these collaborative processes can be nurtured and developed in school settings.

This promising practices data fills this dearth in the literature by illustrating the key elements of efficient collaboration: such as communicating efficiently (see examples from Ghana, Netherlands and Sweden in Section 5.4), sharing responsibility (France, Norway, and Sweden), and valuing the ideas and perspectives of each other (Ghana, France, Norway, India and Denmark examples shown in Section 5 above). This aligns with the second strand of ACER's collaboration framework 'collectively contributing', which involves participation in the group, recognition of others' contributions and engagement with roles and responsibilities (Scoular et al., 2020, p.3). Our data suggests that the promising practice relating to this is to nurture creative and collaborative peer negotiations and discussions, by choosing groups that will allow for meaningful interactions, as well as integrating opportunities for choice. Sometimes this may mean carefully selecting groups so that children learn to work with a diversity of partners and collaborators, and experience multiple ways of working. However, the videos and interviews also suggest that it is important to make opportunities to give students agency over how they interact: allowing them to make choices about who they work with, and how they work with them. By giving children choice in collaborative contexts, they learn to take risks and develop their creative confidence, as well as their ability to make individual and group decisions.

Facilitating reflection during and after collaboration

This final practice relating to reflection aligns closely with the third and final strand of ACER's collaboration framework 'Regulating': this strand has four aspects, the resolution of differences, constructive contributions, maintaining shared understanding, and the adaptation of behaviour and contribution (Scoular et al., 2020, p.3). To support these four elements of regulation, two practices were highlighted as important: modelling flexible and responsive behaviour and facilitating reflection. Many teachers emphasised the importance of modelling flexible, reflective, and responsive behaviour to show students ways to engage with the actions of others and adapt their behaviour and ideas accordingly. This was particularly seen in the class of Teacher 8, when he used a group discussion about respect and consent, to allow children to respond to the ideas of others, take new ideas on board, and change their mind. This process was visible on the videos as the teacher used the physical space of the classroom to articulate agreement (standing on one side of the room meant the students agreed with one answer, the other side meant they agreed with the other answer). After listening to different contributions, the students could be seen moving to different sides of the classroom, to indicate that they had taken the ideas and arguments of others on board and had changed their

decision. This activity, although not explicitly a collaboration activity, taught the students different ways to listen and respond to diverse perspectives, which is a key element of collaboration, as well as a key attribute of the IB learner profile especially in terms of being 'Thinkers', 'Communicators' and 'Open-minded' which are intended attributes of all IB learners, as presented in the IB learner profile (IBO, 2013). By designing a physical activity that involved the explanation of reasoning behind opinions and decisions, Teacher 8 was able to bring to life these three attributes to illustrate elements of learning that are often difficult for students to perceive when they are internal processes.

The second practice of facilitating reflection relates closely to our earlier discussion of self-regulated learning, as well as linking ahead to our final theme of self-expression. This relates directly to the intended attribute 'Reflective' from the IB learner profile: 'We thoughtfully consider the world and our own ideas and experience. We work to understand our strengths and weaknesses in order to support our learning and personal development' (IBO, 2013, p.1). This attribute was evidenced throughout the classrooms and especially visible in a class debate held in the Netherlands, where students debated whether it was better to be 'Reflective' or a 'Communicator' - the debate concluded with reflections that being a good communicator was essential, but that reflection was essential to being an effective communicator, and that both were vital for meaningful collaboration. This focus on communication was seen in many of the post-it notes reflecting on collaboration (e.g., Figures 5.2 and 5.5). The reflections in the data allowed children to think back over what had happened, and then look ahead to how to improve: the reflections link closely to the 'Regulating' elements of ACER'S Collaboration framework especially adaptation of behaviour and contribution (Scoular et al., 2020, p.3).

The key practice was that teachers helped children to use reflection to make invisible or abstract learning processes either visible or more concrete. Reflection can help students to engage with learning processes that can be hard to perceive or conceptualise if not given the time, language or opportunity to think about what they have been learning and how the lesson went (Scoular & Ramalingham, 2021). It is helpful to allow students to experiment with how they like to reflect (some may prefer written, verbal or pictural ways to engage and remember), the key element is that they engage with the reflective process and take the ideas forward. In terms of collaboration, it is useful to give students time to reflect on and write about how well the collaboration went, why, and how it can be improved, as this may support them to develop new ways of successfully collaborating and creating.

6.4 Promising Practices for Choice over Creative Self-Expression

Creative self-expression has been linked extensively to positive psychological outcomes (e.g., Daykin, 2019; Lassig, 2020), and has also been highlighted to share, develop and evidence creative processes (Richardson & Krstic, 2021). There is emerging evidence that allowing students to engage with the creative expressions of peers can function as a stimulus to spark creativity and curiosity in others (ACER, 2021a; Beghetto & Karwowski, 2018). In this section, we discuss how our findings relating to 'choice over creative self-expression', align with, and extend, current research and thinking in this field.

Modelling and valuing multiple modes of expression

Children express themselves through and across diverse communicative modes (Dicks et al., 2011). The evolution of digital technologies and the shifting communication practices and landscapes of the 21st century demand a multitude of communicative modes and interactions (Jewitt, 2008): developing

children's confidence and competence in multiple expressive modes is key to enabling them to flourish and engage with the increasingly complex communicative demands of the world (Jewitt, 2008).

The data showed that teachers created opportunities to model and value diverse contributions, and diverse modes of expression from each student. Teachers actively planned opportunities for this diversity into their lessons, and also welcomed and valued unexpected, novel and creative ways that children chose to express themselves. This was particularly seen in the data from Denmark, Norway, the Netherlands, Sweden, France, Ghana and India: it was particularly interesting in the online learning environment of Teacher's 16 and 17 (India) as children were physically far from each other and had been for a long time (due to extensive lockdowns), but connected with each other, shared information, and interacted through dance, body percussion, laughing, puppets, writing and acting.

Our findings align closely with the work of Carey Jewitt, who has conducted extensive research into self-expression and communication in global classrooms. Jewitt (2008) argues for the importance of three practices: firstly, teachers must engage carefully with each individual's different ways they choose to express themselves, their feelings, their opinions and their interests (Jewitt, 2008); secondly, teachers must offer opportunities for students to develop their competence in these different modes of expression through opportunities to share and gain peer and teacher feedback (Jewitt, 2008, see also Beghetto & Karwowski, 2018). Thirdly, Jewitt (2008) emphasises the importance of ensuring children are exposed to a diversity of modes and 'literacies', and she situates this in the larger educational context:

> "The need is to move away from a monocultural and monomodal view of literacy. One way in which teachers, curriculum, and policy can respond to this task is to broaden the diversity of signs and cultural meanings that circulate in the classroom... Rethinking literacy beyond language can support teachers, curriculum, and educational policy in the work of connecting the school, children, young people, and the demands of the contemporary communicational landscape." (Jewitt, 2008, p.262-263).

Across the data of this present study, the teachers integrated opportunities for children to engage with many different modes of communication through many different media: art, music, inventions, discoveries, scientific findings and population data. The diversity of the communicative modes in the classroom reflected the diversity in the world outside the classroom, and this was important not just for their creativity but also for their curiosity. The promising practice was to regularly integrate opportunities for students to act, build, dance, mime, write, craft, move, paint, sketch, doodle, discover and to follow their curiosity through and across different expressive modes. It was also helpful when teachers made explicit mention of how they valued not only the content of what was produced, but also how the children produced and communicated what they had learnt.

Choice over modes of expression

A key element underpinning much of the self-expression was that teachers gave children choice over how they explored, reflected and communicated during their learning. There was also a key focus on confidence, teachers emphasised the importance of choice over timing and positioning, making sure that students could pick how, where and when they shared their views and creations with the class, so that students felt in control of their own learning and how they shared what they had learnt with others. For example, a student in Sweden felt nervous to present but still wanted to share his ideas, and so pre-recorded short voice-clips (this could be done on a phone, laptop, tablet or voice-recorder). This allowed him to speak confidently whilst he showed his PowerPoint, knowing that he had pre-prepared his ideas in advance. Sometimes self-expression was perceived as a way to engage students in the process for learning and sharing what they had learnt:

> When students demonstrate what they have learnt, we try to let them do it in many different ways, so it could be like a role play or PowerPoint or making an iMovie. (Teacher 10, Sweden)

Other times it was framed as an important moment to let students express their feelings or make connections, and this was explicitly linked to confidence:

> Creativity, it's very individual. I think it can be something that can be displayed in many different facets and it's to do with imagination... creativity can be how they express themselves when they're standing up and talking in front of the class. It can be how they write using the language that they know. It can be the books they choose to read, the art they choose to draw, and as I said, many, many different ways they can express it, but it's having the confidence to do that and to engage their imagination. (Teacher 20, Denmark).

Lassig (2020) found that supportive environmental conditions (such as multiple opportunities for creativity, emphasis on choice and student independence and autonomy, and supportive psychological environments where diverse contributions are valued), could help children and overcome the potentially inhibiting influence of adolescents' lack of confidence. Similarly, Beghetto & Karwowski (2018) argue:

> "Instructional practices, which explicitly recognize and attempt to examine the potential value of idiosyncratic differences in how students' make sense of academic subject matter, can help students develop a deeper understanding and potentially contribute to the learning of others. Conversely, instructional practices that require students to conform to a singular way of meeting of academic learning goals likely will suppress students' and teachers' willingness see the value in different (i.e., creative) ways of meeting learning goals...unless students and teachers see the value in and believe that they are capable of making creative contributions to the learning of others, then it is unlikely they will put forth the effort necessary to do so" (Beghetto & Karwowski, 2018, p.150).

Supporting children's confidence in both their creative capabilities, and their creative outputs is essential: helping them to recognise how their creativity and curiosity is valuable to the class (and school) can support this confidence building. This further emphasises the importance of creativity being conceptualised as a whole school endeavour, not just the focus of individual teachers and classes, but rather every member of the school makes a valuable contribution by modelling different forms of expression, creativity and curiosity in their everyday lives (Frisch, 2018).

Integrating opportunities for choice, decision-making and risk-taking

An important element of our data was the extensive illustrations of how teachers integrated choice-making into their classes, and also how they found ways to support students to learn how to make these choices, modelling how to give explanations, and ways to reason and evaluate their risk-taking. The importance of children having the chance to gain experience and expertise in decision-making and risk-taking is highlighted as a key element of creativity (Henricksen et al., 2021; Page & Thorsteinsson, 2017).

Teachers integrated multiple opportunities for children to make creative decisions in the classrooms: these could be small, short-term decisions such as who to work with for this lesson or project (seen in the data in Denmark, the Netherlands, Sweden, and Ghana); or decisions about where and how to work (seen in the data from India, France, Germany, and Sweden). There were also illustrations of how teachers taught students about choice in terms of larger decisions that might have implications for children's friendships and futures. This was particularly seen in the classroom of Teacher 8 (Sweden), who facilitated a debate where children imagined making significant real-life decisions and then articulated their reasoning. This was also seen in Teacher's 9 and 10's classroom (Sweden) where the teachers helped the children imagine scenarios about borrowing and stealing (Teacher 9) and

internet safety (Teacher 10). These activities not only illustrated to children different ways that people might make choices, but it also stirred curiosity in the decision-making processes of others, with children asking each other how they had come to particular decisions, and why that decision was right in their opinion. Stoycheva and Lubart (2010) explore the inter-relation between creativity, choice and decision-making arguing that creative products and processes in being novel or unexpected can also be perceived as 'risky'. Interestingly, our quantitative findings from the curiosity questionnaire showed that over 60% of students disagreed with the statement 'I am afraid that my classmates will think I am a nerd if I ask a lot of questions in class.' Often, asking a lot of questions can be viewed as risky within the context of classroom setting, especially when providing new ideas (Sharma, 2015). Moreover, 87% of students agreed with the statement 'When I see a word that I do not know, I look it up or ask someone what it means,', suggesting that they are willing to take a risk to find out new information by demonstrating their lack of knowledge. Therefore, based on these findings, it appears that these multiple opportunities that teachers provide to make creative decisions potentially offer students a safe space within which to express their thoughts, ideas and questions.

Above all, this returns to the vital importance of fostering what has already been discussed as a 'safe psychological environment' or what has sometimes been described as a 'safety net' (Henricksen et al., 2021) as well as supporting confidence in expressions and decisions (Beghetto & Karwowski, 2018). This also relates back to the discussion of self-regulation and learning from mistakes and the importance of giving students a safe space and opportunity to take risks and make mistakes. There has been extensive research into the role of making mistakes in learning and creativity: spanning from in-depth research into the neural mechanisms that occur when mistakes are made (Moser et al., 2011; Schroder et al., 2017) to more recent policy research into the way that macro-level policy and leadership practice can affect mistake-making and creativity (Henriksen et al., 2019; Creely et al., 2021). There is strong emphasis in the literature that mistake-making plays a key role in creativity: 'Without the possibility of, and the space for, risk and failure, there can be no creativity' (Henriksen et al., 2019, p.4). See Section 5.1.2. (Self-Regulated Learning) for examples of modelling and valuing mistakes in the current study.

Previous research into supporting student confidence and student motivation corroborate our findings of the need for safe psychological environments (Hattie et al., 2020; Ryan & Deci, 2020). A promising practice, to support this safe psychological environment, is to ensure that all student contributions are recognised, valued and praised meaningfully, and that praise is justified through highlighting for example a student's effort, idea or indeed mode of expression. Furthermore, it is also helpful to ensure that individual and unexpected elements are recognised and valued. In terms of making mistakes this links closely to the discussions on self-regulation, and the data in this study highlight the importance of encouraging curiosity in low-stakes risk-taking and mistake-making, where students can explore new ideas, extend their thinking, puzzle through dilemma, and try new pathways without worrying about achieving the 'correct' answer the first time. This can be facilitated through tasks and questions that have either multiple answers or multiple pathways to achieving a solution.

Linking creative self-expression to curiosity

Teachers sparked children's curiosity in new and creative ways that they could express themselves. This was particularly notable in the Netherlands with the encouragement to express data through different ways, in Norway through creative doodling and in France where the children were encouraged to engage in a 'hack the tube' activity and creatively develop a cardboard tube into something imaginative and scientific. Each of these activities resulted in very creative processes as well as creative results (for example in France a teacher explained that a student turned their tube

into a lighthouse with a working beacon at the top). Students followed their own curiosity to discover new ways to explore and create, and in turn these creations sparked the curiosity of their teachers and peers. This interrelation of creativity and curiosity in expressive processes relates closely to the perspective of Beghetto and Karwowski (2018) who propose the perspective that creativity and academic learning are intertwined, and that creations can spark curiosity and creativity in others: they propose that self-expression is a means of moving individual conceptions into the social sphere in order to develop ideas and gain feedback for improvement. This also aligns with Jewitt's (2008) emphasis on developing different ways for students to express their curiosity: "New skills for reading, finding information, authenticating information, and manipulating, linking, and recontextualizing information are demanded in this multimodal symbol-saturated environment" (Jewitt, 2008, p.259). This theme further emphasises the value of studying curiosity and creativity together, as there are multiple illustrations in this data (see examples at the beginning of this paragraph) of why and how curiosity and creativity could spark and stimulate each other and could be intertwined to powerfully develop new opportunities for innovation and learning.

6.5 Conclusions

Concluding Discussions

Creativity and curiosity have been identified as essential skills for the 21st Century (Joynes et al., 2019; OECD, 2021). This project has responded to the need for a rigorous and high-quality exploration of the practices to support creativity and curiosity in primary school classrooms. This research worked with nine schools in nine different countries to identify, evaluate and share promising practices to foster these skills. The focus on both curiosity and creativity together has proven to be significant, with evidence suggesting that these two elements can function to spark and stimulate each other and can be intertwined to powerfully develop new opportunities for innovation and learning. In the current study, we identified five key themes in the promising practices that teachers use to foster curiosity and creativity: Diversifying Feedback Pathways, Self-Regulated Learning, Nurturing an Inquisitive Mind, Facilitating Creative Collaboration and Choice Over Self-Expression. Despite the complications of conducting a multi-site international project in a global pandemic, 46 videos were collected and analysed alongside 22 staff and 92 student interviews as well as 193 responses to the student curiosity task and 179 responses to the student creativity task. Teachers and students indicated that they enjoyed taking part in the research (see Appendix 9).

In addition to providing empirical data on how curiosity and creativity can be fostered, this study makes a significant methodological contribution to classroom research with our novel and flexible approach of collaborating with teachers online, using teacher-captured video recordings to understand how they facilitate curiosity and creativity, and the development of instruments (online consultation protocol, video recording protocol, and instructional videos) to facilitate the study and make it easy for teachers to participate. All these methodological innovations were required due to the Covid-19 pandemic's impact on the possibility of onsite visits to schools. The research team had to pivot from the original plan of visiting schools to record the classroom contexts ourselves and think creatively about other feasible options that would allow us to maintain the robustness and fidelity of the data. More broadly, given the knowledge sharing that emerged during this research, this study provides a gateway and a means for further discussion among researchers about how to carry out remote multi-site, multi-perspective video-based classroom studies.

Limitations

We identified four key limitations in the current study. Firstly, the concepts of curiosity and creativity, including their conceptualisation and operationalisation, require additional research. Indeed, in both our study and that of ACER (see ACER, 2021a; 2021b), the review of the literature and our empirical findings have shown that these skills are defined and fostered quite differently across different scenario. Therefore, given the exploratory nature of the study, more research would be needed before schools implement any of the identified practices. Secondly, as discussed in Section 4.3, we experienced recruitment challenges due to the COVID-19 pandemic. A school in Australia that initially agreed to participate had to withdraw and schools we contacted in the United States expressed that they were under a great amount of pressure and uncertain about teaching circumstances during the pandemic. There were also unanticipated issues and delays with review boards as state schools often has specific local authority ethics boards that would take between 6 weeks and 6 months to process an ethics application. Due to these circumstances, the composition of our sample includes primarily countries within Europe. We recommend that future studies include additional countries to provide more diversity in the sample, with a particular focus on including state or public schools, alongside the inclusion of private schools. Thirdly, we sought to recruit at least 2 teachers from each participating school so that they could operate as an internal support network. However, in some schools we were able to recruit only a single participating teacher. Moreover, several teachers echoed that they would have appreciated a virtual network of teachers from other countries with whom they could exchange ideas in their preparation for recording. Perhaps this would have strengthened the support available in our study and this is an avenue for future research, particularly to determine what impact if any, including this virtual network would have on teacher engagement in the study. Finally, given the cross-sectional nature of study, our data does not lend itself to drawing any conclusions regarding the long-term impact of the identified promising practices on student curiosity and creativity outcomes.

Recommendations for Future Studies

In future studies, it would be useful to assess the long-term impact of promising practices on student curiosity and creativity. This could involve capturing student experiences using qualitative and quantitative data on the development of curiosity and creativity skills as students' progress through the IB continuum.

In addition, it would be beneficial to examine the ways in which curiosity and creativity are fostered within the Middle Years and Diploma Programmes (MYP and DP, respectively) and make the findings available to IB teachers at the appropriate grade levels. Knowing what teachers are doing to foster curiosity and creativity at the MYP level may be useful for PYP teachers as they prepare students to progress to the next level. Also, seeing how the DP teachers nurture curiosity and creativity in their students may be beneficial to MYP teachers as they prepare students to successfully transition to the DP. In addition, it would be useful to identify specific contributors to curiosity and creativity in the MYP and/DP. For example, within the context of the MYP, a longitudinal study could be conducted in which different aspects of teaching practices within the IB PYP are examined in relation to their long-term impact upon student curiosity and creativity at the MYP level. Importantly, it would be useful to invest research efforts in the measurement of these skills, to ensure that any conclusions derived from such research represent an effective and evidence-based way of fostering curiosity and creativity.

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Appendices

Appendix 1: Examples of pre-engagement survey questions

Below are examples of questions asked in the pre-engagement survey. Due to timing constraints, some teachers were asked these questions in their interview. The language and order of the questions below were developed through the research to ensure that the questionnaire was understandable: the language below reflects the final iterations of the questions that were asked of teachers and aligned with the questions asked in interview.

Thank you very much for taking the time to participate in the Curiosity and Creativity Promising Practices study led by the Oxford University Centre for Educational Assessment (OUCEA). We would like to know more about the practices you use to foster curiosity and creativity in students. In the section below, we will ask you 4 questions about this. The final question asks you to tell us when you would be available to meet with us to discuss the project.

The information you provide will be used in our first planning meeting with you. It will also help us to develop materials that will be useful for you and your IB teacher colleagues. The survey should take approximately 15 minutes. Thank you again for your time and we look forward to meeting with you.

1. Please describe a particular situation or situations where strategies you used stimulated curiosity in one or more students
2. Please also describe additional strategies that you use to facilitate curiosity in students. You may discuss inquiry-based strategies if you use them.
3. Please describe a particular situation or situations where strategies you used stimulated creativity in one or more students.
4. Please also describe additional strategies that you use to facilitate creativity in students. You may discuss brainstorming if you use it.

Appendix 2: Thematic codes with related teacher e-interview schedule

Thematic Codes	*Questions below to be asked **prior to video collection.***
Rapport building: Getting to know each other (not a thematic code)	It was very nice meeting you during our initial consultation. Would you like to ask any questions before we start? Thank you very much for agreeing to speak with me today. Before we get started please tell me your full name, school name, how long you've been teaching, and the grade level that you currently teach.
Understanding curiosity	We know that people have various perspectives on the concept, and we would like to know more about your understanding of curiosity. What do you think curiosity is?
Curiosity role in education	What would you say the role of curiosity is in education?
Understanding of creativity	We would like to know about your understanding of creativity. What do you think creativity is?
Creativity role in education	What would you say the role of creativity is in education?
Training	Have you had any training on how to foster curiosity in students? If so, when and where did you receive training? What did this involve? Have you had any training on how to foster creativity in students? If so, when and where did you receive training? What did this involve?
Rapport building: Opportunity for teachers to ask questions (not a thematic code)	Invite teacher(s) to ask any additional questions.
	Questions below to be asked after video collection.
Videotaped lesson choice	Please tell me about why you chose to showcase this lesson.
Video specific questions	These questions will be generated based on a review of targeted video clips.
Rapport building: Opportunity for teachers to ask questions (not a thematic code)	Invite teacher(s) to ask any additional questions.

Appendix 3: Thematic codes with related student e-interview schedule

Thematic Codes	Questions
Rapport building: Getting to know each other (not a thematic code)	**Getting to know each other.** • For some students, interviews can be perceived as a formal context (O'Reilly & Dogra, 2016). Therefore, each researcher invested time in building rapport with the participants (e.g., telling the student a little about ourselves and where we are from, ensuring that this information is presented in an age and context appropriate manner). • Ask students about themselves (e.g., favourite colours, sport, pets, favourite subject and why). Close-ended questions are generally fine here as they help to build rapport. Some participants do elaborate on close-ended questions (Roulston, 2010). **Let students know why you are speaking with them and what to expect during the interview (e.g., viewing parts of classroom videos).** • Why: "One of the reasons why I am speaking with students is to try to find out what changes we can make to make learning better." • What to expect: "I'll ask you some questions about your learning. Is that ok with you?" **Encourage students to ask you any questions during interview and let them know that there is some time after the interview to ask further questions.** • "Remember, you can also ask me any questions during our talk today. I will also give you some time at the end so that you can ask me questions you might have."
Understanding curiosity	Have you ever heard the word curious before? In your opinion, what do you think being curious means? **Prompt 1**: Tell me about what you do when you want to find out new information?

Gaps in Knowledge	Were there things in the lesson that you did not understand? **Prompt 1**: What were they? **Prompt 2**: Was there anything that you did that helped you to understand? **Prompt 3:** Was there anything that your teacher did that helped you to understand? Tell me more about this.
Level of curiosity	Were there things that you tried to learn more about during this lesson/activity? **Prompt 1**: Can you remember the reasons for wanting to learn more? Were there things that you did to help you to learn more about this lesson/activity? **Prompt 1**: Can you remember the reasons for wanting to do these things?
Understanding creativity	Have you ever heard the word creativity before? In your opinion, what do you think being creative means? **Prompt 1:** Tell me about what you do when you make something new?
Creation	Please tell me about what you have created. **Prompt 1**: What made you want to create this? **Prompt 2**: Who do you think your creation can help? What might people do with your creation? **Prompt 3**: Can you think about any other way that your creation might be used?
Process	Tell me more about how you went about solving this issue/creating this solution. **Prompt 1:** Tell me some of the things that you were thinking while you were creating your solution? **Prompt 2**: Tell me some of the things that you found hard while you were creating your solution? **Prompt 3:** Tell me what you did to work out the things you found hard? **Prompt 4**: How did you figure out how to … [in relation to a specific aspects of student work]? **Prompt 5**: I noticed in the video that you created this by yourself/with a classmate. Can you tell me the reasons for making this by yourself/with a classmate?

Level of prior knowledge	Has anything that you learned before helped you to create this? **OR** Has anything that you learned before helped you to solve this? **Prompt 1**: Tell me more about those.
Level of interest	Were you interested in this subject or anything related to this before the lesson/creation of product?
Classroom environment	Remember, we've been talking about what curiosity/creativity means? Imagine that you were the teacher for one day and you could make changes to your classroom... • What would you do to help students in your class be more curious? • What would you do to help students in your class be more creative?
Unexpected events in the video clips	These questions will be generated based on a review of targeted video clips. • Ask student "Can you tell me more about .."
Rapport building: Opportunity for students to ask questions (not a thematic code)	Thank you so much for taking the time to speak with me. I learnt a lot about your experiences. Do you have any questions for me or is there anything else that you might want to let me know?

Appendix 4: Creativity teacher-focused video codes

Number of creativity teacher-focused video codes: 9

Video observation: Creativity teacher-focused codes			
Codes	**Definitions**	**References**	**Link to student-focused creativity codes in Appendix 2**
1. Creativity demonstration opportunities	Instances in which the teacher provides opportunities for students to demonstrate their creativity within the context of realistic scenarios. **Example 1**: Opportunities to present and explain a product they created to an authentic audience (community members, etc.) **Example 2**: Students asked to role play and develop ideas to solve a particular problem. **Example 3**: Allows student to choose the format for assignments (e.g., presentation, speech, play, artwork, musical number, etc.)	ACER (2021). Creativity literature review – Framework foundations. Hattie, J. (2012). *Visible learning for teachers: Maximizing impact on learning*. Routledge. https://psycnet.apa.org/record/2012-07127-000 Ritchhart, R., Church, M., & Morrison, K. (2011). *Making Thinking Visible: How to Promote Engagement, Understanding, and Independence for All Learners* (First edition). Jossey-Bass. Scott, G., Leritz, L.E., Mumford, M.D. (2004) The effectiveness of creativity training: A quantitative review. *Creativity Research Journal*, *16*(4), 361-388, https://doi.org/10.1080/10400410409534549	Produces creative solutions
2. Feedback	Instances in which teachers provide useful feedback to students, including feedback and assessment for learning strategies.	Amabile, T. (1996). *Creativity in context*. Westview Press. Boud, D. & Molloy, E. (2013). Rethinking models of feedback for learning: The challenge of design. *Assessment & Evaluation in Higher Education*, *38*(6), 698-712.	Engages in self-regulation

	Feedforward has been described as a "necessary characteristic of feedback." Boud & Molloy (2013). The teacher provides feedforward prompts. **Example 1** (novice): "To meet the learning intention, you could …" **Example 2** (proficient): "You could improve your _____ skills by …" **Example 3** (advanced): "How could you improve your work?" Brooks et al. (2019) Acknowledgement of creativity and evidence of how to improve. **Example 1**: Given as verbal or written feedforward to students.	https://doi.org/10.1080/02602938.2012.691462 Brooks, C., Carroll, A., Gillies, R. M., & Hattie, J. (2019). A matrix of feedback for learning. *Australian Journal of Teacher Education, 44*(4). http://dx.doi.org/10.14221/ajte.2018v44n4.2. Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*(1), 81–112. https://doi.org/10.3102/003465430298487 Hennessey, B. A., & Amabile, T. M. (2010). Creativity. *Annual Review of Psychology*, *61*(1), 569–598. https://doi.org/10.1146/annurev.psych.093008.100416.	
3. Explore and elaborate creative ideas	Instances in which the teacher encourages students to explore and elaborate their creative ideas. **Example 1**: Tell me more. **Example 2**: How did you come up with that idea? **Example: 3**: What would that look like? **Example 4**: How would that work? **Example 5**: "View new perspectives of a creative	Ramalingam, D., Anderson, P., Duckworth, D., Scoular, C., & Heard, J. (2020). Creative thinking: Skill development framework. *Assessment and Reporting*. https://research.acer.edu.au/ar_misc/40	Engages in creative thinking

	idea or view their idea in different contexts. **Example 6**: Develop new interpretations of a creative idea. **Example 7**: Use design thinking to design, develop, and test their creative ideas. **Example 8**: Modify, elaborate, experiment with, manipulate, and transform their creative ideas. **Example 9**: Consider the consequences and limits of their creative ideas. **Example 10**: Evaluate their creative ideas – whether they are fit for purpose, novel and useful."		
4. Encourages divergent thinking	Instances in which the teacher encourages divergent thinking either by asking enabling questions, brainstorming sessions, or other methods. **Examples 1**: What allows you to measure distance? **Example 2:** What can we do to accomplish this goal? **Example 3**: What can we do with magnets? **Example 4**: How many ways can we …? **Example 5**: Brainstorming sessions	Guilford, J. P. (1975). Creativity: A quarter century of progress. In I. A. Taylor & J. W. Said-Metwaly, S., Noortgate, W. V. den, & Kyndt, E. (2017). Methodological issues in measuring creativity: A systematic literature review. *Creativity. Theories – Research - Applications*, *4*(2), 276–301. https://doi.org/10.1515/ctra-2017-0014	Engages in creative thinking

	Additional examples below are from the WKCT, a battery of three verbal and two figural tests inspired by Guilford's (et al., 1968). **Example 6**: Alternate Uses (verbal) test includes "List the different ways you could use a chair", newspaper, or shoe. **Example 7**: Instances (verbal) test includes "name all the things you can think of that move on wheels as possible", "things that make noise", and "square things". **Example 8**: Similarities (verbal) test whereby the learner is verbally asked to list as many commonalities as possible between two objects. One example is for the learner to list the ways in which a potato and a carrot are alike. **Example 9**: Pattern-meanings (figural) test whereby learners are shown cards with drawings and asked, "tell me all the things you think this could be". **Example 10**: Line Meanings (figural) test with eight items which is a more abstract version of the pattern-meanings test (Acar & Runco, 2012)."		

5. Safe to express ideas	Instances in which the teacher demonstrates efforts to make students feel safe to express their ideas and relax. **Example 1**: Don't be afraid to express your ideas. **Example 2**: Brainstorming sessions are held. **Example 3**: Teachers can use 'What I Wish my teacher knew' technique	Klapwijk, R. M. (2018). Formative Assessment of Creativity. In M. J. de Vries (Ed.), *Handbook of Technology Education* (pp. 765–784). Springer International Publishing. https://doi.org/10.1007/978-3-319-44687-5_55	Engages in creative thinking
6. Encourages imagination	Instances in which teacher encourages students to be imaginative. **Example 1**: Use your imagination to… **Example 2**: What can you imagine …	Lucas, B. (2016). A five-dimensional model of creativity and its assessment in schools. *Applied Measurement in Education*, *29*(4), 278–290. https://doi.org/10.1080/08957347.2016.1209206 Spencer, E., B. Lucas, and G. Claxton. 2012. *Progression in Creativity: Developing New Forms of Assessment – Final Research Report*. Newcastle: CCE. Stokes, D. (2014) The role of imagination in creativity. In: E.S. Paul and S.B. Kaufman (eds.) The Philosophy of Creativity: New Essays. Oxford Scholarship Online. DOI:10.1093/acprof:oso/9780199836963.003.0009	Engages in creative thinking
7. Encourages inquisitiveness	Instances in which teacher encourages students to be inquisitive. **Example 1**: Demonstrates an openness to student questions.	Lucas, B. (2016). A five-dimensional model of creativity and its assessment in schools. *Applied Measurement in Education*, *29*(4), 278–290. https://doi.org/10.1080/08957347.2016.1209206	Engages in creative thinking

	Example 2: That is an interesting question. Do you know how you can find the answer?	Spencer, E., B. Lucas, and G. Claxton. 2012. *Progression in Creativity: Developing New Forms of Assessment – Final Research Report*. Newcastle: CCE.	
8. Encourages self-regulation	Instances in which teacher encourages students to be persistent and disciplined in the completion of their tasks. Instances in which teacher encourages students to be persistent. **Example 1**: This might take some time but don't give up. **Example 2**: Don't give up if you didn't get it right this time. **Example 3**: Everyone has times of uncertainty. **Example 4**: Dare to be different. **Example 5**: Teacher explicitly teaches self-regulations skills (e.g., how to organize information – outline, diagram, chart) **Example 6**: Teacher models self-regulation skills. Instances in which teacher encourages students to reflect and improve their creative skill.	Berger, R. (2003). An ethic of excellence: Building a culture of craftsmanship with students. Portsmouth, NH: Heinemann Educational Books. Brandmo, C., Panadero, E., & Hopfenbeck, T.N. (2020). Bridging classroom assessment and self-regulated learning, *Assessment in Education: Principles, Policy & Practice, 27*(4), 319-331, https://doi.org/10.1080/0969594X.2020.1803589 Dignath-van Ewijk, C., Dickhäuser, O., & Büttner, G. (2013). Assessing how teachers enhance self-regulated learning: A multiperspective approach. *Journal of Cognitive Education and Psychology*, *12*(3), 338-358. https://doi.org/10.1891/1945-8959.12.3.338 Spencer, E., B. Lucas, and G. Claxton. 2012. *Progression in Creativity: Developing New Forms of Assessment – Final Research Report*. Newcastle: CCE. Lucas, B. (2016). A five-dimensional model of creativity and its assessment in schools. *Applied Measurement in Education*, *29*(4), 278–290. https://doi.org/10.1080/08957347.2016.1209206	Engages in self-regulation

	Example 1: Teacher asks questions to prompt students to consider how they might improve a product or solution. **Example 2**: Teacher encourages students to reflect critically on their ideas.		
9. Encourages collaboration	Instances in which teacher encourages students to be collaborative. **Example 1**: Ask three, then me. **Example 2**: Let us examine this in small groups. **Example 3**: Think-Pair-Share technique (each student thinks about a given question then pairs with a partner to discuss their thoughts).	Lucas, B. (2016). A five-dimensional model of creativity and its assessment in schools. *Applied Measurement in Education*, *29*(4), 278–290. https://doi.org/10.1080/08957347.2016.1209206 Spencer, E., B. Lucas, and G. Claxton. 2012. *Progression in Creativity: Developing New Forms of Assessment – Final Research Report*. Newcastle: CCE.	Engages in creative thinking

Appendix 5: Creativity student-focused video codes

Number of creativity student-focused video codes: 3

Video observation: Creativity student-focused codes		
Codes	**Definitions**	**References**
1. Engages in creative (divergent) thinking	Instances where students demonstrate a "competence to engage productively in the generation, evaluation and improvement of ideas, that can result in original and effective solutions, advances in knowledge and impactful expressions of imagination" (OECD, 2019, p. 7). **Example 1**: Student generates ideas of a certain quantity: development, combination, and re-combination of ideas (fluency), **Example 2**: Student generates ideas of a certain variety/across different categories (flexibility) **Example 3**: Student generates ideas of a certain exceptionality (originality or relative frequency) **Example 4**: Student generates/asks questions that extend their thinking **Example 5**: Student generates connection between their own and other's experiences in an innovative way. **Example 6**: Student or group of students use existing knowledge to generate imaginative, ideas. This involves generating an idea, manipulating it and building upon the idea to generate novel and appropriate solutions.	El Turkey, H., Tang, G., Savic, M., Karakok, G., Cilli-Turner, E., & Plaxco, D. (2018). The creativity-in-progress rubric on proving: Two teaching implementations and students' reported usage. *Primus: Problems, Resources & Issues in Mathematics Undergraduate Studies*, *28*(1), 57–79. https://doi.org/10.1080/10511970.2017.1346735 Guilford, J. P. (1956). The structure of intellect model. *Psychological Bulletin*, *53*(4), 267–293. https://doi.org/10.1037/h0040755 Ramalingam, D., Anderson, P., Duckworth, D., Scoular, C., & Heard, J. (2020). Creative thinking: Skill development framework. Assessment and Reporting. https://research.acer.edu.au/ar_misc/40 Schut, A., Klapwijk, R. M., Gielen, M., & Vries, M. de. (2019). Children's responses to divergent and convergent design feedback. *Design and Technology Education: An International Journal, 24*(2), 67–89. https://ojs.lboro.ac.uk/DATE/article/view/2611 Torrance, E. P. (1966). Torrance tests of creative thinking. Personnel Press.

		https://www.worldcat.org/title/torrance-tests-of-creative-thinking/oclc/8018719?ht=edition&referer=di
2. Engages in self-regulation	Instances in which students display the knowledge and skills to understand, manage and reflect on their creative processes and outputs, including considering risks associated with their decisions. **Example 1:** Student invests time in planning for their creative projects. **Example 2:** Student takes the time to critically reflect on, evaluate and improve their own creative ideas **Example 3:** Students take calculated risks after logically considering the advantages and disadvantages of acting on a creative idea.	Brandmo, C., Panadero, E., & Hopfenbeck, T.N. (2020). Bridging classroom assessment and self-regulated learning, *Assessment in Education: Principles, Policy & Practice, 27*(4), 319-331, https://doi.org/10.1080/0969594X.2020.1803589 Lucas, B. (2016). A five-dimensional model of creativity and its assessment in schools. *Applied Measurement in Education*, *29*(4), 278–290. https://doi.org/10.1080/08957347.2016.1209206 Lucchiari, C., Sala, P. M., & Vanutelli, M. E. (2019). The effects of a cognitive pathway to promote class creative thinking. An experimental study on Italian primary school students. *Thinking Skills and Creativity*, 31, 156–166. https://doi.org/10.1016/j.tsc.2018.12.002 Runco, M. A. (2015). Meta-creativity: Being creative about creativity. *Creativity Research Journal*, *27*(3), 295-298.https://doi.org/10.1080/10400419.2015.1065134
3.Develops creative solutions	Instances in which students develops fit for purpose, novel solutions within a social context.	Cropley, D. & Cropley, A. (2016). Promoting creativity through assessment: A formative computer-

	Example 1: Student creates and shares a well-executed (elegant) product or other type of solution developed to address a community or school problem. A well-executed or elegant solution is one that is complete, well-organised and delightful. **Example 2:** Student creates a product or other type of solution that provides a new perspective on the problem. For example, students shed light on new ways of using a solution, including how to use the product to solve unrelated problems or how to extend a solution into a new direction. **Example 3**: Student engages in appropriate cooperation- they work collaboratively as needed and not necessarily all the time. **Example 4:** Student actively engages in giving and receiving feedback to improve their ideas. **Example 5: Student develops** project as an artifact of project-based learning.	assisted assessment tool for teachers. *Educational Technology*, *56*(6), 17-24. Kaufman, J. C. (2012). Counting the muses: Development of the Kaufman Domains of Creativity Scale (K-DOCS). *Psychology of Aesthetics, Creativity, and the Arts*, *6*(4), 298–308. https://doi.org/10.1037/a0029751 Lucas, B. (2016). A five-dimensional model of creativity and its assessment in schools. *Applied Measurement in Education*, *29*(4), 278–290. https://doi.org/10.1080/08957347.2016.1209206 Plucker, J. A., Beghetto, R. A., & Dow, G. T. (2004). Why isn't creativity more important to educational psychologists? Potentials, pitfalls, and future directions in creativity research. *Educational Psychologist*, *39*(2), 83–96. https://doi.org/10.1207/s15326985ep3902_1 Runco, M. A., & Jaeger, G. J. (2012). The standard definition of creativity. *Creativity Research Journal*, *24*(1), 92–96. https://doi.org/10.1080/10400419.2012.650092

Appendix 6: Curiosity teacher-focused video codes

Number of curiosity teacher-focused video codes: 7

Video observation: Curiosity teacher-focused codes			
Code	**Definitions**	**References**	**Link to student-focused curiosity codes in Appendix 4**
1.Models curiosity	Teacher models curiosity **Example 1:** Teacher uses the phrase "I am curious about..." **Example 2**: Teachers uses the phrase "I wonder…" **Example 3**: Teacher expresses what made them curious when learning about the topic and what they did to quench their curiosity. **Example 3**: Teacher expresses lingering curiosities about the topic. Teacher encourages 'Forward Curiosity' which is driven by uncertainty and a lack of knowledge, focuses on 'what' questions, aims at knowledge acquisition and is relatively superficial. **Example 1**: What is the oldest religion? **Example 2**: Where do butterflies live? **Example 3**: How do bees pollinate?	Jirout, J. J. (2020). Supporting early scientific thinking through curiosity. *Frontiers in Psychology*, 11. https://doi.org/10.3389/fpsyg.2020.01717 Sher, K. B.-T., Levi-Keren, M., & Gordon, G. (2019). Priming, enabling and assessment of curiosity. *Educational Technology Research and Development*, *67*(4), 931–952. https://doi.org/10.1007/s11423-019-09665-4 Shin, D. D., & Kim, S. (2019). Homo curious: Curious or interested? *Educational Psychology Review*, 31(4), 853–874. https://doi.org/10.1007/s10648-019-09497-x	Information gap recognition/filling
2.Identify/Fill knowledge gaps	Teacher facilitates or models strategies for 'stretching' curiosity also referred to as exploration. 'Stretching curiosity is regarded as the search for information	Markey, A., & Loewenstein, G. (2014). Curiosity. In *International*	Information gap

	and experiences.' This helps students to identify and fill their knowledge gaps. **Example 1**: Uses 'know/need to know' activities in groups or with individual students. **Example 2**: Small group tutorial sessions to increase student understanding on specified topics **Example 1**: Teacher provides examples for how to locate needed information. **Example 2**: Teacher demonstrates how to revisit what was learned in the past to help fill the new gap. Teacher develops skills on how to search for knowledge – helps close the information gap. **Example 1**: Teacher discusses/demonstrates how to search for reliable information on the internet. **Example 2**: Teacher discusses/demonstrates processes for contacting others for information. Teacher encourages self-directed exploration. Exploration could demonstrate how uncertainty engages curiosity. **Example 1**: Teacher utilizes an inquiry-based learning approach. **Example 2**: Teacher allows students to explore the best way to demonstrate what they have learned. Teacher provides opportunities for experimentation. **Example 1**: Student are given opportunities to collect data or observe to answer a question or solve a problem.	*Handbook of Emotions in Education* (pp. 228–245). Routledge/Taylor & Francis Group For Question Formulation Technique (QFT), see Rothstein, D. and Santana, L. (2011) *Make just one change: Teach students to ask their own questions.* Cambridge: Harvard Education Press. For 'prior knowledge' see Shin, D. D., & Kim, S. (2019). Homo curious: curious or interested? *Educational Psychology Review*, 31(4), 853–874. https://doi.org/10.1007/s10648-019-09497-x	recognition/filling

	Teacher provides opportunities for students to find answers themselves. **Example 1**: Ask three, then me. **Example 2**: Students given time for research and develop answers. Teacher taps into students' prior knowledge of a subject to help close the knowledge gap. **Example 1**: Elicits a list of what students have already learned about a topic. Teacher models or scaffolds question asking skills. **Example 1**: Teacher utilizes Question formulation technique (QFT). An example of this strategy can be found at https://rightquestion.org/education/		
3. Encourages empathetic exploration	Exploration could include the following IB examples of what might facilitate empathetic curiosity. **Example 1**: Exploring "the relationships between and the interconnectedness of individuals and civilisations, from local and global perspectives." **Example 2**: Exploring multilingualism, intercultural awareness and international mindedness." **Example 3:** "Exploring ideas related to making friends, problem-solving and empathy." Teacher utilizes a cooperative learning technique (e.g., the Jigsaw Classroom).	Elliot, A. (1978) *The Jigsaw Classroom*. Beverly Hills: Sage Publication. https://www.jigsaw.org/#overview Jirout, J. (2020). Supporting early scientific thinking through curiosity. *Frontiers in Psychology*, 11. https://doi.org/10.3389/fpsyg.2020.01717	Empathetic curiosity

		Jirout, J., Klahr, D. (2012) Children's scientific curiosity: In search of an operational definition of an elusive concept. *Developmental Review*, *32*(2), 125-160. http://dx.doi.org/10.1016/j.dr.2012.04.002 Kashdan, T. B., Gallagher, M. W., Silvia, P. J., Winterstein, B. P., Breen, W. E., Terhar, D., & Steger, M. F. (2009). The curiosity and exploration inventory-II: Development, factor structure, and psychometrics. *Journal of Research in Personality*, 43(6), 987–998. https://doi.org/10.1016/j.jrp.2009.04.011	
4. Encourage question-asking	Teacher encourages students asking questions. **Example 1**: Utilizes a 'Know-Need to Know' chart where students generated questions about what they need to know for an assignment. **Example 2**: Teacher verbally encourages questions during a lesson. **Example 3**: Ask three then me which encourages classmates to ask each other questions.	ACER (2021). Curiosity literature review – Framework foundations. Engel, S. (2013). The Case for Curiosity. *Educational Leadership*, 70(5), 36-40. Jirout, J. J. (2020b). Supporting early	Critical analysis & discussion

	Teacher helps students to feel safe asking questions (e.g., treating none as stupid, being receptive to questions). **Example 1**: It's good to ask questions. **Example 2**: We all learn from everyone's questions. **Example 3**: Let's brainstorm a list of questions. Teacher utilizes additional strategies other than direct instruction to allow for student agency and voice. **Example 1**: Teacher encourages students to share their thoughts. **Examples 2**: Allows students to shape their work product by providing various options. Teacher promotes alternative ideas to addressing a problem. Teacher demonstrates that there is more than one correct procedure for finding answers. This can involve asking multiple questions to the same problem rather than just asking a singular question. **Example 1**: Teacher demonstrates various ways to get to the answer of a math problem. **Example 2**: Demonstrates utilizes a brainstorming session for ideas on how one might go about finding an answer to a question or problem. **Example 3**: Teacher uses the phrase 'It might also be that…'	scientific thinking through curiosity. *Frontiers in Psychology*, 11. https://doi.org/10.3389/fpsyg.2020.01717 Whitehouse, S., Vickers-Hulse, K., & Carter, J. (2018). Curious teachers create curious learners and great historians. *Education* 3-13, 46(6), 648-660. https://doi.org/10.1080/03004279.2018.1483800	
5. Explores contradictions /surprises	Teacher encourages 'backward' curiosity. 'Backward' curiosity requires some relevant knowledge and is driven by incongruity and surprise when a prediction is found to be incorrect,	Shin, D. D., & Kim, S. (2019). Homo curious: Curious or interested? *Educational Psychology Review*, 31(4), 853–874.	Critical analysis & discussion

	focuses on 'why' questions and aims at knowledge revision. **Example 1**: Why was this prediction incorrect? **Example 2**: Why has this happened? **Example 3**: Why do people… Teacher presents instances where contradictions are present, and students are required to discuss/explain. **Example 1**: Teacher utilizes contradictions in literature and asks students to discuss why they think these contradictions exist.	https://doi.org/10.1007/s10648-019-09497-x	
6.Individualised learning	Teacher works to relate topics to students' lives. **Example 1**: Teacher connects topic to community or school issue that impacts them. **Example 2**: Teacher connects topic to something students are interested in (e.g., social media, a celebrity, etc.) Teacher adjusts scaffolding based on student abilities. **Example 1**: Teacher demonstrates how to solve a problem, then steps back allowing the student to work but helps when needed until the student becomes independent.	ACER (2021). Curiosity literature review – Framework foundations. Jirout, J., & Klahr, D. (2011). Children's question asking and curiosity: A training study. *Society for Research on Educational Effectiveness*. https://files.eric.ed.gov/fulltext/ED528504.pdf Markey, A., & Loewenstein, G. (2014). Curiosity. In *International Handbook of Emotions in Education* (pp. 228–245). Routledge/Taylor & Francis Group.	All

7. Posing problems	Teacher poses problems. **Example 1**: Teacher utilizes a problem-based learning approach (problem posed, hands-on-learning takes place where students figure out what needs to be done to come up with a viable solution which will be presented to an audience).	ACER (2021). Curiosity literature review – Framework foundations. Chase, C. C., Connolly, H., Lamnina, M., & Aleven, V. (2019). Problematizing helps! A classroom study of computer-based guidance for invention activities. *International Journal of Artificial Intelligence in Education*, *29*(2), 283-316.https://doi.org/10.1007/s40593-019-00178-y Ronfard, S., Butler, L.P., Corriveau, K.H. (2020) The questioning child. In: Lucas Payne Butler, Samuel Ronfard, Kathleen H. Corriveau (eds.) *Insights from Psychology and Education*. Cambridge: Cambridge University Press, 301-320. https://ezproxy-prd.bodleian.ox.ac.uk:2102/10.1017/9781108553803.015	Experimentation

Appendix 7: Curiosity student-focused video codes

Video observation: Curiosity student-focused codes		
Code	**Definitions**	**References**
1. Information gap recognition /filling	Student recognizes a gap in knowledge that needs to be filled. **Example 1**: Students contribute to a "Need to Know' list prompted by teacher or in a group. Students use strategies to fill identified knowledge gaps. **Example 1**: Question asking **Example 2**: Students go through a process of generating both closed and open-ended questions. Student uses open ended stems such as 'What do you think of/'How similar is.../What do you think caused ... **Example 3**: Discussions with peers **Example 4**: Looking up information **Example 5**: Comments or suggestions made to resolve knowledge gap.	Pekrun, R. (2019). The murky distinction between curiosity and interest: State of the art and future prospects. *Educational Psychology Review*, 31(4), 905-914. https://doi.org/10.1007/s10648-019-09512-1 Rothstein, D. and Santana, L. (2011) *Make just one change: Teach students to ask their own questions.* Cambridge: Harvard Education Press.
2. Empathetic curiosity	Evidence of empathetic curiosity when working with others. "Individuals who are both caring and curious have empathetic curiosity and want to know about other people and take the initiative to learn about perspectives, needs, and goals of those around them" (Nadelson et al. 2019). **Example 1**: Asks questions of others to better understand them. **Example 2**: Seeks to understand the perspectives of others.	Nadelson, L. S., Nadelson, S. G., Broyles, A., Edgar, J., Einhorn, J., Hatchett, A., Scroggins, T., Skipper, A., & Ulrich, C. (2019). Beyond the books: Teacher practices and perceptions of teaching caring and curiosity. *Journal of Curriculum and Teaching,* 8(3), 84-101. Phillips, R. (2016). Curious about others: Relational and empathetic curiosity for diverse societies. *New Formations, 88*, 123-142. https://doi.org/10.3898/NEWF.88.02.2016

3. Experimentation	Student uses experimentation to understand how things work - Possibility that learners 'enact their curiosity through experiments'. **Example 1**: Students prefer to engage in data collection to answer questions or solve problems.	Engel, S. (2011). Children's need to know: Curiosity in Schools. *Harvard Educational Review*, 81(4), 625–645. https://doi.org/10.17763/haer.81.4.h054131316473115
4. Persistence at challenging tasks	Student is persistent at challenging tasks. **Example 1**: Student continues to work at something that is challenging. **Example 2**: Student discusses challenging task and describes behaviors that reveal persistence.	Lauriola, M., Litman, J. A., Mussel, P., De Santis, R., Crowson, H. M., & Hoffman, R. R. (2015). Epistemic curiosity and self-regulation. *Personality and Individual Differences*, 83, 202–207. https://doi.org/10.1016/j.paid.2015.04.017 Szumowska, E., & Kruglanski, A. W. (2020). Curiosity as end and means. *Current Opinion in Behavioral Sciences*, 35, 35–39. https://doi.org/10.1016/j.cobeha.2020.06.008
5. Risk-taking	Evidence of exploratory behaviours. These are ways of enacting curiosity, including risk taking - "*testing new ideas, evaluating new approaches and creating.*" **Example 1**: Volunteering an answer in front of class (risk of seeming uninformed) **Example 2**: Working with unfamiliar classmates or others.	Reio, T. G., Jr. (2010). What about adolescent curiosity and risk taking? [Invited]. In J. L. DeVitis & L. Irwin-DeVitis (Eds.), *Adolescent education: A reader* (pp. 99-109). New York: Peter Lang Publishing. Adolescent Education: A Reader.
6. Critical analysis & discussion	Students develop questions and reflect on them then critically analyze and discuss experiences. **Example 1**: Student pose questions and reflect on them in relation to a historical event allowing them an "opportunity to look at events and practices of the past through the lens of their own lives." **Example 2**: Students discuss and analyze a historical narrative, play or story. **Example 3**: Students discuss and analyze options for creating a project.	Whitehouse, S., Vickers-Hulse, K., & Carter, J. (2018). Curious teachers, create curious learners and great historians. *Education* 3-13, 46(6), 648-660. https://doi.org/10.1080/03004279.2018.1483800

Appendix 8: Relevant video studies consulted

Theme 1: Video Recordings Procedures & Equipment	Center for Education Policy Research at Harvard University (2015). Best Foot Forward: A Toolkit for Fast-Forwarding Classroom Observations Using Video. See https://video-observation.torsh.co/hubfs/Downloads/Reports/Harvard_best-foot-forward-video-observation-toolkit.pdf Jewitt, C. (2012) An Introduction to Using Video for Research. National Centre for Research Methods. See https://eprints.ncrm.ac.uk/id/eprint/2259/4/NCRM_workingpaper_0312.pdf Richards, J., Altshuler, M., Sherin, Bruce L., Gamoran, M., Leatherwood, C.J. (2021) Complexities and opportunities in teachers' generation of videos from their own classrooms. *Learning Culture and Social Interaction*, 38, 100490. https://doi.org/10.1016/j.lcsi.2021.100490 Sage Research Methods Online (2014). What is multimodal Research? Carey Jewitt in conversation with Patrick Brindle.
Theme 2: Teachers' self-generation of classroom videos	Center for Education Policy Research at Harvard University (2015). Best Foot Forward: A Toolkit for Fast-Forwarding Classroom Observations Using Video. See https://video-observation.torsh.co/hubfs/Downloads/Reports/Harvard_best-foot-forward-video-observation-toolkit.pdf Richards, J., Altshuler, M., Sherin, Bruce L., Gamoran, M., Leatherwood, C.J. (2021) Complexities and opportunities in teachers' generation of videos from their own classrooms. *Learning Culture and Social Interaction*, 38, 100490. https://doi.org/10.1016/j.lcsi.2021.100490
Theme 3: Methods	Flewitt, R. (2006) Using video to investigate preschool classroom interaction: education research assumptions and methodological practices. Visual Communication, 5(1), 25–50. Stigler, J.W., Gonzales, P., Kawanaka, T., Knoll, S. and Serrano, A. (1999). The TIMSS Videotape Classroom Study: Methods and Findings from an Exploratory Research Project on Eighth-Grade Mathematics Instruction in Germany, Japan, and the United States. U.S. Department of Education. National Center for Education Statistics.
Theme 4: Analysis	Arizona State University (2016) Learning How to Look & Listen: Building Capacity for Video Based Social & Educational Research. See https://www.learninghowtolookandlisten.com. Fitzgerald, A., Hackling, M. and Dawson, V. (2013) Through the Viewfinder: Reflecting on the Collection and Analysis of Classroom Video Data. *Visual Communication*, 12(1), 52-64.

	Goldman, S. and McDermott, R. (2010) Staying the course with video analysis. In: S. Berry, R. Pea, B. Barron, R. Engle, F. Erickson, R. Goldman, R. Hall, T. Koschmann, J. Lemke, M.G. Sherin and B. Sherin (eds.) *Conducting Video Research in the Learning Sciences: Guidance on Selection, Analysis, Technology, and Ethics*.
Theme 5: Potential Concerns	Center for Education Policy Research at Harvard University (2015). Best Foot Forward: A Toolkit for Fast-Forwarding Classroom Observations Using Video. See https://video-observation.torsh.co/hubfs/Downloads/Reports/Harvard_best-foot-forward-video-observation-toolkit.pdf Sage Research Methods Online (2014). What is multimodal Research? Carey Jewitt in conversation with Patrick Brindle. Stigler, J.W., Gonzales, P., Kawanaka, T., Knoll, S. and Serrano, A. (1999). The TIMSS Videotape Classroom Study: Methods and Findings from an Exploratory Research Project on Eighth-Grade Mathematics Instruction in Germany, Japan, and the United States. U.S. Department of Education. National Center for Education Statistics.

Appendix 9. Reflections from Participants

Reflections from Teacher Participants

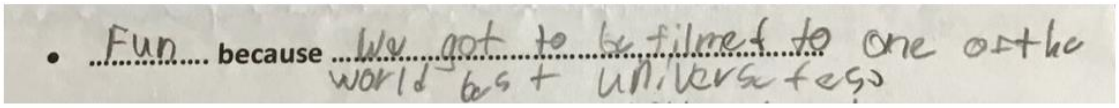
I just wanted to thank you, I really enjoyed participating in this research project so far. In fact, it's really helped me spark my creativity.... So I think it's been very helpful for all of us, not just the students, but for myself as a teacher. So thank you very much!

(Anonymous reflection from participating teacher).

Thank you, thank you. It's so wonderful to be part of research. I mean I love creativity, it means so much to me. I really jumped at the opportunity to be part of a research project about it. I'm a total advocate for it. It just served me in so many ways in my life, personally, academically, career-wise, emotionally. I just can't imagine anything that's more important than it in education!

(Anonymous reflection from participating teacher).

Reflections from Student Participants



What two words would you use to describe this lesson?

- **Enjoying because there was teamwork**
- **I liked the lesson because we were recorded and it felt like in a movie**

What two words would you use to describe this lesson?

- **Fun because I experienced new things while learning**
- **Happy because we recorded and that made me feel happy**