Does student-centred learning improve learning outcomes in Indian classrooms?

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MSc Education: Comparative and International Education (CIE)

Dissertation submitted to the University of Oxford in part-fulfilment of the requirements for the Degree of Master of Comparative and International Education

Trinity Term, 2015

ABSTRACT

In an effort to improve education quality in developing countries, as outlined by the EFA2015 goals, student-centred learning (SCL) has been identified as a promising avenue for pedagogical reform. The promotion of SCL, usually through teacher-training programs, has received wide support from international development agencies. Situated within a case study of the TESS-India project, the present research explores whether SCL actually improves student learning outcomes. It contributes both theoretically to the debate on SCL efficacy, as well as to the policy debate on pedagogical reform.

The research, conducted in 15 government schools in Karnataka, finds that SCL has a positive correlation with learning outcomes in primary schools but not in secondary schools. Furthermore, it finds that SCL is already a marked feature of Indian classrooms, despite the fact that teachers lack a sophisticated understanding of how SCL contributes to learning. Lastly, this research identifies a number of barriers to the successful promotion of SCL in Indian classrooms, and suggests a number of institutional, infrastructural, and intellectual reforms that might need to go hand-in-hand with pedagogical reform.

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LIST OF ABBREVIATIONS

SCL	Student-centred learning
OERs	Open educational resources
DFID	Department for International Development
UNESCO	United Nations Education, Scientific and Cultural Organisation
EFA	Education for All
DSERT	Department of State Education, Research and Training
PR	Primary researcher
RA	Research assistant
TIMSS	Trends in International Mathematics and Science Study
DSERT	Directorate of State Education, Research and Training
PCK	Pedagogical content knowledge

CHAPTER ONE: INTRODUCTION

1.1 Context

In April 2000, ten years after *Education For All by the year 2000* emerged as a global imperative, 1100 participants representing 164 countries gathered in Dakar to take stock of the progress made. The Summit established that there had been remarkable achievements in terms of increased access to education. By the end of the 1990s, developing countries as a whole had achieved net enrolment in excess of 80 per cent, with primary school enrolments rising by 82 million pupils (UNESCO, 2000, p. 13).

There was nevertheless a quality gap: achievement scores in reading, writing, and arithmetic were abysmally low (Dembélé & Miaro-II, 2003, p. 10), which resulted in children in developing countries leaving primary school with very limited grasp of basic learning skills (Dembélé & Miaro-II, 2003, p. 10; Kingdon, 2007, p. 182). Not only did these learning outcomes deter parents from investing in further education, but the nature of schools in these regions alienated students from their socio-cultural environment. This output-focused approach to education access ended up wasting more than 25% of financial resources allocated to primary education (Dembélé & Miaro-II, 2003, p. 10).

It is not surprising therefore that the Dakar summit prioritized the quality dimension in the new goal of EFA by 2015 (Ndoye, 2002). "Any policy aimed at pushing net enrolments towards 100% must also assure decent learning conditions and opportunities", argued UNESCO (2004, p. 16). In this context quality was characterized according to two principles: the first is to ensure the cognitive development of learners, while the second emphasises the role of education in nurturing the creative and emotional growth of learners and in helping them to acquire values and attitudes for responsible citizenship (UNESCO, 2004). These definitions of quality education, and the subsequent conversations concerning how to achieve it, became key factors in decisions regarding the flow of donor money aimed at reaching the EFA goals.

However, the challenge of providing quality education "where genuine learning can take place for each and every learner" (UNESCO, 2004) is a much tougher agenda than merely providing basic educational access. As UNESCO observes, true education is a set of processes and outcomes that are defined *qualitatively* (UNESCO, 2004, p. 23, emphasis added); quality, unlike desks and textbooks, cannot simply be bought and counted.

The existing literature on school effectiveness indicates that the role of the teacher is of primary importance in ensuring education quality (Coleman, et al., 1966; Wang & Walberg, 1994; Crahay, 2000). As a result, donor agencies, including the World Bank, DFID, and UNICEF, have heavily invested in teacher training programs. Nevertheless, effective teacher training depends heavily on the choice of pedagogy, defined as "any conscious activity by one person designed to enhance the learning of another" (Watkins & Mortimore, 1999, p. 3). Pedagogical reform has become an important goal in teacher training. Two important questions therefore emerge: 1) Which pedagogies characterize quality education, and 2) What are the skills, beliefs, attitudes, and knowledge domains that teachers need in order to use these pedagogies successfully?

Current literature appears more confident on the pedagogies that characterize poor quality education, than high quality education. Looking at the teaching practices that exist in regions with poor learning outcomes reveal a number of commonalities. Such practices can be described in a nutshell as being

rigid, chalk-and-talk, teacher centred/dominated, and lecture-driven. This pedagogy is the norm in the vast majority of Sub-Saharan Africa and India and places students in a passive role. Activities in class are limited to memorizing facts and reciting them back to the teacher, which is further reflected in classroom assessment (Clarke, 2003; Dembélé & Miaro-II, 2003; Saigal, 2012).

Since such teacher centred pedagogies appear to be prevalent within low-quality education systems, an intuitive logic seems to hold that the opposite pedagogies will deliver the opposite results. Dembele and Miaro-II therefore refer to a "*principled* agreement" (2003, pg 11, emphasis added, note that this is not an "evidenced agreement"[1]) between international development agencies on what practices are desirable; namely participatory, interactive, child-centred, exploratory pedagogy characterized by cooperative learning and inquiry, with a view to fostering conceptual understanding, critical thinking, and problem solving skills. These practices or ideals, generally termed 'student-centred learning' (SCL) have formed the basis of efforts in pedagogical renewal (Westbrook J, 2013, p. 2013), particularly within developing countries, in an attempt to meet the EFA goals (Anderson, 2002; Kotta, 1986; Tabulawa, 1997; Storeng, 2001; van Graan, 2003; O'Sullivan, 2004; Saigal, 2012; Clarke, 2003). They are considered an effective antidote to the prevalence of teacher-centred didactic classroom practices, which allegedly support teacher dominance over passive learners and lead to the stifling of critical and creative thinking (Rowell & Prophet, 1990; Heyneman, 1984; Rowell P. , 1995; Dove, 1986; Jessop & Penney, 1998).

Even when well-planned, however, the implementation of SCL has not always been successful. Evidence suggests that a wide gap exists between the expected goals and actual progress achieved in classrooms (Chrisholm & Leyendecker, 2008; Dembele & Lefoka, 2007; The World Bank, 2008). According to UNESCO most attempts to institutionalize SCL in schools and teacher-training institutions have produced inconclusive results (2004, p. 152).

Considering that international development agencies invest millions of dollars into pedagogical reform, there is a pressing need to better understand the relationship between SCL and student learning outcomes both cognitive and behavioural. There are two broad assumptions that these international development agencies make. The first is that SCL is currently a weak feature of the educational systems in developing countries. And the second is that by investing in interventions designed to increase the prevalence of SCL in developing countries, the learning outcomes in these countries will ultimately improve.

This study investigates these assumptions. It focuses on a DFID sponsored initiative aimed at training Indian teachers to facilitate SCL. The project, TESS-India, implemented by the Open University (UK) has developed teacher training online educational resources (OERs) with the purpose of training teachers to use activities commonly associated with SCL. In the coming months it plans to disseminate these OERs across seven states in India.

[1] 'Principled' refers to agreements that are ideologically driven, whereas 'evidenced' refers to agreements that are shown to have worked.

1.2 Research aims and objectives

The objective of this study is to test some of the assumptions made by TESS-India, which reflect those made by international development agencies more broadly. In doing so, this study has a dual purpose. The first is to contribute theoretically to the debates on the efficacy of SCL in improving student learning outcomes. The second is to contribute to more policy-orientated discussions relating to pedagogical renewal, and its role in promoting quality education in developing countries.

With these aims in mind, my research question is –

> Does student-centred learning improve learning outcomes in Indian classrooms?

By 'student-centred learning' I am referring to TESS-India's operationalization of the term, which consists of ten classroom activities; group work, pair work, feedback, drama, stories, collecting materials from outside the classroom to use inside the classroom, teachers asking questions, students asking questions, teachers listening to ideas, and students sharing ideas. By 'learning outcomes' I am referring to both cognitive outcomes, e.g. a mathematical problem solving task, and behavioural outcomes, e.g. the ability to work in a group.

In testing the assumptions made by TESS-India two sub-questions are also raised which will be pertinent to investigating the efficacy of this approach to pedagogical renewal –

1) What is the current state of pedagogy in Indian classrooms?

2) How does teachers' understanding of SCL influence classroom practices?

1.3 Dissertation outline

The dissertation is organised as follows. In Chapter 2 I outline the current literature on SCL and in particular look at the challenges of promoting SCL in India and other developing contexts. In Chapter 3 I present the methodology of the data collection and analysis, drawing particular attention to the value of a mixed-methods approach when researching education quality. In Chapter 4 I detail the findings of the study, presenting both descriptive and correlational analysis. In Chapter 5 I discuss the explanations and implications of these findings, with reference to the current literature. I conclude by discussing how these findings contribute to debates on the efficacy of SCL as well as current approaches to pedagogical renewal.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter is divided into four sections. The first section situates this study in the context of the Indian educational system, examining current pedagogical norms and identifying the actors and challenges involved in promoting student-centred learning (SCL). The second section introduces TESS-India as a case-study for this research, describes its approach, and discusses some of the theoretical and methodological benefits of situating this study within the remits of such a project. The third section takes a closer look at SCL, its theoretical underpinnings, how it has been operationalised[2] in the literature, and its efficacy in promoting learning outcomes. This chapter ends with a brief summary and outline of the academic contributions this study hopes to make.

2.2 The Indian context

2.2.1 Teacher training and pedagogy in India

India is a prime focus of the EFA goals. While it has made sound progress in enrolment rates[3] the quality of education has yet to reflect this. A survey of learning achievement in 2006 found that 47% of children who were in school at grade 5 could not read a story text at grade 2 level of difficulty. Similarly, in arithmetic nearly 55% of grade 5 and nearly 25% of grade 8 children could not solve a simple division problem (Kingdon, 2007, p. 180). These findings were corroborated by the 2009 PISA study which ranked India as 71 out of 73 nations in science, mathematics, and literacy (Chhapia, 2012).

Since the mid-2000s educational reform efforts in India have deepened the focus on issues of schooling quality as a result of low learning outcomes. These efforts have primarily concerned themselves with challenging and redefining traditional curriculum and teaching methods, moving them toward a constructivist approach and a focus on children's conceptual learning (NCF, 2005; NCFTE, 2009; RtE, 2009). In 2009 the passage of the Right to Education Act made it mandatory for the entire school system to adopt and implement curricular and pedagogic reform along this orientation. Teachers have been repositioned from 'deliverers' of syllabus material to becoming active and reflective, professional practitioners. It has necessitated aligning teacher professional development toward preparing and supporting teachers in adapting their everyday pedagogic practice (Saigal, 2012, p. 1009).

This marks a change from the teacher training practices of the 1980s and 1990s. At that time teacher training followed a 'cascade' transmission of knowledge approach, in which 'knowledge' was assumed to be a given, independent of context or experience, and easily transferrable (Saigal, 2012, p. 1010). Teachers were positioned as recipients of knowledge, rather than professionals who were co-constructing and negotiating knowledge about their teaching practices (Saigal, 2012, p. 1010). This

[2] By operationalised is meant: To define a concept in such a way that it can be practically measured.
[3] The 2006 ACER survey (Pratham, 2007) estimated that 93% of all elementary-school age children (6-14 years old) were enrolled in school.

approach to teacher training is both a cause and a result of pedagogical norms in Indian classrooms which are characterised by rote and repetition (Clarke, 2003, p. 27). A report by the National Council of Educational Research and Training (NCERT) found that lectures were the default way of teaching in nine separate studies of Indian classrooms. Classes were invariably large, resources scarce, and training misaligned to these contexts. Teachers lectured didactically without any interaction, often for 98% of the time, telling the students the content, reading verbatim from the textbook or putting what was to be learnt on the board for students to copy or to recite (NCERT, 2011, p. 57). According to Shotton (1998, p. 6) the lack of pedagogical development in India has resulted in the floundering of many Indian educational initiatives. The archaic model of schooling, he argues, has little relevance or attraction to the mass of people in India who avoid formal schooling as a result.

A number of authors, most notably Clarke (2003), ascribe the style of pedagogy found across India to cultural constructs which represent a broader meaning system. The first construct Clarke identifies is a shared holistic worldview that supports the acceptance of regulation (Shweder, 1991; Marriott, 1990). In holism, individuals are not autonomous but instead are governed by the rules of interdependence which increases the ease of being regulated and regulating (Shweder, 1991, p. 154). Second is the concept of instruction as duty; an imperative to do what must be done regardless of what is felt (Shweder, 1991, p. 166). The third is a social framework that is defined by structural and qualitative hierarchy (Roland, 1988). This applies to the teacher-structural hierarchy in terms of the teacher being more knowledgeable than the student. A fourth cultural construct is that knowledge is collectively accumulated, attested and transferred (Derne, 1995; Kurtz, 1992; Kakar, 1979). In short, an individual's decisions are often constructed by the choices made by the community rather than by individual experience and perception. In this process an individual constructing his or her knowledge becomes less significant (Clarke, 2003, p. 29).

2.2.2 Donor involvement in Indian education

The failing in educational quality is a shared concern of the Indian government and international development partners. Teacher education in India has been identified as an area in particular need of reform. In April 2015 the World Bank released a program appraisal document on a proposed credit of US$250 million for enhancing teacher effectiveness in Bihar. Within this document the World Bank states that teacher enhancement "cannot be achieved through traditional modes of teacher training" (2015, p. 4). This commitment to new modes of teacher training is also reflected in DFID's education priorities. In their 2010-2015 education strategy document (DFID, 2010) they reaffirmed their commitment to the EFA goals, identifying teachers and teaching as a priority for achieving quality education. In line with this commitment they invested £10 million in the design of inter-active teacher materials for elementary and secondary schools (TESS-India) with the aim of a) motivating teachers, and b) "shifting rote learning towards more interactive teaching practices" (DFID, 2012, p. 1).

UNICEF similarly notes that:

> *"The alarming state of Teacher Education in [India] is reflected in the fact that, in recent years, the majority of graduates that have appeared for the Teacher Eligibility Test (TET) have failed to demonstrate even the most basic knowledge base expected from a teacher. This is not to mention the vision, skills and values necessary for the kind of classroom envisioned by progressive policy documents, but which for the most part are not adequately addressed by teacher training programmes."* (UNICEF, 2015)

As a result UNICEF took the decision to streamline and re-conceive a more targeted involvement in teacher education. Part of their involvement included the development of training programmes that use "constructivist methodologies that enable teachers to reflect on their beliefs, attitudes and classroom experience." What these examples illustrate is not only the importance placed on teacher training by donor agencies, but also a specific type of teacher training, namely non-traditional, constructivist and student-centred.

This is reflective of what Vavrus refers to as a "surge of interest" in teacher education among international development organizations, especially among those working in countries where teacher-centred pedagogy prevails (Vavrus, 2009, p. 304). According to Mulkeen et al., "teachers are increasingly required to employ constructivist teaching approaches, a shift in the teaching and learning paradigm that will require that teachers learn a much more complex and varied repertoire of teaching skills than has been necessary in the past" (2007, pp. 26-27). Some have speculated that this trend reflects the rise of neo-liberalism and the particular role which it assigns to individual autonomy within a market system (Tabulawa, 2003, p. 18). SCL, with its reputation for instilling civic and democratic values (Omoeva, 2012, p. 35), and a particular emphasis on classroom equality, freedom of speech, and debate, is ideologically congruent with international agencies and donor countries (O'Neill & McMahon, 2015). Such critics draw attention to a political, rather than a pedagogical rationale for the growing interest in SCL (Vavrus, 2009, p. 304). Donor agencies, they argue, may not always be motivated by considerations of cultural appropriateness.

2.2.3 Implementing student-centred learning in India

A number of authors have noted that considerations of cultural appropriateness, such as those outlined by Clarke (2003), pose barriers to success for SCL. For instance, Tabulawa's (1997) study in Botswana explained the difficulty concerning teachers' assumptions about the nature of knowledge and how it ought to be transmitted, their perceptions of students, and their aims of schooling. These assumptions, Tabulawa argued, are incongruent with the basic tenets of SCL; taking these tenets for granted when trying to change classroom practices can lead to disappointing results. Rowell (1995) conducted research during a workshop with Namibian educators and his findings were very similar to Tabulawas. Although the workshop participants were generally educated to a degree level, they experienced significant difficulties in attempting to adopt a constructivist view of knowledge. They tended to view knowledge as fixed, objective and detached from the learner and believed that it was the teachers' function to transmit this knowledge to the children, usually through rote learning techniques.

When teachers are required to engage in SCL within a culture that does not support its most basic principles they tend to perform the outward mechanisms of the practice without the underlying principle being observed (Westbrook J, 2013, p. 23). For example, when Clarke (2003) explored the impact of an in-service teacher training program in Karnataka, India, which was designed to promote a more active, student-centred pedagogy, she found that the role of hierarchy was difficult to overcome. While questions were asked, only teachers asked them, and responded to students' answers by telling them whether it was correct or incorrect. The interaction implied the importance of teachers' authority and command over all valid knowledge (Clarke, 2003, p. 36). Similarly in Ethiopia, Barrow et al. noted that even in some classrooms where students were seated in groups and where some group work occurred, students were still often only interacting with the teacher or what the teacher had written on the chalk board (2007, p. 24).

The implication of these observations is twofold: 1) Pedagogical renewal must take into consideration the cultural norms relating to child-adult interactions and knowledge. And 2) evaluations of SCL efficacy must investigate whether the underlying principles are being observed, as opposed to simply the outward mechanisms. This highlights the need for a qualitative understanding of what is happening in the classroom.

2.3 Case Study: TESS-India

The World Bank, DFID, and UNICEF have all directed significant funding into improving the quality of Indian education through constructivist approaches to teacher-training. India therefore serves as a critical case in which to understand the value of donor decisions to further the EFA goals through SCL. This study, which investigates the relationship between SCL and learning outcomes, is situated within one such donor sponsored initiative: TESS-India.

TESS-India is reflective of a broad range of projects designed to promote SCL. In order for this research to offer a valuable critique it must be aligned to TESS-India's aims. For this reason, this study will investigate the efficacy of SCL as it is understood by TESS-India. In doing so this study hopes to contribute to broader conversations regarding 1) effective pedagogy and 2) effective approaches to pedagogical renewal. The following section reviews TESS-India's conceptual and operational understanding of SCL, as well as the assumptions implicit within TESS-India's approach.

2.3.1 Outline of the TESS-India Project

TESS-India is a project funded by DFID and led by The Open University (UK). It is working towards improving Indian education quality by focussing on the professional development of teachers through the provision of open educational resources (OERs). The goal of TESS-India is "to encourage student-centric, active teaching and learning pedagogies at both elementary and secondary school levels across India". Their expressed belief is that "participatory teaching and learning practices are crucial to an enhanced classroom experience" (TESS-India, 2015). A desired output of the project is the increase of SCL strategies being practiced in schools, and improved teacher knowledge, attitude, and approach to participatory teaching and learning. At the time this research was conducted TESS-India had not yet launched the OERs.

TESS-India operationalises SCL in the form of "ten key resources" which apply to all subjects and levels. These ten resources (detailed in Appendix 2.1) include: Group work, pair work, teacher asking questions, student asking questions, teacher listening to ideas, student sharing ideas, collecting materials, drama, stories, and feedback. According to TESS-India they should be understood both as activities, e.g. group work, feedback, etc., and aims, e.g. students working through new skills, or helping students to be more aware of their performance. An enhanced classroom experience requires both the activities and their aims to be met.

2.3.2 Assumptions of the TESS-India log-frame

Implicit within TESS-India's approach are three key assumptions which this study aims to test. They are:

1) SCL, as operationalised according to TESS-India's ten key resources, is currently not a marked feature of Indian classrooms.

2) Even when teachers use SCL, as operationalised according to TESS-India's ten key resources, they lack a sophisticated understanding of the relationship between SCL and student learning.

3) By investing in interventions designed to increase the prevalence of SCL in India, the learning outcomes in India will ultimately improve.

Testing these assumptions will allow this study to comment on the likelihood that TESS-India will contribute to the EFA goals. In doing so, this study also contributes more broadly to a theoretical debate on whether SCL results in improved student learning outcomes, and a policy-oriented debate on how donor-agencies should improve education quality.

2.4 Student-Centred Learning

In the policy rhetoric of pedagogical reform SCL is equated with modernization, development, and increased democratization in the education system (Omoeva, 2012, p. 6). In general, SCL refers to a shift in power away from the teacher as the source of knowledge (Barr & Tagg, 1995), and towards the student who constructs knowledge through experiment, experience, collaboration, and reflection. At times it is referred to as child-centred learning, learner-centred pedagogies, cooperative learning methods, experiential learning, or participatory learning. While I acknowledge that there may be subtle differences between these approaches, for the purpose of this study I will consider them all to fall under the heading of SCL.

The premise of SCL is that better learning outcomes will be achieved if the emphasis of teaching is on the student, and greater social interaction is introduced in the learning process. It is believed that through active participation in the learning process, students are able to "make sense" of the subject matter, and gain a deeper understanding of its impact on the world around them. Through engagement of all of their senses, and in the context of social interaction, students form a comprehensive picture of how each element of what they are learning fits into the framework of their previous knowledge, and thus identify where more knowledge is necessary to form a complete understanding of a given phenomenon. This deeper knowledge leads to the development of an intuitive ability to address problems, tasks, and assignments, not only in a specific subject but also more generally (Omoeva, 2012, p. 70).

2.4.1 Theoretical underpinnings of student-centred learning

SCL has been strongly influenced by the writings of John Dewey. Dewey argued that education and learning are social and interactive processes and thus the school itself is a social institution through which social reform can and should take place (Dewey, 1916). He believed that students thrive in an environment where they are allowed to experience and interact with the curriculum and also that all

students should have the opportunity to take part in their own learning (Dewey, Experience and Education, 1938). Furthermore, education must use the child's capacities and interests as a starting point and continuous reference framework to establish continuity of learning. The teacher is not there to impose ideas or form habits, but rather to create the learning environment for the child and to assist the child in engaging with outside influences and responding to them (Dewey, 1938, p. 70). Education is therefore, by Dewey's definition, student-centred, focused on the creative and learning potential of the child, and rejecting uniformity in any aspect, be it curriculum, teaching, or grading.

Dewey's theory of learning corresponds in many ways to theories of constructivism, which were built on the works of the Swiss psychologist Jean Piaget (Montagnero & Maurice-Naville, 1997). Constructivism is a theory of knowledge which argues that knowledge and meaning are generated from an interaction between experiences and ideas. This is in contrast to an understanding of knowledge as being 'fixed' and able to be passed down from teacher to student through didactic teaching methods which require the student to passively absorb and retain what is taught. Since, according to Piaget, intelligence develops in stages through the construction of mental structures between the subject and the object, education is most effective when it stimulates the development of natural intelligence. Learning environments should therefore be conducive to experimentation, promoting the active role of the student in constructing their reality.

It is important to note that constructivism is not a particular pedagogy. While SCL draws from theories of constructivism, constructivism does not necessarily imply SCL. Rather constructivism is a theory describing how learning happens, regardless of whether that learning happens through the experience of a lecture, or through the experience of a group project.

2.4.2 Operationalising student-centred learning

Despite its popularity, the literature on SCL remains poorly consolidated. This is because SCL is not a fixed package of instructional practices, but rather an umbrella term for methods that are designed to generate student participation in her own learning (Omoeva, 2012, p. 64). Hopkins (2002) encapsulates the issue well when he states that "there are many concepts in education that generate passionate support, but, in practice, lack operational clarity. Child-centred learning is one of these concepts" (Hopkins, 2002, p. 280).

A substantial but by no means exhaustive list of the ways in which SCL has been operationalised can be found in Appendix 2. It ranges from "an increased sense of autonomy" (Lea, Stephenson, & Troy, 2003, p. 322) to students inventing their own problem-solving strategies (Bransford, Brown, & Cocking, 2004; Megahed, Ginsburg, Abdellah, & Zohry, 2008) to collaboration (Veenam, Denessen, van den Akker, & van der Rijt, 2005; Omoeva, 2012; Westbrook J, 2013) and to physical movement (Burnard, 1989; Omoeva, 2012).

There are two important considerations that can be drawn from the diversity of ways SCL has been operationalised. The first is the relative futility of research that discusses or evaluates the merits of SCL without detailed description of *how* their study has operationalised it. SCL is not a fixed set of classroom practices. It is better understood as a culture, value-system, or attitude that guides the way in which activities and interactions take place in the classroom.

This relates to the second consideration: Since SCL is not simply about *what* activities are conducted but rather *how* and *why* they are conducted, how might we measure less tangible indicators? Many interventions assume that student engagement in certain activities, such as group work, will create the appropriate classroom culture; that if an activity like group work takes place, then SCL must be happening. The belief that learning occurs through experience which constructs knowledge should not imply that the same activities (e.g. group work) will facilitate the same universal experiences, e.g. feeling valued, empowered, equal, engaged, autonomous etc. Studies which focus on the performance of activities without trying to understand what the participants understand by these activities often draw inconclusive results.

2.4.3 Is student-centred learning quality learning?

The evidence as to whether SCL improves the cognitive or behavioural development of learners is inconclusive and lacks rigorous research. Evidence can, for the most part be divided into two categories; small scale intervention, and large quantitative analysis. Smaller case studies of targeted interventions where specific programs and practices are evaluated in detail claim to show positive effects on learning. However, these studies tend to provide few generalizable or repeatable lessons (Darling-Hammond, et al., 2008). Quantitative studies that use observational data from international achievement studies fail to correct for the highly non-random nature of the sample, undermining the validity of the causal analysis (Omoeva, 2012). Furthermore, they struggle to find any evidence of a relationship between classroom methods and achievement outcomes. The following section provides an overview of studies investigating the effectiveness of SCL, and serves to illustrate the inconclusive nature of the evidence.

Johnson, Johnson, and Stanne (2000) carried out a meta-analysis that examines the effects of SCL. They identified ten stand-alone programs in cooperative learning that were designed and implemented in the United States between the 1960s and 1980s. Using a total of 158 studies they were able to estimate the separate effects for each program. The results of this meta-analysis provide evidence implying that more conceptual approaches to cooperative learning may produce higher achievement than the direct methods. It was found that most of the cooperative learning strategies had statistically significant positive effects on student learning, in some cases as large as 0.83 standard deviations, when compared to competitive methods, and 1.03 standard deviations when compared to individualistic methods.

Sammons, Hillman, and Mortimore (1995) however, conducted a review of school effectiveness studies in the USA and found no evidence to support the view that any one particular teaching style is more effective than any other. Instead they suggest that teaching quality, regardless of style, is characterized by two factors. The first is a concentration on teaching and learning, which includes the maximization of learning time, an academic emphasis, and a focus on achievement. The second is purposeful teaching, which is defined as efficient organisation, clarity of purpose, structured lessons, and adaptive practice. Both of these factors could be qualities of either teacher-centred or student-centred learning. They draw further attention to the methodological difficulties of reviewing teaching style. The authors point to Mortimore et al's analysis of observations regarding primary school teachers which indicated that teacher behaviour was too complex and varied for the application of simple descriptions of teaching style or approach; "teachers could not validly be divided into a number of categories on the basis of difference in teaching style" (1988, p. 81).

A number of studies focus on specific activities associated with SCL, e.g. group work. Nanyonjo (2007), in an analysis of factors which influenced achievement for Grade Six students in Uganda, during which she used data from the National Assessment of Progress in Education (NAPE), found that group and pair work were positively correlated with student achievements in Mathematics and English. The students of teachers who reported using group work more frequently had higher scores than those who did not. In mathematics, for example, the mean test score for pupils who worked in groups every day was 28.39 compared to 19.71 for those who worked in groups none of the time. The trend was the same for English, with a mean score for working in groups being 28.04 compared to 22.94 for those who worked in groups none of the time. However details regarding the facilitation of group work by the teacher, and the inter-group dynamics were not included in the study.

Conversely, Ross (1995) in a study of cooperative learning groups in a Grade 7 mathematics class cites a number of empirical studies which point to the classroom inequalities generated by group work. Dale (1993) observed that students who were perceived to have weak task-relevant skills were marginalized by their peers in a co-authoring activity. King (1993) found that when low ability students were assigned leadership positions, their roles were usurped by more able group members. Moreover, the dominance of cooperative group work by more capable students is particularly strong when the goal is to produce a single group product (Matthews, 1992). In these circumstances, students who feel their offerings are of little value respond by withdrawing from the task (Karau & Williams, 1993). Importantly, it was the quality not the frequency of group work that made a difference (Moust, Schmidt, DeVolder, Belien, & DeGrave, 1987). If group interactions indicated that students were friendly towards one another, helpful, collaborative, and showed concern for the needs of others, high student participation was associated with positive outcomes. But if peer concern was low, high participation rates had a negative effect (Battistich, Solomon, & Delucchi, 1994).

The importance of the qualitative nature of SCL is again emphasised in regards to asking questions in the classroom, another activity closely associated with SCL. In Westbrook et al.'s review of studies relating to teaching practices in developing countries, it was found that the effective use of questioning and response was reported in 10 studies in a range of settings (2013, p. 56). Both Nannyojo (2007) and Aslam and Kingdon (2011) found that involving students via questioning correlated to higher student scores. However the effects were greatest when teachers gave children time to speak, did not interrupt, and listened to their opinions (Sharma, 2013). When student responses were choral, seen as cued elicitations, requiring single word answers, "no learning" took place (Hardman, Abd-Kadir, & Tibuhinda, 2012, p. 828).

A number of larger scale, quantitative studies also produce inconclusive results. Omoeva (2012) examined the relationship in Kazakhstan between the use of student-centred instructional methods in teaching mathematics and science, and the achievement of fourth graders in these subjects. The measures of the student-centred instructional methods were drawn from student surveys administered as part of the 2007 Trends in International Mathematics and Science Study (TIMSS), with the TIMSS test scores serving as measures of student achievement. The quantitative analysis found that student-centred instructional methods generally showed no statistically significant relationship with student achievement.

Schwerdt and Wuppermann (2011) also used 2003 TIMSS data to explore the effect of lecture-style approaches in US schools relative to teaching based on in-class problem solving. They found that a 10 percentage point shift from problem solving to lecture study presentation resulted in an increase in student achievement of about 1% of a standard deviation. Therefore they did not find any evidence that the high share of total teaching time devoted to traditional lecture style teaching in science and

mathematics instruction in US middle schools had detrimental effects on student achievement. Their findings implied that simply changing the teaching method from lecture style presentation to problem solving without concern for how the methods are implemented has little potential for raising overall achievement levels.

Bietenbeck (2014) however, disagrees. She uses TIMSS data to show that traditional (teacher-centred) and modern (student-centred) teaching practices promote different cognitive skills in students. In particular, traditional teaching practices increase students' factual knowledge and their competency in solving routine problems, but have no significant effect on their reasoning skills (2014, p. 1). Conversely, the impact of modern teaching on students' factual knowledge and on their routine problem-solving skills was close to zero, while its estimated impact on reasoning was positive and significant. Bietenbeck argues that the positive effect of modern teaching on reasoning skills is masked by the overall test score regression because standardized tests, both in TIMSS and elsewhere, contain relatively few questions measuring these skills (2014, p. 2).

The review of the literature thus far has concentrated on the effects of SCL on cognitive abilities, most commonly mathematics and science scores. There is evidence to suggest however, that the value of SCL lies in the behavioural domain (Cornelius-White, 2007). It may for example, enhance students' ability to address problems related to their daily lives and cope with challenges not related to their academic performance (Omoeva, 2012, p. 73). While it is difficult to find substantial data on these socio-emotional influences, qualitative observations point to several non-academic outcomes, such as greater self-confidence, increased motivation, reduced fear of the teachers and exams, improved student-teacher relations, and better cooperation among students (NCERT, 2011). The challenge of measuring these outcomes remains a barrier to a complete understanding of the value of SCL.

Considering the inconclusive evidence for the relationship between SCL and learning outcomes, further research needs to be conducted in order to determine whether this type of pedagogical reform is conducive to meeting the EFA goals. Research which hopes to offer clarity in this area will need to fulfil three criteria:

1) Clearly conceptualize how SCL has operationalised
2) Consider the qualitative elements of what is happening within the classroom
3) Be concerned with both cognitive and behavioural learning outcomes

As will be outlined in the following chapter, the present study fulfils these three criteria.

2.5 Summary and contribution

This chapter has outlined the poor state of pedagogy in India which has incentivised donor agencies to make investments in pedagogical reform. While these programs have identified SCL as a promising avenue, this chapter questions whether a) SCL actually contributes to improved student learning outcomes, and b) whether SCL is appropriate for the Indian cultural context. In exploring these two questions, this research situates itself within a study of TESS-India, a DFID sponsored project aimed at encouraging SCL within Indian classrooms.

The present study aims to make a number of theoretical contributions to the academic literature on SCL as well as contribute to policy debates on the efficacy and implementation of pedagogical

reform. The first is a general exploration of current teaching styles within Indian classrooms, thus investigating the claims of didactic, lecture style approaches that are so often described in the literature. The second is to investigate teachers' understanding of the relationship between SCL and learning outcomes, to offer qualitative data on the experiences of teachers as they engage with this teaching style, and to explore how culture and beliefs are likely to impact new pedagogical reforms. The third is to investigate the relationship between SCL and both cognitive and behavioural learning outcomes, in an attempt to better understand the potential of this teaching style to improve quality education.

The next chapter will outline the methodological approach to this study.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

The present research is an explorative study of the relationship between SCL and learning outcomes. It aims to comment upon the decisions of many donor agencies to promote, at great expense, SCL in developing countries. It uses the case-study of the TESS-India project in Karnataka, a DFID sponsored development initiative which is representative of many of the projects in question. TESS-India aims to promote SCL in Indian government schools through open educational teacher training resources, and in doing so makes three assumptions:

1) SCL is currently not a marked feature of Indian classrooms.

2) Even when teachers use SCL they lack a sophisticated understanding of how SCL promotes learning.

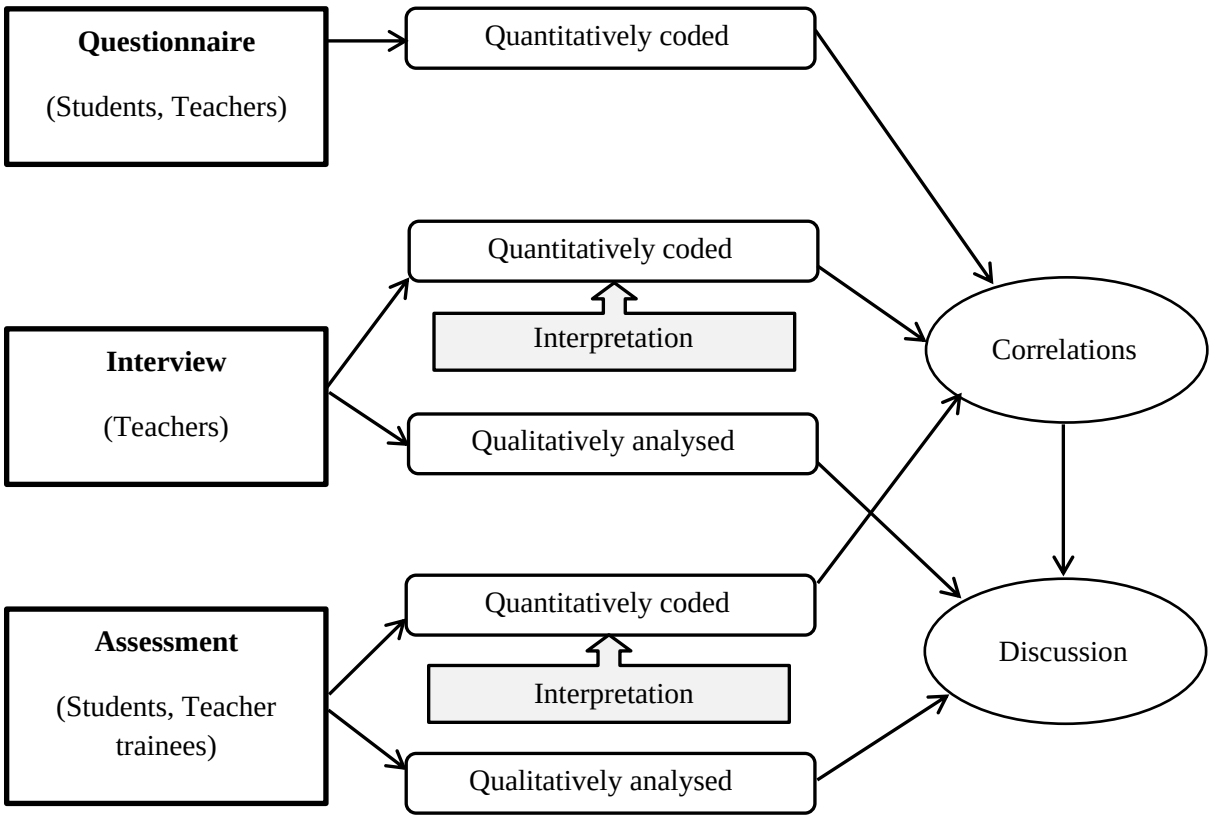
3) Promoting SCL improves student learning outcomes.

By testing the validity of these assumptions this study will not only give an indication as to the potential of TESS-India in meeting its objectives, but will also contribute more broadly to theoretical understandings of the effectiveness of SCL and to policy-orientated debates regarding the implementation and effectiveness of pedagogical reform.

This study uses a mixed methods approach. While quantitative tools, such as questionnaires, are used to gain a broad comparative overview of current teaching practices and understandings across 15 schools and 40 classrooms, qualitative observations and analysis are used to contextualise and interpret the quantitative data. Crucially, this study does not consider the qualitative approach to embellish superficially the "facts" of quantitative data, but rather considers it as fundamental to data interpretation. It analyses the same data sources in different ways in order to both compare and contextualise the data. In this regard, the methodological approach of this study is motivated by a perceived absence in the literature regarding the experiences of those engaged in SCL, particularly in developing countries. It is reflective of a belief, confirmed by EFA, that "true education is a set of processes and outcomes that are defined *qualitatively*" (UNESCO, 2004, p. 23), and that SCL is more than simply a routine of quantified activities.

Figure 1 below is a visual representation of the three types of research instruments that are employed in this study, the ways in which they are analysed, and how the different types of analysis interact in order to create a broad but also contextualized understanding of SCL in Karnataka classrooms.

Figure 1: Methodological approach to this study



This chapter is divided into seven parts: Gaining access, sampling procedure, pilot study, research instruments, analysis method, methodological limitations and ethical considerations.

3.2 Gaining Access

Gaining access to schools and teacher-training colleges in Karnataka was facilitated through the TESS-India project.

TESS-India employees work in conjunction with state-level education authorities and schools. In this capacity, they develop relationships with head teachers and teacher educators, which results in a strong familiarity with the educational demographics and personalities of their state.

A consideration when selecting a state in which to conduct this research was the quality of the relationship between the TESS-India employees and the state education authorities. The office in Karnataka had a particularly strong relationship with the Directorate of State Education, Research and Training (DSERT), to the extent that they shared offices in the same building. This relationship meant that the primary researcher (PR) was received as a guest of the director, who took a keen interest in

the data collected. He provided a letter addressed to each school, requesting their full cooperation. Along with a detailed description of the project, this letter was presented to each head teacher resulting in easy access to schools and colleges.

TESS-India was also able to arrange a vehicle, local driver, translators and three research assistants (RA) for the PR throughout the four week period in which the fieldwork took place.

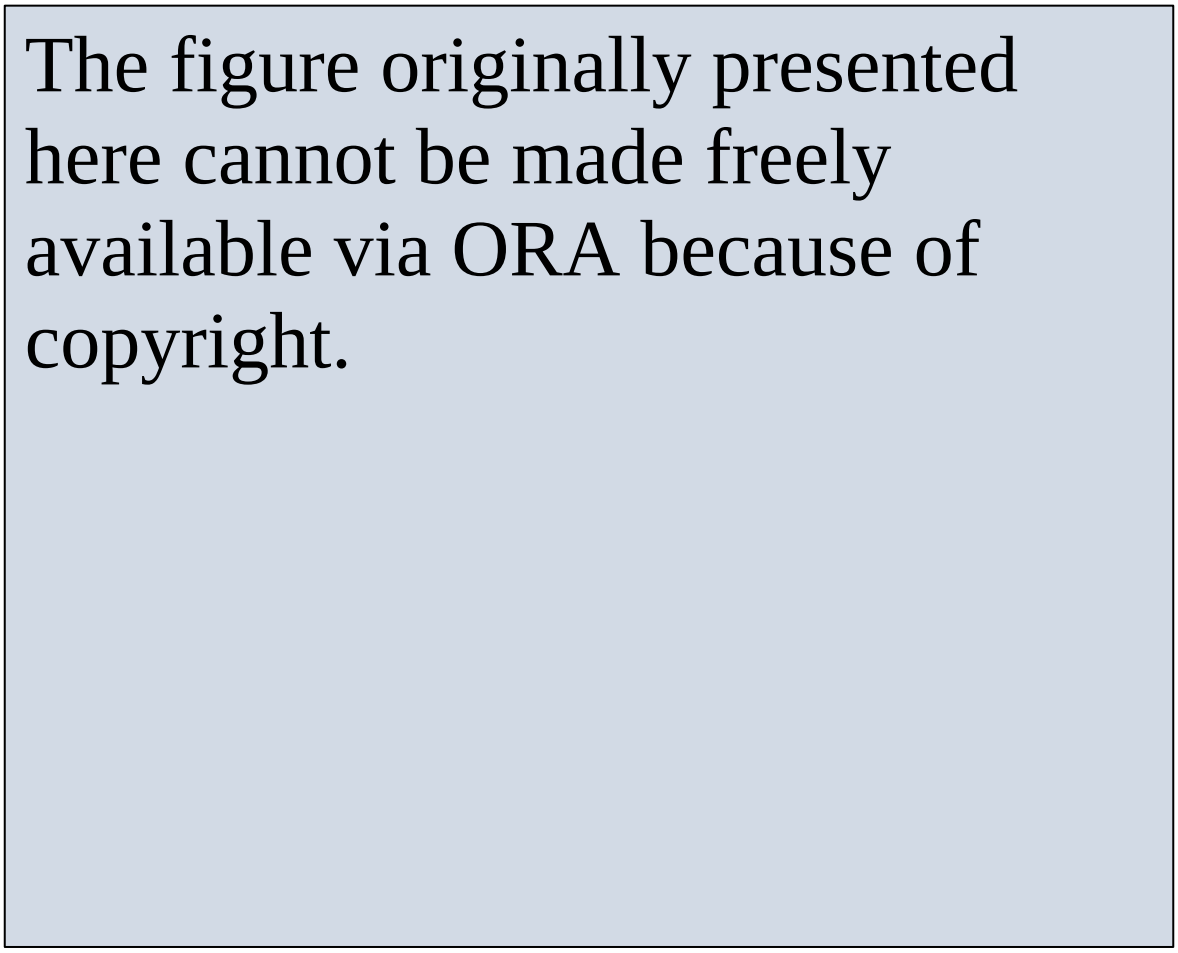
All elements of the research design, analyses, and authorship of findings were conducted solely by the PR and do not represent any of the supporting institutions' views, policies or opinions.

3.3 Sampling Procedure

3.3.1 Selecting the state and districts

Three districts were chosen within Karnataka state from which to select schools and teacher training colleges. Due to time constraints, all districts were within three hours' drive of central Bangalore. Districts were chosen according to their enrolment of children at different levels of schooling, which was used as a proxy for teacher-student ratios. Student-teacher ratios were considered to be an important aspect when considering the feasibility of student-centred activities. Bangalore South district has the highest enrolment rates of any district across all school grades, making it likely that there would a high teacher-student ratio. This was contrasted with Bangalore Rural district, and Ramanagara district, which came 30/34 and 29/34 respectively in regards to student enrolment rates (DOE, 2012).

Figure 2: Map showing the districts within Karnataka state where the study was conducted:, including Bangalore Urban, Bangalore Rural and Ramanagara



3.3.2 Selecting schools

Fifteen schools, five from each district, were selected according to a convenience sampling framework, loosely based on demographic school data in Karnataka state. In Karnataka 75% of schools are primary schools, and 75% of schools are in rural areas. Nine primary schools and six secondary schools were chosen, with seven coming from rural areas and eight from urban areas. Schools were also stratified based on infrastructure quality, which was used as a proxy for levels of poverty in the area. Seven low quality infrastructure schools and eight high quality infrastructure schools were chosen. Only schools that were managed by the department of education were included in the sample.

Three teacher training colleges were selected, one from each district. As a result of reduced government recruitment from government teacher training colleges, the intake of students was extremely low. For this reason the sampling strategy was extended to include private teacher training colleges.

Once the sampling framework was decided, it was given to the TESS-India office in Bangalore who then selected the specific schools and colleges according to the criteria. Effort was made not to select schools which regularly had visits from the DSERT or external guests. A full list of the schools and participants selected can be found in Appendix 3.

3.3.3 Selecting participants

3.3.3.1 Student participants

Where possible, at least one entire class from each Grade 4, 5 and 6 in primary schools, and each Grade 8, 9 and 10 in secondary schools was selected to fill in the activity frequency questionnaire. In a number of schools it was not possible to include all grades in the sample due to examinations. If certain classes were not available to participate, the numbers were made up through including another class from the same grade. In total 40 classes were assessed: 24 from primary schools, 16 from secondary schools. The study originally planned to recruit 100 students per school but this was often not possible due to low school enrolment, particularly in the rural areas.

Three students from each class were arbitrarily selected by the PR to participate in a test of group learning outcomes. In the case that a student did not wish to participate, another student was selected from the class by the researcher. Equal numbers of male and female students were included.

3.3.3.2 Teacher participants

Between two and four teachers from each school were invited to participate in an individual interview and to fill in a questionnaire. Each of the teachers selected taught at least one of the classes that participated, and each class had at least one of their teachers participating. Where different subjects were taught by different teachers, the teachers who had most interaction with the sample classes were prioritised.

3.3.3.3 Teacher trainee participants

From each teacher training college between two and three trainee teachers, all of whom were training to become either maths or physics teachers, were invited to participate in a mathematics problem solving assessment.

3.4 Research Instruments: Design, Use and Rationale

3.4.1 Questionnaire

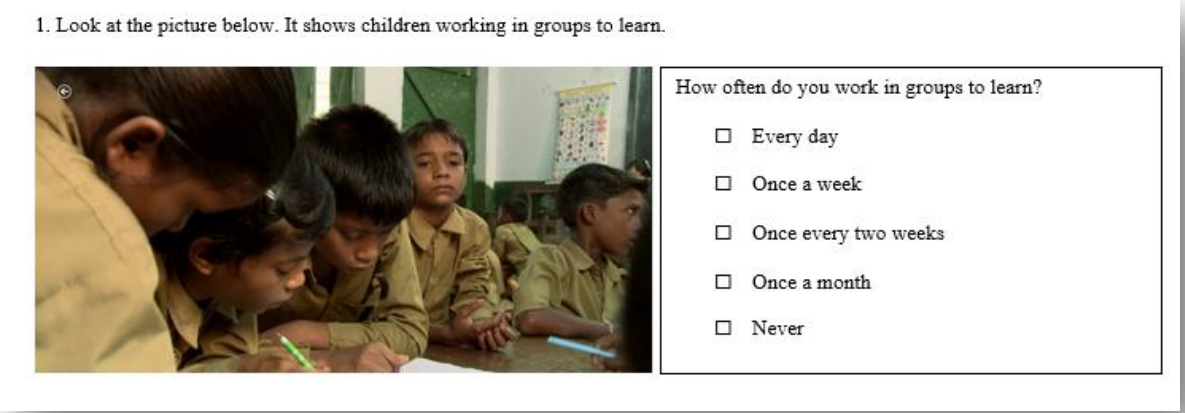
3.4.1.1. Student questionnaire

The questionnaire (Appendix 4) consisted of ten questions, each of which tested the frequency of a different student-centred activity. The student-centred activities, defined in the TESS-India

materials, included group work, pair work, students asking questions, teachers asking questions, feedback, collecting materials, listening to students ideas, stories, drama. The purpose of this questionnaire was to investigate how frequently these activities were already being experienced by the students.

For each question the student was shown a photograph of an activity occurring in a classroom, was given a brief description of that activity and then was asked how often this activity was used in their classroom. The students had a choice of five different answers: every day, once a week, once every two weeks, once a month, and never. The photographs that were included in each question were still images taken from TESS-India videos. The videos were developed to demonstrate to teachers how the activities may be carried out in a classroom context and were therefore of real Indian teachers and students working in classrooms. The photographs were included to help students visualise what was meant by the various activities.

Image 1: An example question from the primary school student frequency questionnaire

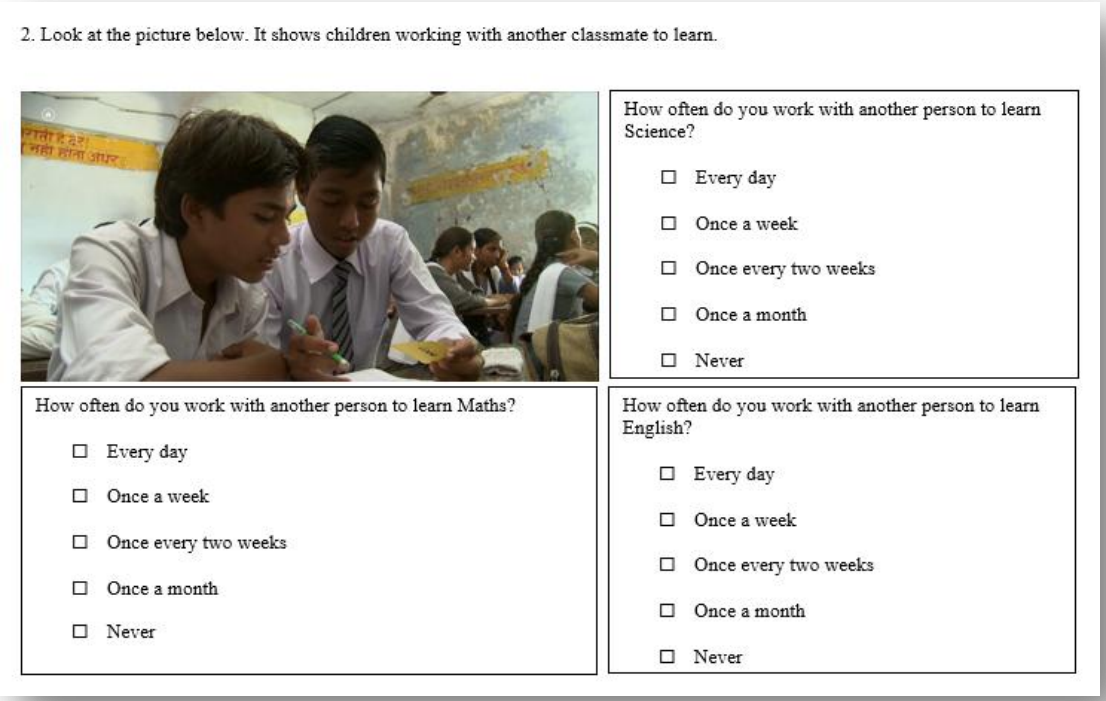


The questionnaires were introduced to the students either by the PR or RA. The purpose of the study was explained as well as its voluntary nature. For the primary school students, each question was read aloud to mitigate the effects of poor-literacy on students' answers.

Image 2: A teacher explains the questionnaire to a class of primary school students (Karnataka, India)

The questionnaire was adapted for primary school and secondary school students. The secondary school students were asked to give a separate score for the frequency of each activity in their science, maths, and English classes. This was in order to understand whether the frequency of student-centred activities was subject dependent.

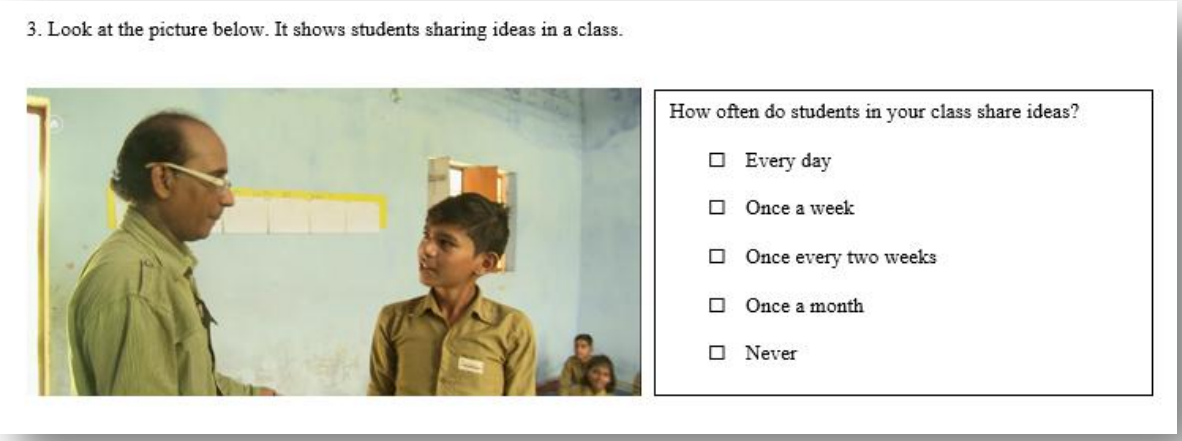
Image 3: An example question from the secondary school student frequency questionnaire



3.4.1.2 Teacher questionnaire

The teacher questionnaire matched the student questionnaire but the phrasing was changed to reflect the different positioning in the classroom, e.g. “How often do you work in groups?” was replaced by “How often do the students in your class work in groups?”

Image 4: Image showing an example question from the teacher frequency questionnaire



The purpose of the teacher questionnaire was to ascertain the frequency at which teachers believed they employed student-centred activities, and to cross-check this with student reported questionnaire data.

3.4.1.3 Questionnaire Rationale

Analysis of the questionnaires indicates how frequently student-centred activities are occurring in the classroom, whether the frequency of activities are subject specific, and how the perceptions between students and teachers differ in the extent to which these activities occur. It was then possible to correlate the frequency of these findings with students' learning outcome scores to determine their relationship. These questionnaires are used to test the first and third assumptions; whether student-centred activities are currently occurring within Indian classrooms, and whether they have a positive relationship with student learning outcomes.

3.4.2 Teacher interview

Structured interviews were conducted with all the teachers, lasting between 20 and 40 minutes each. During the interview teachers were shown eight photographs of student-centred activities, similar to those included in the questionnaire. For each photo, the interviewer introduced the activity, asked the teacher to give an example of how they might use this activity in their classroom, and then asked if they could explain why this activity would be valuable to use (see Appendix 4.4).

The interview took place in a private space. If the teacher's English ability was sufficient the interview was conducted in English by the PR. Otherwise the RA acted as interpreter for the PR. The interview was audio recorded.

3.4.2.1 Teacher interview rationale

The purpose of the teacher interview was to gather qualitative data on teacher understanding of how student-centred activities improve learning, and details of how these activities were used. This was used to test assumption 2, to explore whether a better teacher understanding of SCL increased the frequency with which the activities were used.

3.4.3 Student group assessment

The purpose of the student assessment was to evaluate the students' ability to solve mathematically based problems through working in groups. Three students from each class were arbitrarily hand-picked to take part in the activity. The activity was conducted in a private space. The assignments are described below. Each activity was video recorded.

3.4.3.1 Primary school assessment

Students were given a pen, some paper, and six long white envelopes which were placed side to side on the desk/floor. One coin was placed on top of each of the six envelopes. Students were asked to make arrangements with the coins and the envelopes. A number of examples were shown to the students. The students were then asked to make as many of their own arrangements as they could in fifteen minutes. They were asked to record these arrangements using the pen and paper in such a way that someone else could recreate their arrangements just by looking at their recordings. They were reminded that they are allowed to write or draw their recordings but they were not given specific instructions as to how to record. One person was designated as the recorder.

This activity tested a number of skills in students: Arranging the coins required skills of pattern making, set making and sequencing which are basic mathematical skills. Recording the patterns required developing a systematic code of representation or a 'key', which is a basic scientific skill. The combination of making patterns and recording them required cooperation, communication, and mutual support, which has been broadly termed as 'group work'.

Image 5: A research assistant explains the assessment to a group of primary school students (Karnataka, India)

3.4.3.2 Secondary school assessment

Students were given five identical cuboids, a pen, a ruler, and a sheet of paper. Students were asked to calculate both the surface area and volume of one cuboid. The RA explained that the surface area consists of the six sides or faces of the cuboid, and the volume is the amount of space that the cuboid occupies. They were then asked to imagine that two cuboids are placed together to form a larger cuboid, and to calculate the surface area and volume of that larger cuboid. They were asked to calculate the surface area and volume of three, four and five cuboids placed together. Finally, they were asked to predict the surface area and volume of ten cuboids placed together. Calculating both the surface area and volume of cuboids is included in the government

high-school mathematics curriculum, and so should not have been unfamiliar to students of this age group.

This activity tests a number of skills: Identifying the measurements required to do the calculations, the ability to accurately measure a straight edge with a ruler, basic multiplication, recognition of patterns, predictions on the basis of recognized patterns, and the division of tasks.

Image 6: Secondary school students calculating the volume of a cuboid during an assessment (Karnataka, India)

Testing student learning outcomes through group problem solving tasks assessed not only the content knowledge of the students, but also their ability to apply their knowledge, and to work collaboratively. It tested both cognitive and behavioural skills, which according to EFA are the two defining features of quality education (UNESCO, 2004). This test was considered to be a truer reflection of the desired learning outcomes of student-centred activities than traditional assessment which only evaluates a student's ability to individually apply abstract knowledge in unrealistic situations.

3.4.4 Teacher trainee assessment

Assessments were also given to trainee teachers in three teacher training colleges. It was hypothesised that students' learning outcomes depended not only on the pedagogy employed in the classroom, but also the content knowledge of the teacher. The teacher trainees were asked to individually complete the same assessment as the secondary school students. The purpose of this activity was to investigate how maths teachers conceptually understand and approach mathematical problems, as a way of gauging how they might teach mathematical concepts. In order to avoid undermining the ability of teachers by asking them to complete secondary school tasks, trainee teachers were tested.

3.5 Analysis methods

3.5.1 Questionnaire data

The questionnaire data was inputted by the PR into SPSS. Three data sets were created which amalgamated the student questionnaires, teacher questionnaires, student assessment scores, and teacher interview scores according to classroom for primary schools and secondary schools separately and together. A table showing how the data has been coded and labelled in SPSS can be found in Appendix 6.

3.5.2 Teacher interview data

3.5.2.1 Quantitative analysis of interview data

In order to compare the teachers' understanding of student-centred activities across classrooms, the interviews were numerically graded. A detailed marking scheme can be found in Appendix 5.3.

This taxonomy reflects an understanding present in the TESS-India materials that the purpose of student-centred activities is not simply to improve the memorization or content knowledge of the students, but rather equip students with the capacity to independently learn and develop skills which they can apply to real-world situations and problems.

Each interview was graded by the PR as well as two independent markers, both of whom were qualified teachers, in order to ensure marking consistency.

3.5.2.2 Qualitative analysis of interview data

A thematic analysis of the same interviews was conducted in order to contextualize the quantitative scoring, and understand more broadly the common attitudes and perceptions of SCL.

3.5.3 Student and teacher trainee assessment

3.5.3.1 Quantitative analysis of learning outcome data

In order to compare the learning outcome data across schools and classrooms they were numerically graded with a score between 1 and 5 (1 being very poor, 5 being very good).

3.5.3.1.1 Primary school learning outcomes

The primary school learning outcomes were judged on three criteria: 1) students' ability to work in groups, 2) students' ability to create diverse patterns with the coins and envelopes, and 3) students' ability to accurately record the patterns. A detailed taxonomy can be found in Appendix 5.1.

3.5.3.1.2 Secondary school learning outcomes

The secondary school learning outcomes were judged on three criteria: 1) the students' ability to work in groups, 2) the students' ability to calculate the surface area of ten cuboids placed side to side, and 3) the students' ability to calculate the volume of ten cuboids placed side to side. A detailed taxonomy can be found in Appendix 5.2.

3.5.3.1.3 Teacher trainee learning outcomes

The teacher trainee learning outcomes were judged on two criteria: 1) teacher trainee ability to calculate the surface area of ten cuboids placed side to side, and 2) teacher trainee ability to calculate the volume of ten cuboids placed side to side. A detailed taxonomy can be found in Appendix 5.4.

3.6.3.2 Qualitative analysis of assessment data

A thematic analysis was conducted on the learning outcome data to contextualize the scoring, and to understand how students and teacher trainees address mathematical problems.

3.5.4 Statistical analysis

3.5.4.1. Descriptive statistics

Descriptive statistics were run to ascertain the frequency and distribution of responses.

3.5.4.2 Pearson's correlations

Pearson's correlations were run to ascertain the relationship between the following variables:

1. Frequency of student-centred activities with learning outcomes
2. Frequency of student-centred activities with urbanization
3. Learning outcomes with teacher understanding of student-centred activities
4. Frequency of student-centred activities with teacher understanding of student-centred activities

3.6 Methodological Limitations

3.6.1 Researcher presence bias

Undoubtedly the presence of the researchers, and their association with Oxford University and the DSERT, influenced the teachers' questionnaire answers. The frequency questionnaire data can be easily compared to the student reported frequencies, which will improve reliability.

Since teacher interviews are effectively tests of teachers' pedagogical understanding, it is unlikely that the researcher presence would significantly impact the answers that the teachers could give.

The student and teacher trainee test of learning outcomes may also have been affected by the researcher presence through increased nervousness.

3.6.2 Questionnaire validity

The validity of the frequency questionnaire data needs to be considered since it is asking teachers and students to report the frequency of activities that are not necessarily clearly defined or regularly identified. The questionnaire therefore requires students and teachers to reflect on past events that may at the time not have seemed significant, and then to report on the frequency of past, non-significant events. For this reason a large sample size was important, as well as triangulating the student and teacher reported data.

3.6.3 Sampling limitations

Due to time constraints, it was only possible to conduct tests of group learning outcomes with one group of three students per class. This effectively meant that the abilities of an entire class of up to 60 students were represented by only 3 students per class, which is not a sufficient sample to make strong claims regarding class learning outcomes. This sampling limitation needs to be considered when drawing conclusions from the analysis.

3.7 Ethical Considerations

The PR received CUREC approval from her home institution, Oxford University (Appendix 1). The PR constantly prioritized the safety, privacy and confidentiality of all research participants by working to ensure every participant's right to withdraw, non-traceability, and comfort in expressing their experiences.

Before entering the field RAs were briefed on ethical procedures and expectations, and in particular the voluntary nature of participation. A letter outlining the purpose, scale, and confidentiality of the project, as well as procedures for storing and analysing the data was given to each head teacher and teacher before they participated (Appendix 1). Before each interaction the RA's verbally explained the purpose of the project to the participants and ascertained the participants' consent. For the participating teachers this consent was audio recorded at the beginning of their interview.

Most of the students who participated in this study were first-generation learners, whose parents were illiterate. Since it was not feasible to obtain parent's consent for their children to participate in this study, teachers and head teachers took responsibility as legal guardians for giving consent for their students to participate during school hours. All teachers and head teachers were made aware that they were acting on behalf of students' parents when giving consent for their students to participate.

CHAPTER FOUR: RESULTS AND ANALYSIS

4.1 Introduction

This chapter presents the findings of the study. The study investigated the relationship between SCL and learning outcomes. The research tested three assumptions made by TESS-India. Those assumptions are:

1) SCL is currently not a marked feature of Indian classrooms.
2) Even when teachers use SCL they lack a sophisticated understanding of how SCL promotes learning.
3) Promoting SCL will improve student learning outcomes.

The research questions related to these assumptions are:

1) Are teachers using student-centred activities?
2) Do teachers understand how student-centred activities contribute to student learning?
3) Is there a correlation between student-centred activities and student learning outcomes?

The following data was collected from 15 schools and 3 teacher training colleges:

1) Student and teacher reported frequencies of ten student-centred activities
2) Results of cognitive and behavioural skills assessments
3) Teacher understanding of how student-centred activities promote learning

Pearson's correlations are used to investigate the relationship between variables. Analysis is conducted separately for primary school and secondary school classrooms in order to offer contextually nuanced conclusions.

4.2 Are Indian teachers using student-centred activities?

This section investigates TESS-India's first assumption: that SCL is not currently happening in Indian classrooms. In order to test this assumption teachers and students were asked to rate the frequency of the occurrence of ten different activities. The results are reported below. Secondary school students were asked about the frequency of these activities in their mathematics, science, and English classes separately, and the mean result for each activity is calculated for the purposes of comparability. The relationship between the frequency of student-centred activities and the school context (rural/urban) is also investigated. Descriptive data can be found in Appendix 8.

4.2.1 Frequency of student-centred activities

4.2.1.1 Student reported frequency

Figure 3: Graph showing the frequencies at which student-centred activities are used in the classroom, as reported by primary school students

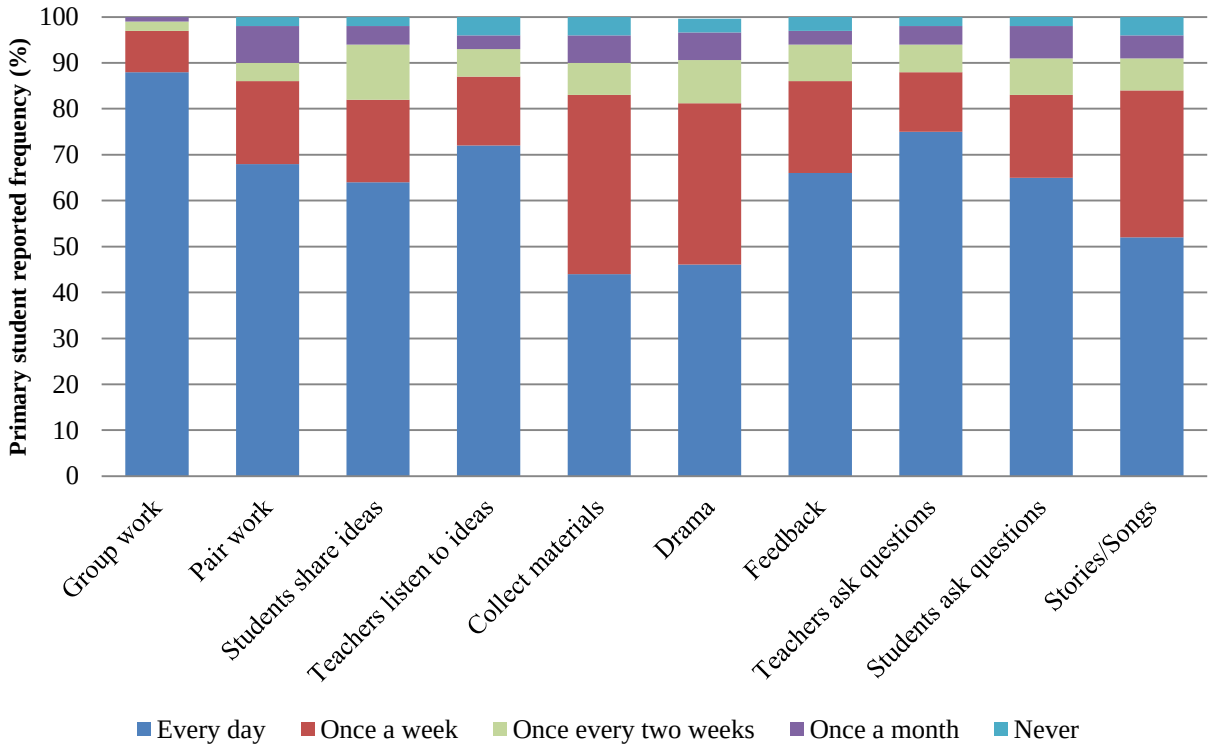
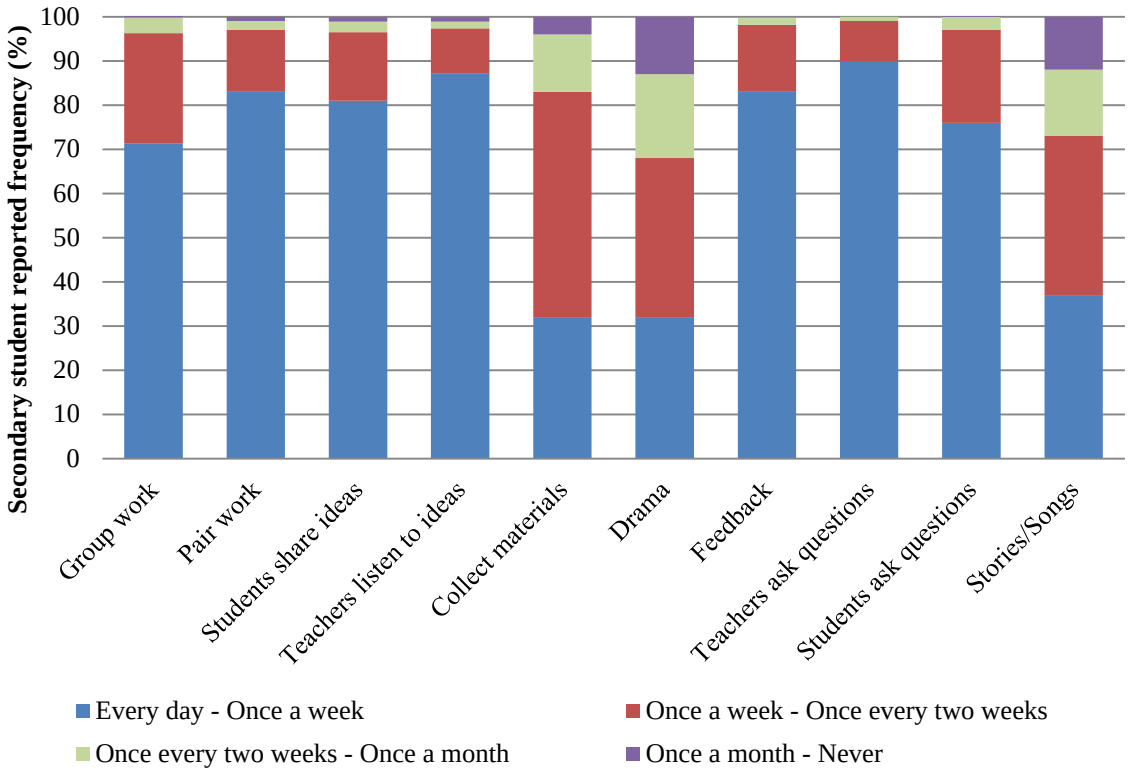


Figure 4: Graph showing the frequencies at which student-centred activities are used in the classroom, as reported by secondary school students



Student-centred activities are being regularly experienced by students in classrooms in Karnataka, however the frequency differs according to the type of school. The majority of primary school students reported each of the ten activities as occurring every day with group work experienced most frequently and teacher listening to ideas, collecting materials, and stories/songs experienced least frequently. Secondary school students reported similar overall frequencies, however collecting materials, drama and stories/songs were reported by most students as occurring between once a week-two weeks, rather than every day-once a week. Teacher listening to ideas was the activity that secondary school students experienced most frequently, while drama was the activity they experienced least frequently.

4.2.1.2 Teacher reported frequency

Figure 5: Graph showing the frequencies at which student-centred activities are used in the classroom, as reported by primary school teachers

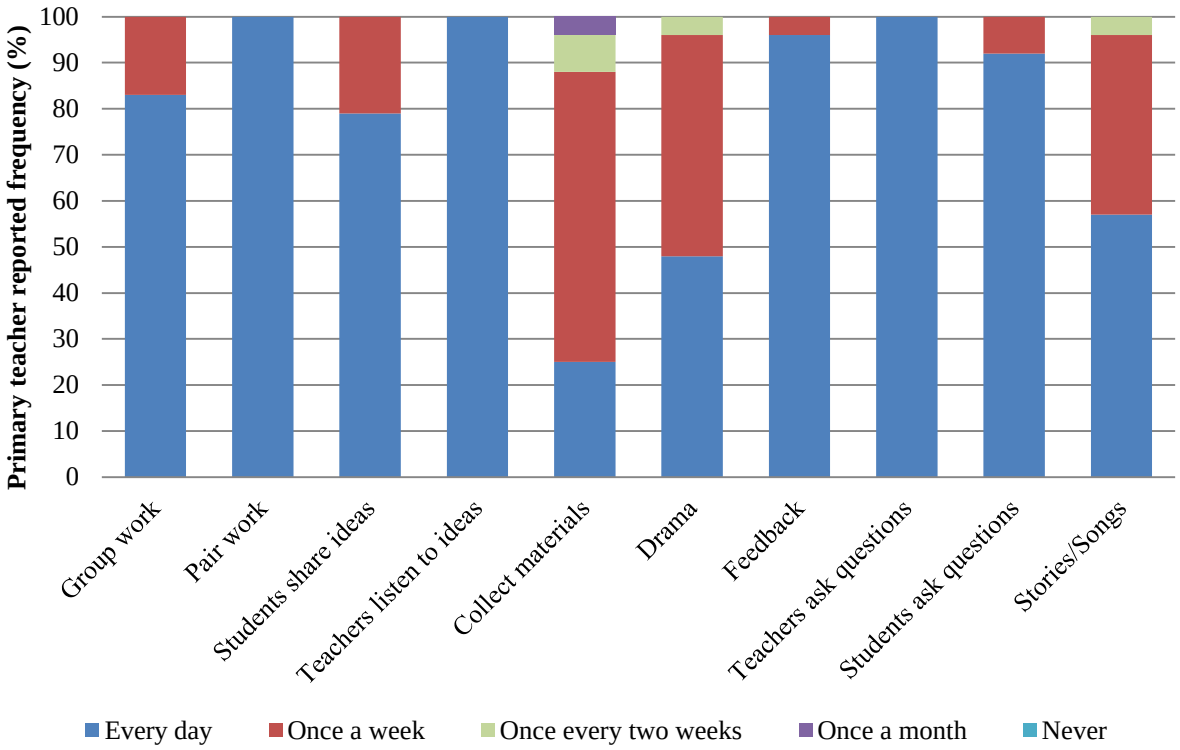
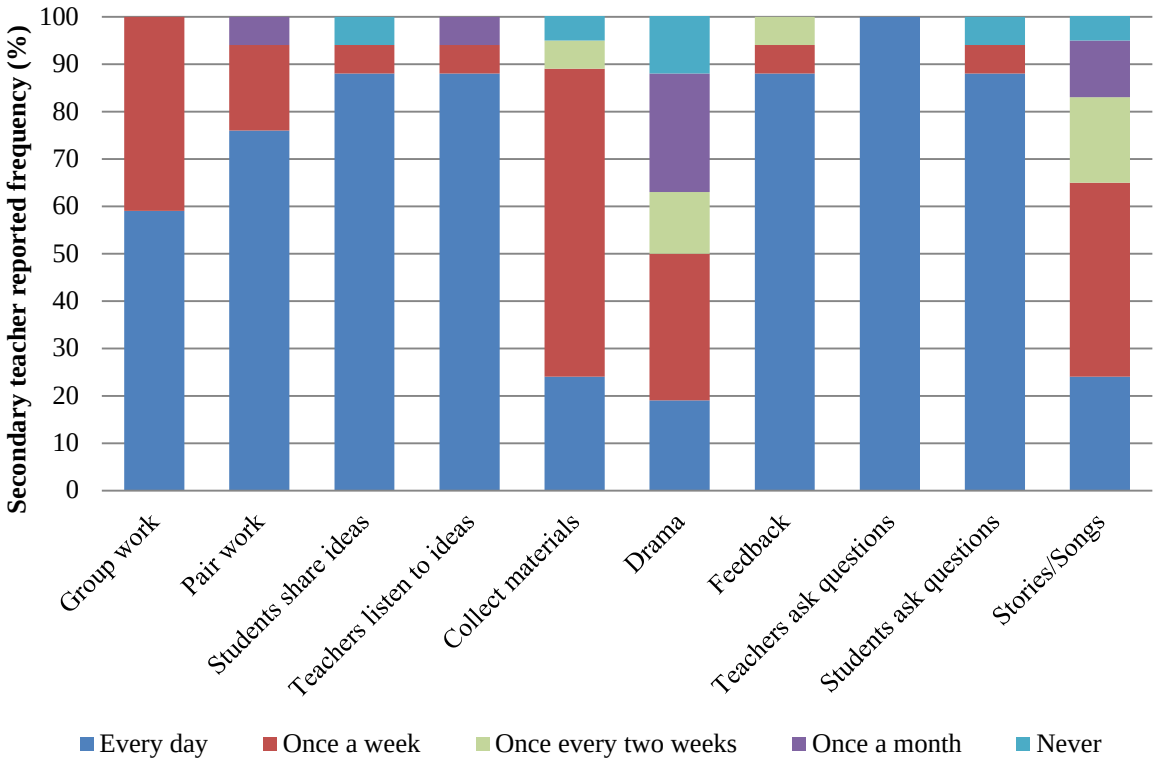


Figure 6: Graph showing the frequencies at which student-centred activities are used in the classroom, as reported by secondary school teachers



Teachers reported an overall higher frequency of student-centred activities than their students, with most activities happening at least once a week. Primary school teachers reported a higher frequency of student-centred activities in their classrooms than secondary school teachers. Pair work, teachers listening to ideas, and teachers asking questions are reported as occurring most frequently by primary school teachers, with all teachers reporting that they happen every day. This is notable as primary school students reported teacher listening to ideas as one of the activities that happened least frequently. Drama and collecting materials were reported by primary school teachers as the activities that happened least frequently which is consistent with the reporting of primary school students. The most frequent activity according to secondary school teachers was teachers asking questions, which all teachers said happened every day. Once again this is consistent with the reports of secondary school students. The least frequent activities according to secondary school teachers were collecting materials, drama and stories/songs, which is consistent with secondary school student reports.

4.2.2 Frequency of teacher reported student-centred activities according to school type

4.2.2.1 Descriptive statistics

Figure 7: Graph showing the frequencies at which student-centred activities are used in urban classrooms, as reported by teachers

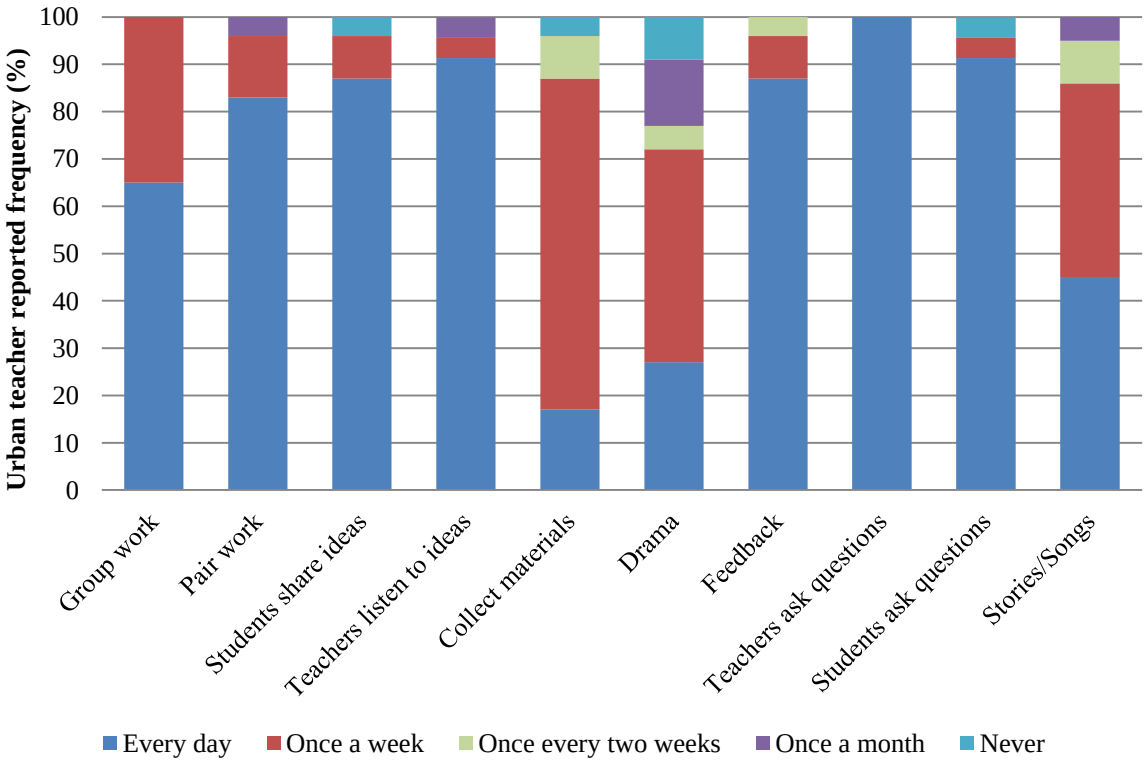
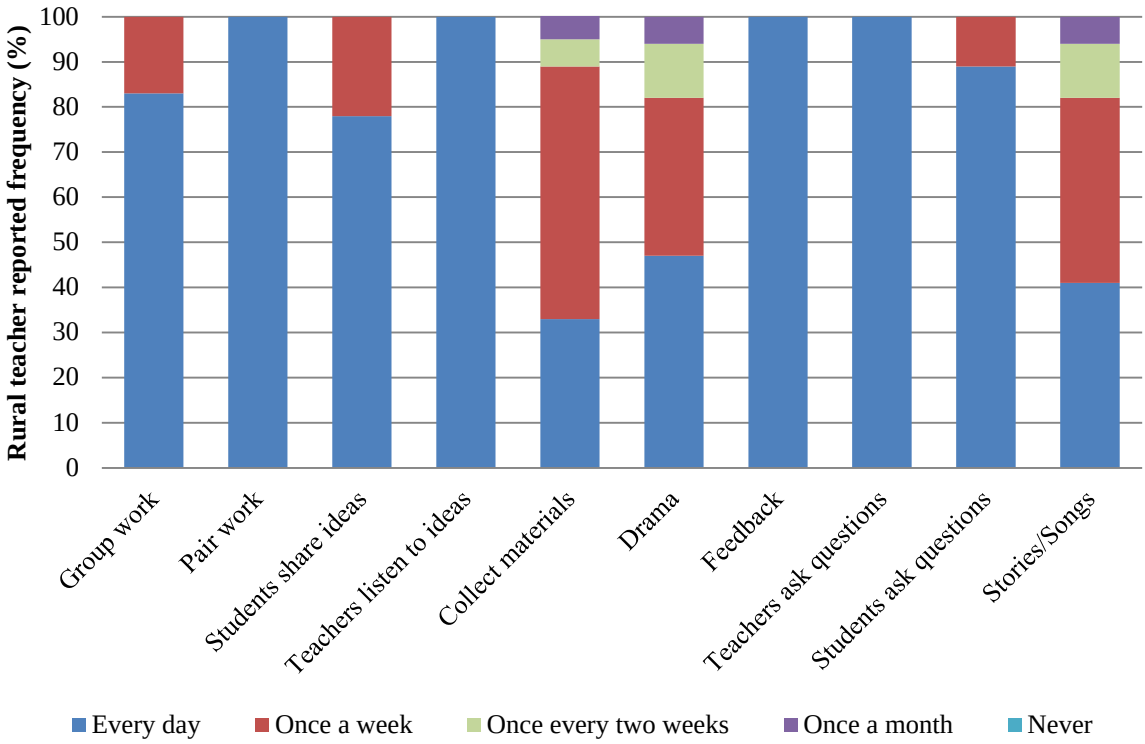


Figure 8: Graph showing the frequencies at which student-centred activities are used in rural classrooms, as reported by teachers



Rural school teachers' report a higher frequency across all activities, with the exception of students asking questions, and stories/songs which are similarly reported between rural and urban schools. Particularly notable is that while between 4-9% of urban teachers report that students "never" share ideas, collect materials, do drama, or ask questions, no rural teachers report "never" doing any activities.

4.2.2.2 Pearson's correlation

4.2.2.2.1 Primary school

A Pearson's correlation was run to assess the relationship between urbanization and the frequency of student-centred activities in primary schools.

Table 1: Table showing the relationship between the frequency of student-centred activities in primary schools and the level of urbanization

	Rural/Urban
Group work	-0.160
Pair work	
Students share ideas	0.448*
Teachers listen to ideas	
Collect materials	-0.047
Drama	-0.442*
Feedback	-0.411*
Teachers ask questions	
Students ask questions Stories/	0.459*
Songs	0.255

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

The analysis showed that there was a significant moderate positive correlation between students sharing ideas and urbanisation (r = 0.448), and between students asking questions and urbanisation (r = 0.459). However there was a significant moderate negative correlation between drama and urbanisation (r = -0.442), and between feedback and urbanisation (r = -0.411).

4.2.2.2.2 Secondary school

A Pearson's correlation was also run to assess the relationship between urbanization and the frequency of student-centred activities in secondary schools.

Table 2: Table showing the relationship between the frequency of student-centred activities in secondary schools and the level of urbanization

	Rural/Urban
Group work	-0.417
Pair work	-0.666**
Students share ideas	-0.293
Teachers listen to ideas	-0.417
Collect materials	-0.439
Drama	-0.359
Feedback	-0.387
Teachers ask questions	
Students ask questions Stories/	-0.293
Songs	-0.030

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

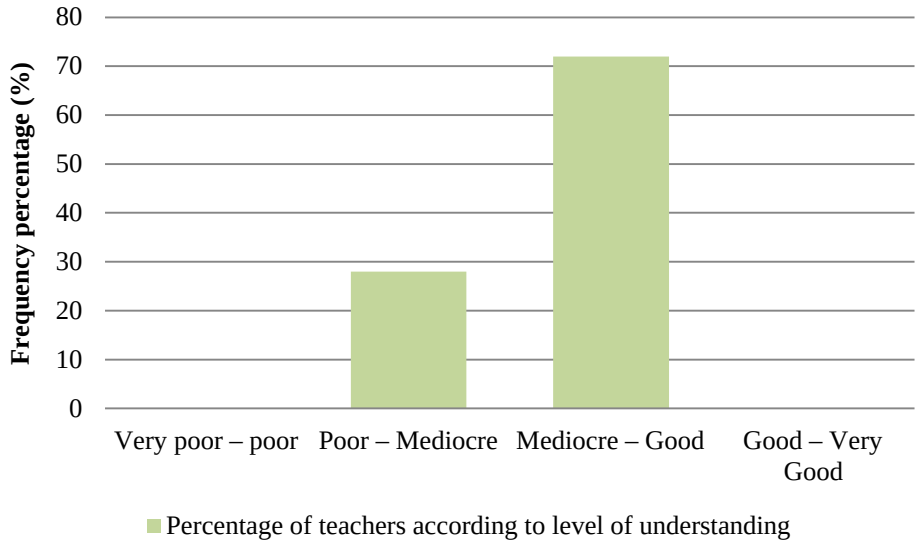
The analysis showed that for all activities for which a viable correlation could be calculated, there was a negative correlation between the frequency of activities and urbanisation. For group work (r = -0.417), students sharing ideas (r = -0.293), teachers listening to ideas (r = -0.417), collecting materials (r = -0.439), drama (r = -0.359), and feedback (r = -0.387), this correlation was moderate but not significant. However there was a significant strong negative correlation between pair work and urbanization (r = -0.666).

4.3 Do teachers understand the purpose of student-centred activities?

This section investigates TESS-India's second assumption; that even if SCL is happening in Indian classrooms, teachers are unable to best utilise SCL because they lack a deep pedagogical understanding of how it promotes student learning. Structured interviews were conducted with teachers to assess their understanding of the relationship between student-centred activities and student learning. The interviews were scored by three independent markers (scoring taxonomy can be found in Appendix 5.3), and inter-rater reliability was confirmed (Appendix 7). This section reports the scores of those interviews.

4.3.1 Teacher interview scores

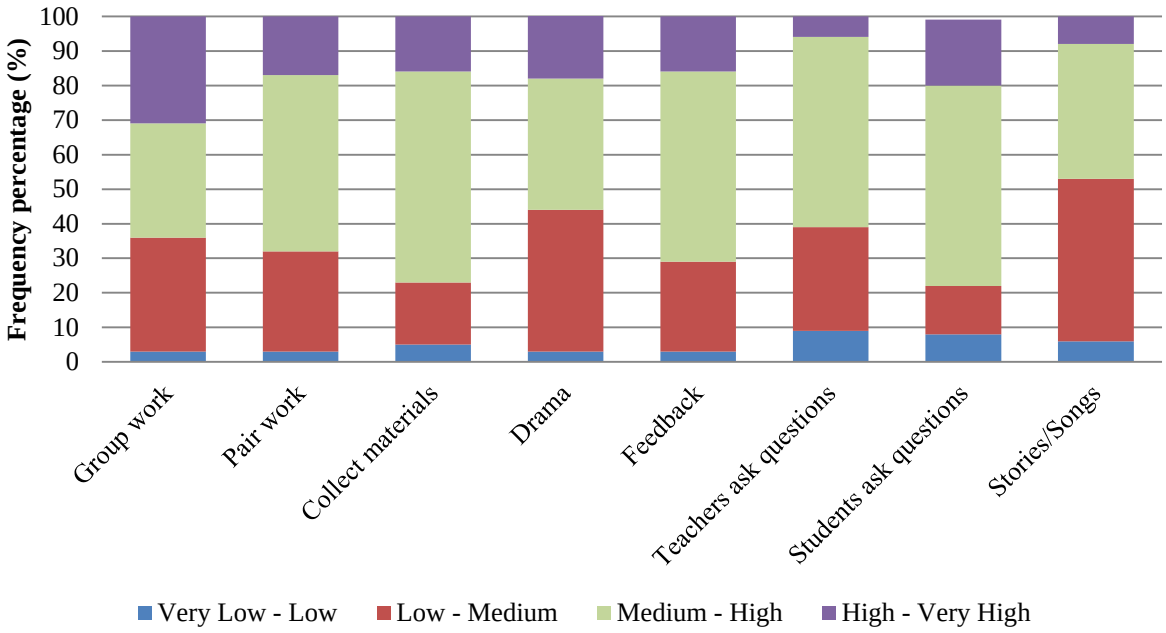
Figure 9: Graph showing the percentage of teachers who achieved a very poor-poor, poor-mediocre, mediocre-good, or good-very good level of understanding in regards to the relationship between student-centred activities and student learning



The majority of teachers score a mark that is between a mediocre and good level of understanding. Teachers who received a mediocre level score could recognize the activity mentioned, offer an example of how the activity might be used in the classroom while referring to classroom context, and had a general understanding of how the activity might contribute towards learning outcomes which includes skill development. Teachers who received a good level score could recognize the activity

mentioned, offered a specific example of how that activity is used in the classroom giving procedural details of what would be involved, had a clear understanding of how the activity contributed towards both learning outcomes and skill development, and were able to relate this to the specific needs/barriers faced in the classroom.

Figure 10: Chart showing the percentage of teachers who achieved a very poor-poor, poor-mediocre, mediocre-good, or good-very good level of understanding in regards to the relationship between student-centred activities and student learning, according to activity



A breakdown of the data shows that teachers understand the relationship of some activities with student learning more than others. The value of group work, for example, is very well understood, with 11 teachers scoring good–very good. This is contrasted with teachers asking questions or stories/ songs, for which only 2 and 3 teachers respectively scored good–very good. For some activities, e.g. group work, drama, and feedback, understandings vary widely with almost equal numbers of teachers scoring high and low marks.

4.3.2 Relationship between teacher understanding and student-centred activity frequency

Pearson's correlations were run to assess the relationship between teacher understanding and the frequency with which teachers employed student-centred activities. Correlations were run separately for primary and secondary schools.

Table 3: Table showing the relationship between teacher understanding and the frequency of student-centred activities as reported by teachers for primary schools

	Total understanding mean
Total frequency mean	0.741**

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

Table 4: Table showing the relationship between teacher understanding and the frequency of student-centred activities as reported by teachers for secondary schools

	Total understanding mean
Total frequency mean	-0.304

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)

While teachers understanding of the relationship between SCL and student learning were strongly and significantly correlated for primary school teachers, they were negatively correlated for secondary school teachers.

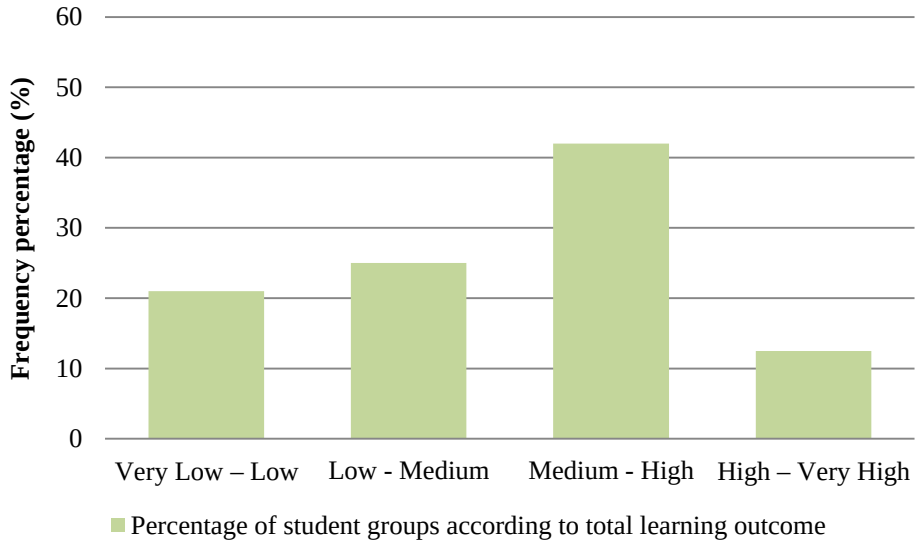
4.4 Is there a relationship between student-centred activities and student learning outcomes?

This section investigates the third assumption of the dissertation: that SCL will improve student learning outcomes. The results of the student group tasks are presented below. A Pearson's correlation is run to investigate the relationship between the frequency of student-centred activities occurring within a classroom and student learning outcome scores. This relationship is investigated for primary school and secondary school classrooms separately.

4.4.1 Student learning outcomes

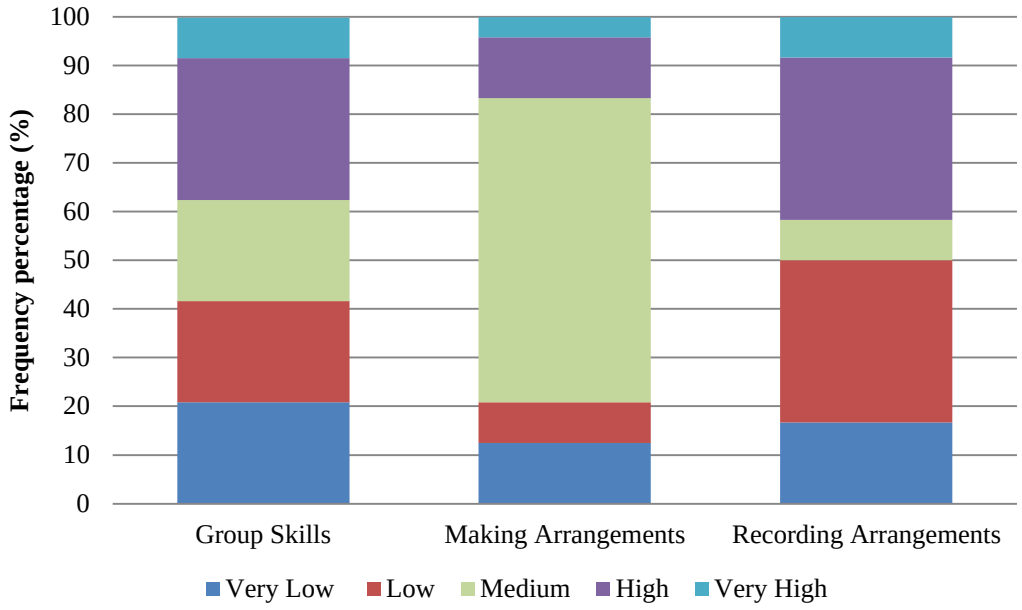
4.4.1.1 Primary school

Figure 11: Graph showing the percentage of primary school student groups who attained a very low-low, low-medium, medium-high, or high-very high overall score in the assessment



The most frequent learning outcome score for primary school students was between a medium–high grade. The total learning outcome was calculated as a mean value of the group's ability to work together, to make arrangements using coins and envelopes, and to accurately record those arrangements. The scoring taxonomy can be found in Appendix 5.1.

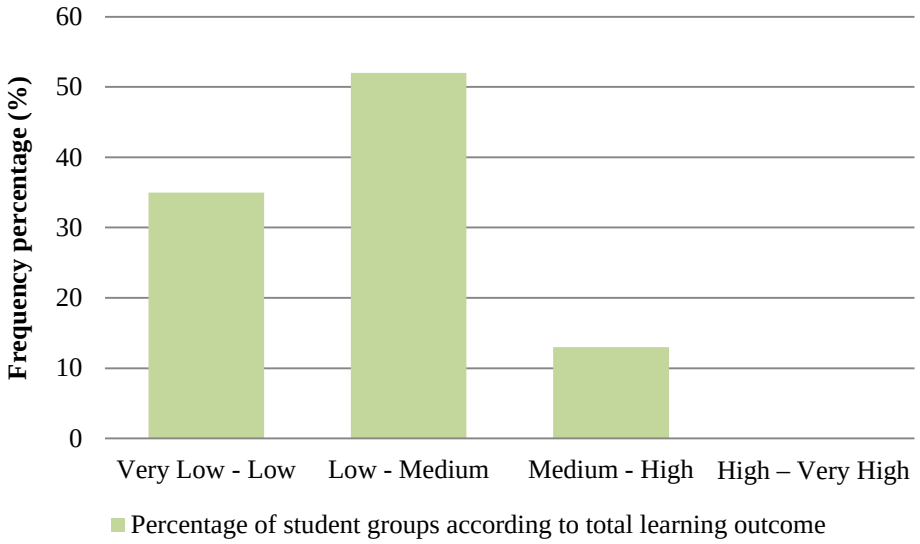
Figure 12: Graph showing the percentage of primary school student groups who attained a very low, low, medium, high or very high score in the assessment according to three different metrics



Group skills had a rather even distribution of scores among the groups tested. This was contrasted with making arrangements where most of the student groups clustered around the medium score. Recording arrangements scores were somewhat polarised, with equal numbers of groups achieving high and low scores. This is a reflection of the difference between groups who linguistically represented the arrangements and those who made the jump to visually representing the arrangements.

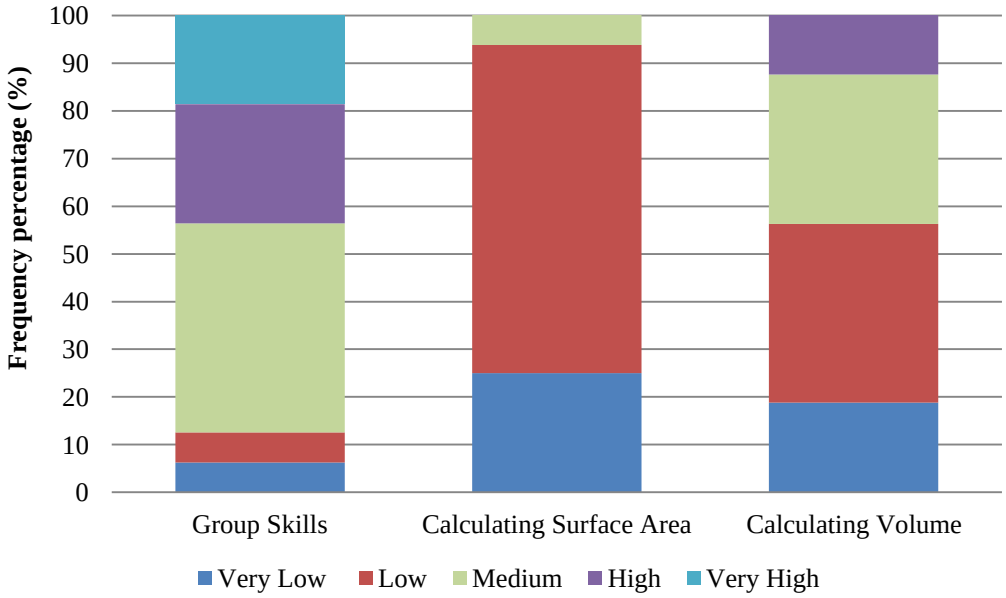
4.4.1.2 Secondary school

Figure 13: Graph showing the percentage of secondary school student groups who attained a very low-low, low-medium, medium-high, or high-very high overall score in the assessment



The most frequent grade achieved by secondary school student groups was Low–Medium. The total learning outcome was calculated as a mean value of the group's ability to work together, to calculate the surface area of ten cuboids, and to calculate the volume of ten cuboids. The scoring taxonomy can be found in Appendix 5.2.

Figure 14: Graph showing the percentage of secondary school student groups who attained a very low, low, medium, high, or very high score in the assessment according to three different metrics



Group skills scores were more evenly distributed than the scores for either of the maths related competencies. Calculating the surface area had particularly low scores, with no groups achieving a high or very high score, and 11 groups receiving a low score. This is perhaps a reflection of the number of groups who calculated the volume while claiming to have calculated the surface area. Students' performance improved when asked to calculate the volume however the majority of groups still received a low or very low score.

4.4.2 Relationship between student-centred activities and student learning outcomes

4.4.2.1 Primary school

Pearson's correlations were run to investigate the relationship between the frequencies of student-centred activities and primary school student learning outcomes.

Table 5: Table showing the relationship between primary school learning outcomes and the teacher-reported frequency of student-centred activities

	Group Skills	Making Arrangements	Recording Arrangements	Total
Group work	-0.073	0.46	0.308	0.117
Pair work				
Students share ideas	-0.250	-0.059	-0.013	-0.134
Listen to students' ideas				
Collect materials	0.380	0.094	0.274	0.315
Drama	.0121	0.167	0.528**	0.337
Feedback	-0.049	0.085	0.246	0.113
Ask students questions				
Students ask teacher questions	0.098	0.022	0.196	0.135
Stories	-0.101	0.089	0.429*	0.172
Total frequency mean	0.083	0.127	0.544**	0.314

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)

Contrary to what might be expected, not all student-centred activities had a positive moderate-strong correlation with student learning outcomes. Drama and stories both had a significant positive correlation with students' abilities to record their coin arrangements (r = -0.528, r = -0.429), while students sharing ideas had a negative non-significant correlation across all skill sets tested for. Collecting materials had a moderate positive, though not significant correlation with students' total learning outcome score (r = 0.315), while group work had a moderate non-significant positive correlation with recording arrangements (r = -0.308). While all skill sets were positively correlated with the total mean frequency of student-centred activities, it is somewhat surprising that group skills, which activities such as group work and pair work explicitly aim to develop, had a very small, non-significant correlation with student-centred activities, and in fact a weak negative correlation with group work (r = -0.073). Overall however, the total frequency mean of student-centred activities had a moderate non-significant correlation with the total learning outcome scores for primary school students (r = 0.314).

4.4.2.2 Secondary school

Table 6: Table showing the correlated values of secondary school learning outcomes and the teacher-reported frequency of student-centred activities

	Group Skills	Calculating Surface area	Calculating Volume	Total
Group work	-0.542*	0.320	0.121	-0.214
Pair work	-0.350	0.020	0.472	0.057
Students share ideas	-0.022	0.224	-0.051	0.035
Listen to students' ideas	-0.541*	0.320	0.121	-0.214
Collect materials	-0.117	0.236	0.057	0.039
Drama	-0.582*	0.365	0.120	-0.229
Feedback	-0.205	0.296	-0.001	-0.045
Ask students questions				
Students ask teacher questions	-0.022	0.224	-0.051	0.035
Stories	-0.118	0.497	-0.275	-0.087
Total frequency mean	-0.288	0.361	0.034	-0.061

* Correlation is significant at the 0.05 level (2-tailed)

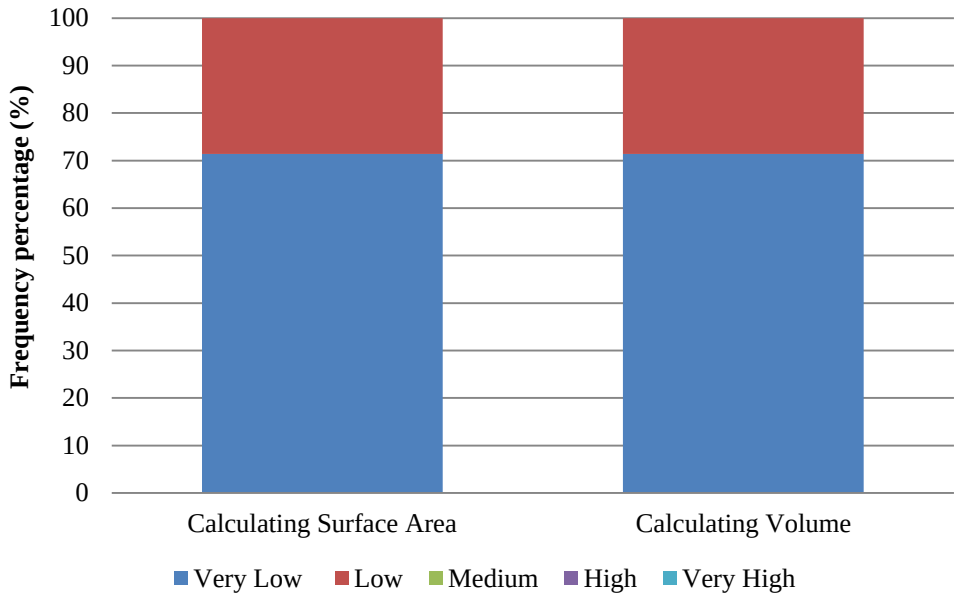
** Correlation is significant at the 0.01 level (2-tailed)

Pearson's correlations were run to investigate the relationship between the frequency of student-centred activities and secondary students' learning outcome scores. Unlike the primary school students, there was no relationship between the mean frequency of all the student-centred activities, and the total learning outcome score (r = -0.061). Surprisingly, student-centred activities often significantly correlated with lower learning outcome scores, particularly in the domain of group skills. Group work, listening to students' ideas, and drama all had strong, significant, negative correlations with group work (r = -0.542, r = -0.541, r = -0.582), while pair work and feedback had a moderately negative, although not significant correlation with group work (r = -0.350, r = -0.205). Of the three skill sets tested, calculating the surface area had the strongest positive correlation with the frequency of student-centred activities (r = 0.361), with group work (r = 0.320), listening to students' ideas (r = 0.320), drama (r = 0.365), and stories (r = 0.497) contributing most of that positive correlation.

4.5 Teacher trainee learning outcomes

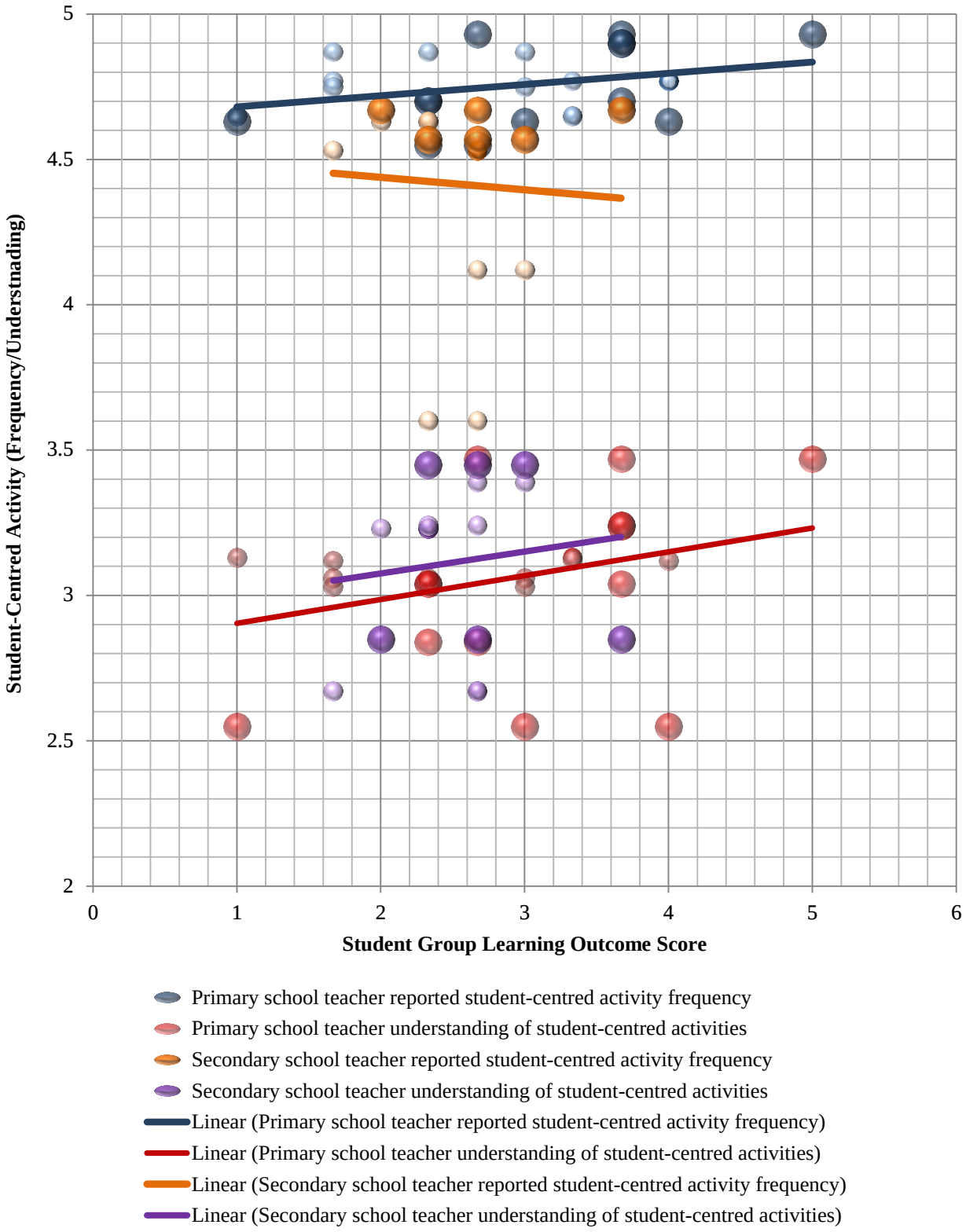
As a result of low basic mathematics ability among secondary school students, trainee teachers were also individually assessed with the same problem solving test. Their results are shown below.

Table 15: Graph showing the percentage of trainee teachers who attained a very low, low, medium, high, or very high score in the secondary school problem solving test



The majority of teacher trainees received a very low score, with no teacher trainees scoring above a low score. Teacher trainees therefore received lower scores than secondary school students.

Figure 16: Graph showing the relationship between student learning outcome scores and student centred activity frequency, and between student learning outcome scores and teacher understanding, for both primary and secondary schools



Note: Larger, darker data points indicate schools in rural areas, while smaller, lighter data points indicate schools in urban areas.

4.6 Chapter Summary

A descriptive analysis of the data shows that teachers were frequently using student-centred activities, thus undermining the first assumption. However teachers reported a higher frequency of student-centred activities than students, and both students and teachers reported a higher frequency of student-centred activities in primary school classrooms than in secondary school classrooms. Similarly the types of student-centred activities reported are different between teachers and students, between primary schools and secondary schools, and between urban and rural schools.

Furthermore, the data shows that most teachers have a 'mediocre' understanding of how student-centred activities help learning. While teacher understanding of SCL is very significantly positively correlated with frequency of student-centred activities for primary schools, it is negatively correlated for secondary schools. This would imply that there is support for the second assumption in the case of secondary schools, i.e. that they are using student-centred activities without understanding its relationship to learning, but weaker support in the case of primary schools, where the teachers who best understand student-centred activities are more likely to use them.

Pearson's correlations were run to investigate the relationship between student-centred activities and student learning outcomes. For primary schools, there was a moderate positive correlation between the frequency of student-centred activities and learning outcomes. For secondary schools there were weak and non-significant correlations between the frequency of student-centred activities and learning outcomes. These findings support the third assumption in the context of primary schools but not secondary schools.

A discussion of these findings, which further draws upon qualitative analysis, will be presented in Chapter 5.

CHAPTER FIVE: DISCUSSION

5.1 Introduction

The research design of the present study is essentially two-pronged; theoretical and policy-oriented. The first investigates substantial theoretical questions about the efficacy of SCL and the learning environment in India. The second is a study of a typical donor funded intervention (TESS-India) that makes assumptions about the nature of the educational deficit in India and the interventions that might be applied to address these.

TESS-India, in the design and delivery of its teacher-training materials, makes three assumptions which this research aims to test. These assumptions are:

1) SCL is not currently a marked feature of Indian classrooms.
2) Even when teachers use SCL they lack a sophisticated understanding of how it contributes to student learning. (policy-orientated question).

The wider international donor assumption, which is also a feature of the TESS-India project is that:

3) SCL improves student learning outcomes (theoretical question).

In testing these assumptions this study will contribute to both the theoretical literature on the efficacy of SCL, questioning whether it indeed leads to "quality" education (UNESCO, 2014), as well as to discussions surrounding appropriate interventions for pedagogical reform.

The research used a mixed-methods approach, drawing on both quantitative and qualitative methodologies. The previous chapter presented the quantitative data in order to provide a broad and comparative overview of SCL in Indian classrooms. In this chapter qualitative analysis is used to both contextualize and interpret the quantitative results. This approach is adopted in response to previous SCL studies that have been limited through their lack of contextual nuance.

This chapter is divided into four sections. The first section discusses the high frequency of student-centred activities occurring within Indian classrooms and thus addresses the first assumption. The second section discusses teachers understanding of SCL and thus addresses the second assumption. The third section discusses student learning outcomes, and in the final section the relationship between SCL and student learning outcomes is discussed, thus addressing the third assumption. Sections one, two, and three address the policy-orientated question, while section four addresses the theoretical question.

5.2 Frequency of student-centred activities

Both teachers and students report that student-centred activities occur frequently, however the activities occurring most frequently vary by demographic. Primary school students experienced group work most frequently, and the teacher listening to ideas least frequently. The teacher listening to ideas was the activity that secondary school students experienced most frequently, and drama was the activity they experienced least frequently. Primary school teachers reported pair work and teachers listening to ideas as occurring most frequently, while drama and collecting materials were reported as

occurring least frequently. Secondary school teachers reported teachers asking questions occurring most frequently, with drama and stories occurred least frequently.

Teachers and students appear to be interacting in a way that surpasses the lecture style approach stereotypical of Indian classrooms. This needs to be recognised when designing educational interventions. However there are noticeable differences between different types of schools which are worth exploring.

5.2.1 Primary schools vs. secondary schools

The mean primary school teacher reported frequency of student-centred activities was 4.8 (closest to "every day") but only 4.4 (closest to "once a week") for secondary schools. From the qualitative analysis of the teacher interviews the pressure of secondary school assessments in a content heavy curriculum emerges as a key theme which might explain the lower frequency.

5.2.1.1 Student assessments

The pressure of student assessments may help to explain the discrepancy between the frequency of student-learning activities in primary and secondary schools. "Without doubt", argues Wells, "a major influencing factor [in teachers' reluctance to abandon traditional teaching methods] is the increasing pressure of accountability for delivering a centrally determined curriculum and for increasing students' scores on standardized tests of 'basic' skills and memorized items of information" (2000, p. 57). Ten secondary school teachers discussed issues relating to "grades", "exams", "assessments" and the "syllabus", compared to only four primary school teachers.

> "*To achieve the learning outcomes you should conduct tests."* (Interview 11b)
>
> *"So overall there is a learning that happens and students will be able to understand and relate the examples, test it by written and oral exam also."* (Interview 10c)
>
> *"For the assessment techniques… she gives written feedback."* (Interview10b)

Meeting curriculum demands was felt strongly by secondary school teachers, even to the detriment of actual learning. A secondary school maths teacher explained that *"there is always that pressure of completing the syllabus"* but that *"if you focus on completing the syllabus then somewhere the students get neglected."* For this reason teachers would use the *"drilling method"*, commonly referred to as rote memorization, because *"unless [students] master the concepts they will not be able to perform [in the exam]"* (Interview 11b).

Similarly, there is evidence that secondary school students are only interested in learning for exam preparation. A secondary school social science teacher described the response of his students to activities which were not directly related to their studies or exams:

> *"They [primary school students] enjoy [listening to stories]… but the secondary school students they don't respond as much as the primary school children do because to them only…in the case of relevance [to the syllabus] they got to listen, otherwise they don't respond as much as the primary children do."* (Interview 10c)

Reading between the lines what these teachers imply is that student-centred activities, in this case stories, are a) not very useful for grades, and b) not always relevant to the syllabus. Indeed this social science teacher later refers to stories as a "supplement" to a concept, i.e. an enhancement but not a main contributor to learning.

This needs to be considered within the context of assessment cultures which may not value broader cognitive or behavioural skills. If national exams reward rote memorization, classroom activities which promote a broader learning may be side-lined.

5.2.2 Rural vs. urban schools

Differences also exist between rural and urban schools. Rural secondary schools report a higher frequency of SCL than urban secondary schools across all activities, particularly in regards to pair work. Among primary schools the results are more nuanced. Students sharing ideas, students asking questions, and stories occur significantly more frequently in urban schools, while group work, drama and feedback occur significantly more frequently in rural schools.

5.2.2.1 Classroom layout

A possible explanation for this difference lies in the layout of the classrooms. According to Wulsin Jr classroom design has a profound influence on pedagogy. He argues that "well-designed space has the ability to elevate discourse, encourage creativity, and promote collaboration" and that "in order to fully engage in constructivist learning, students need… furniture that facilitates rapid reorganization of the classroom environment" (2013, p. 2). In urban schools in Karnataka space within the classrooms was often tightly constrained, particularly by fixed chairs and tables (Image 7 and Image 8). Rural schools in contrast had fewer students who more often sat on the floor to learn (Image 9 and Image 10).

When students sat on the floor they had little difficulty rearranging themselves to work in groups, or to clear space to perform drama; these were "flexible spaces" (Neill & Etheridge, 2008). A number of classrooms had circles and numbers painted on the floor to indicate where students should sit during group work. It was observed that in these classrooms there was more interaction between students than in the classrooms with desks and chairs.

Furthermore, in all the classrooms with desks and chairs, the desks were fixed in rows facing the blackboard rather than in circles where students could face each other. The layout of the classroom constrained teaching and learning to a one-way, linear flow (Neill & Etheridge, 2008). This often left no space in the classroom in which to conduct drama, and the narrow fixed desks made group work logistically difficult. In casual conversations a number of teachers voiced their frustration with inflexible classroom spaces which facilitated only traditional teaching styles.

A hypothesis requiring further research is that activities such as group work and drama, which require flexible classroom space, are less likely to occur in crowded classrooms with fixed desks and chairs. The promotion of SCL, which assumes more equal classroom relationships may also need to go hand-in-hand with the redesign of learning spaces, and a more critical reflection on what those spaces imply. The outcome of this investigation may be counter-intuitive to those who promote desks and chairs as an indication of better equipped schools.

Image 7: Students sitting at fixed desks in a primary school classroom (Karnataka, India)

Image 8: Children sitting on fixed desks in a secondary school classroom (Karnataka, India)

Image 9: Children working while sitting on the floor in an outdoor primary school classroom (Karnataka, India)

Image 10: Children working while sitting on the floor in a primary school classroom (Karnataka, India)

5.2.3 Summary

The data challenges the commonly held view of international donor assisted projects that SCL is not currently happening in Indian classrooms. Both teachers and students indicate that SCL, as operationalised by the TESS-India project, is occurring frequently. This would imply that TESS-India's mission of promoting SCL, or of operationalising it according to ten activities, may not be an appropriate one for this context.

However the data also shows that SCL happens less frequently in secondary schools and in urban schools. An analysis of the qualitative data would indicate that this is due a) to the demands of student assessments in secondary schools, and b) to classroom layout. Promoting SCL may therefore need to go hand-in-hand with broader institutional and infrastructural reforms, rather than teacher training alone.

5.3 Teacher understanding of student-centred learning

The majority of the teachers had a mediocre understanding of the relationship between SCL and student learning. As outlined in the scoring taxonomy (Appendix 5.3) a teacher who has a mediocre understanding:

"Recognizes the activity mentioned. Offers an example of how the activity might be used in the classroom, referring to classroom context. Has a general understand of how the activity might contribute towards learning outcomes, which includes skill development e.g. 'When students discuss together their communication skills improve'"

This is in contrast to teachers who had a very good understanding:

"Recognizes the activity mentioned. Offers a specific example of how that activity is used in the classroom, giving procedural details of what would be involved. Has a sophisticated understanding of how and why the activity contributes towards both learning outcomes and skill development, relating this to specific needs/barriers faced in the classroom, e.g. 'In group work the slow student will not feel shy about asking the strong student for help and so the slow student will learn from the discussion. The strong student will try to learn more because she feels a sense of responsibility, and so her leadership skills will improve.'"

Examples of mediocre and very good answers selected from the teacher interviews can be found in Appendix 10.

Pearson's correlations showed that in primary schools teachers are more likely to use student-centred activities if they understand the relationship between SCL and student learning; however secondary school teachers are more likely to use student-centred activities if they don't understand the relationship between SCL and student learning. This validates Assumption 2 for secondary schools but undermines it for primary schools. It also raises the question: Can we expect teachers to facilitate quality SCL if they don't have a sophisticated understanding of the relationship between SCL and learning? Simply encouraging the use of these activities without deepening teachers' conceptual pedagogy runs the risk of making only superficial changes to the classroom dynamics.

As discussed in Chapter 2, this is a problem that has been noticed by numerous authors. O'Sullivan suggests that Namibian teachers did not understand the meaning of student-centred education and thus

failed to implement it (2004, p. 594). Omovea (2012) similarly noticed that regardless of their attitudes to student-centred instruction, Kazakh teachers found it difficult to describe the learning theory behind it (2012, p. 175). Indeed Saigal argues that in the Indian context, teachers' professional knowledge has been largely overlooked, positioned as irrelevant by policy and program interventions (2012, p. 1010). The reflective practitioner issue is of no particular concern to the modernizing state, confronted with problems of providing very rapidly mass elementary education on the basis of scarce resources (Cowen, 1995, p. 21).

From a thematic analysis two themes emerge which help to explain why teachers have a mediocre understanding of SCL, both relating to teacher beliefs. The first relates to teachers epistemological understandings and their beliefs about learning, which in turn impact ideas of power and classroom hierarchy. The second relates to teacher beliefs about the purposes of SCL, namely as a 'softer' form of teaching which mitigates the effects that student poverty has on learning.

5.3.1 Teachers' epistemological beliefs

For many teachers, learning equated to memorisation. Many SCL activities were valued in their ability to help students memorise content, as opposed to helping them apply or explore that content.

In this regard knowledge was understood as being largely fixed and held by the teacher who occupied a position of authority and respect in the classroom. As one secondary-school maths teacher explained:

> *"The teacher points out certain things, they [the students] are happy to learn things. Students follow literally follow the teacher's words and in that regard when the teacher says something by default they have to do it. That is the kind of ultimate respect they have towards the teacher."* (Interview 6c)

Drama and story-telling were mentioned most frequently in relation to memorization. Teachers understood that association with characters and objects was a helpful strategy in children's information retention.

A number of extracts from the interviews illustrate this:

> *"Conducted a drama and role-play on solar system in science and the students were involved…A good teaching technique because it helps them to remember and stays in their memory for a longer time."* (Interview 12b)

> *"They will also try to associate themselves with the character so when they are writing when it comes to assessment they are able to remember better because the learning that has happened has been effective."* (Interview 11c)

> *"When a student plays a particular role in the play then his association with that role is stronger. He remembers it for a longer time because he has been that character, that particular role and the most important thing that he remembers is the dialogues and the concepts."* (Interview 6b)

In relation to collecting materials from outside the classroom a teacher explained, *"they remember it better for a longer time because they have seen it so it will become a part of their learning"* (Interview 11c).

In regards to feedback a teacher explained, *"next time they will tell us 'you told me that time these things, so this time I did that' so they are able to remember."* (Interview 5a)

In regards to the teacher asking questions, *"The teacher asks what is the learning of the previous class by posing questions to students so she can know whether they are able to remember it"* (Interview 5a).

When a student asks questions, *"they remember what the teacher answers so when the question appears in the test then they remember what the teacher says and this helps recalling and adds to the learning"* (Interview 17b).

Similarly, knowledge was understood as being a fixed entity which is passed from teacher to student or in some cases from student to student. This was strongly implied when the teachers spoke about group work and pair work. While collaboration and leadership skills were at times mentioned, it was the ability of stronger students to act as substitute teachers for the weaker students, and to "tell the answer" that was most prominently spoken about.

> *"The good ones already know, they know what I'm telling, the little ones they get interacting with them and they know what is."* (Interview 5a)
>
> *"If a student is unable to understand the concept he will definitely take the help of a student who is intelligent and ask him to help him out."* (Interview 7c)

The teachers understanding of knowledge and learning influenced the ways in which SCL activities were used and facilitated. Group work, for example, was not an opportunity for students to explore new ideas as equals since teachers believed that learning could only take place through the transmission of knowledge from someone more knowledgeable than the student. The student herself has very little role in the construction of her own understanding. This is reflective of Rowell's (1995) experiences in Namibia, where he describes the teachers' views of knowledge as being fixed, objective, and detached from the learner, and teaching therefore being perceived as the transmission of knowledge.

It also suggests that "progressive" classroom practices do not necessarily imply progressive or constructivist attitudes. As Edwards and Mercer (1987) have argued, when there is a conflict between espoused beliefs and perceived external requirements, teachers' actual practices are likely to be swayed by the latter. Group-work, drama, story-telling etc., may be occurring in a classroom while knowledge and power are still strictly held by the teacher. This is reflected in the evaluations of numerous case studies which find that teachers may ask questions yet only respond by indicating whether the student is correct or incorrect (Clarke, 2003), or where children sit in groups yet only interact with the teacher (Barrow, 2007).

These explanations for teachers' limited understanding of SCL have two implications for TESS-India. The first is that promoting SCL requires more than training teachers in the mechanics of the process, i.e. training teachers how to facilitate group work, drama, etc. As Guthrie explains, "culture is a prior condition for classroom change" without which "progressive classroom interventions are unlikely to survive" (2011, p. 17). Training is required which promotes an epistemological shift in the traditional

mind-set, and which encourages teachers to think of knowledge as constructed through experiences, and students as people whose ideas are valuable sources of insight. It also requires training which promotes the value of teachers as facilitators of experience and capacity development, rather than sources of authority. If TESS-India cannot provide training which shifts attitudes, it is unlikely that the underlying processes of learning in Indian classrooms will change.

5.3.2 Teachers' beliefs about the purpose of student-centred learning: Student poverty

A recurring theme in teacher interviews was student poverty. As one teacher explained, "Students come from those families… who live in a shed with a temporary structure where the labour class live" (Interview 5c). Throughout the interviews it became clear that SCL activities were often used and thought about as a way to mitigate the multiple effects of student poverty, and to involve students who would otherwise be marginalized by traditional teaching approaches. In this regard teachers believed SCL to be a weaker form of teaching, necessary for weaker students who do not have the concentration, attendance rates, language abilities or family backgrounds necessary to learn from more "advanced" styles of teaching. This belief that SCL is "proto-learning" helps to explain why so many teachers lacked a sophisticated understanding of how SCL contributes to learning. In this section teachers' beliefs about SCL are discussed in relation to the different ways in which poverty manifests itself in Indian classrooms.

5.3.2.1 Student engagement

The challenge of maintaining student engagement, interest, and curiosity was mentioned by almost every teacher as a reason why SCL was useful. First generation learners, whose families often lived in temporary accommodation and moved frequently, were prone to missing school. Teachers noted the importance of engaging, enjoyable classes as a way to motivate students to attend and pay attention. One teacher explained, "Only when you use these activities it makes an appeal. They will be able to enjoy that because otherwise it may not be so effective" (Interview 13a). Another teacher also identified that, "just a lesson will not make it interesting, instead you narrate it in the form of a story then it just catches attention so they enjoy that" (Interview 6a).

Secondary school teachers similarly argued that this lack of engagement in study was a result of students' impatience to financially provide for their families. Activities however could be used to keep them in school:

> *"Students say 'I'll not continue learning, I'll go for a job, what is the use of these things?' … Most of the students are coming from the lower middle class so they want a job... [They say] 'in that case why should I learn these things?' Because they think that mathematics and science are supposed to be the difficult subjects. [They say], 'I don't want all those things in my life.' So in that time some of these [SCL] activities will definitely help them. In that way activities are useful I think."* (Interview 5c)

Furthermore, a primary school teacher explained that first generation learners struggled when adapting to a classroom setting. For this reason more stories would be told in the month of June because the students were coming from their homes and "must adjust to the school environment." The

practice of sharing stories was familiar to young children, helping them to build friendships and engage in the classroom dynamics.

5.3.2.2 Diverse abilities

Diverse abilities within a single classroom, resulting from the fact that many poor students did not frequently attend class, were a further challenge. A school leader explained:

> *"Children come from poor families... People don't settle in one place; they keep moving depending on place of work so… students are not regular. Today the student turns up but the next day he is not available and that means whatever learning happens it is only momentary."* (Interview 2b)

This challenge of diverse abilities was often mentioned in conjunction with the value of pair work and group work. Stronger students were routinely paired with weaker students, and encouraged to become second teachers. "If some student is facing difficulty we ask another student to help them with his problem" (Interview 5b) explains a teacher. "If a better student [works] with an average student he goes on explaining the things which means he gets confidence in that subject and mutually this student is quite helped by his help." (Interview 5b) Similarly a teacher from a small rural primary school describes how she selects the brightest student and ensures that this girl learns properly so that she can help the others; "Whatever she learns the other students make sure they learn at least half" (Interview 13b). Group work and pair work were therefore seen as having value for catching-up and engaging weaker students.

A further challenge for which SCL was deemed helpful was that of diverse languages; "Nepalese are here, Kannada people are there, so many different languages" (Interview 7a). This diversity meant that the language of instruction was not always familiar to all the children in the classroom. Once again group work and pair work were used by the teachers to overcome the language barrier; "Whenever the teacher uses a particular language the students might not be able to understand it completely but then there is a paired discussion that happens, they are more comfortable discussing some concepts" (Interview 5c). Capable students were used to translate what the teacher was saying into more familiar language.

Drama was also used for this purpose; through props and body language concepts could be communicated that transcended language barrier. As one teacher explained, "those who are not able to communicate… they will listen to those who are narrating or performing and they will know through the performance they will be able to understand better." (Interview 9c)

5.3.2.3 Personal problems

Students' backgrounds also resulted in personal problems that at times affected the students' school work. Teachers highlighted the importance of group work in facilitating systems of peer support in the classroom. A secondary school teacher explained:

> *"So the problems like the parents; the father will drink and scold or she may get work in the home so because of that she can't do homework. Problems like that can't be shared in the class openly so problems like that will be shared in the group… [student group] leader will say the real exact problem to the teachers so she can coordinate the problem."* (Interview 15a)

These examples highlight that Indian teachers had very different beliefs about the value of SCL than those described in the academic literature. They believed that SCL could mitigate specific contextual issues relating to student poverty, such as absenteeism, low motivation, multi-lingual classrooms, and a broad range of student abilities. Rather than viewed as an innovative and modern pedagogy, teachers implied that SCL was "proto-learning"; bridging students normative reality outside the classroom, as a way to teach poorly socialised students who were not yet ready for "real," e.g. traditional teaching methods. This is also reflected in interviews with secondary teachers who described SCL as "supplementary".

5.4 Summary

Data indicates that teachers lack a sophisticated academic understanding of SCL. Despite this, teacher understanding is positively correlated with the frequency of student-centred activities in primary schools, but negatively correlated in secondary schools. This means that secondary school teachers are using SCL activities despite not being able to articulate how SCL activities contribute to student learning.

A thematic analysis also indicates that teachers lack a sophisticated understanding of SCL due to their beliefs a) regarding the fixed nature of knowledge, and b) regarding SCL as a 'softer' form of teaching necessary for weaker students. A number of authors have discussed the importance of considering teachers' pre-existing beliefs when promoting new pedagogies, especially since they seem to heavily influence classroom practice and be resistant to change (Bird, Anderson, & Swidler, 1993; Grossman, Wilson, & Shulman, 1989; Powell, 1992; Wubbels, 1993). Feiman-Nemser and Buchmann (1985) argue that the examination of beliefs and how they relate to practice is crucial to growth and change without which, as Goodman (1986) suggests, teachers are likely to adopt practices they remember from their own experiences as pupils.

This implies that successful pedagogical reform requires not only practical instruction in how to facilitate activities but also an epistemological and cultural shift in the mind-set of the teachers. Without such a shift teachers in Karnataka are likely to continue going through the motions of SCL without ever understanding what TESS-India hopes to achieve.

5.5 Assessment results

Observations were made from the video recordings of the assessments which help to understand and contextualize students' scores. These observations fall into two sections, the first relating to secondary school students, and the second relating to teacher trainees.

5.5.1 Secondary school assessment observations

During this test students were marked on their ability to work in groups, to calculate the volume of five cuboids, and to calculate the surface area of five cuboids. The results from this task were strikingly poor. 9 out of 23 groups achieved a very low score, and 13 out of 23 groups achieved a low score for calculating surface area of the cuboids. 8 out of 23 groups achieved a very low score, and 8 out of 23 groups achieved a low score for calculating the volume of the cuboids. This means that 9

groups could not even attempt to calculate the surface area of a single cuboid, 8 groups could not attempt to calculate the volume of a single cuboid, 13 groups could identify the relevant vertices and measured them but then didn't know how to calculate the volume of a single cuboid using these measurements, and 8 groups could identify the relevant vertices and measure them but then did not know how to calculate the surface area of a single cuboid. Furthermore, the students who did attempt the necessary calculations did not have the basic mathematical ability to accurately do so (see Photograph 11).

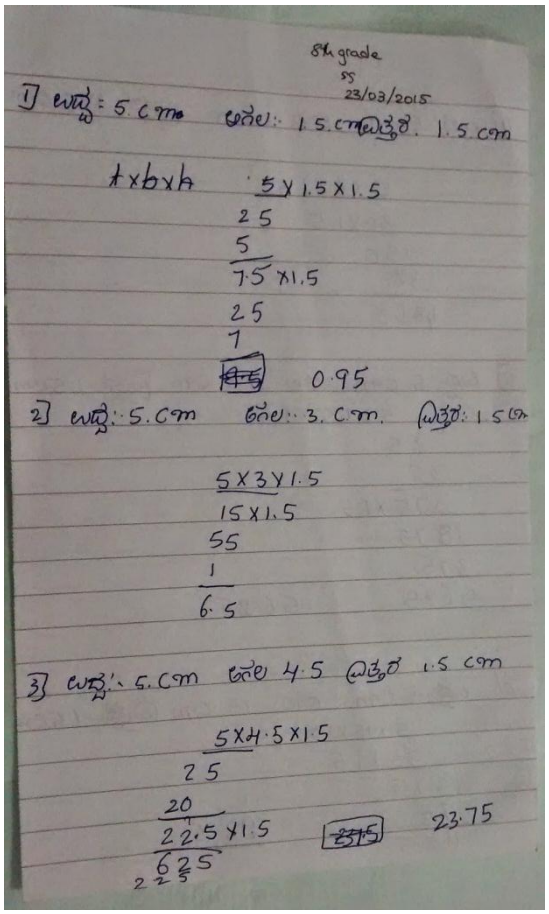


Image 11: Example of a secondary school group's attempt to calculate the volume of a cuboid, indicating their inability to do basic multiplication.

A notable observation was the way in which the task was discussed both between the students and with the PR. Student discussions indicated that mathematics was conceived as a series of formulas to be memorized and recalled, rather than a conceptual approach to understanding three-dimensional space.

Common statements included:

> *"They don't know the formula for volume."*
>
> *"They took the formula, they multiplied by ten."*
>
> *"They have taken a different formula."*

The primary concern in completing the assessment was remembering the formula. Many groups and teachers could remember that the formula included "length", "height" and "breadth" but few could accurately identify these dimensions. Indeed a number of students measured the length three times, mistaking it for three separate dimensions. Seven of the sixteen secondary school student groups correctly remembered the formula for the volume but mistakenly used that formula to calculate the surface area of the cuboids, even after the PR confirmed that they understood the definitions of volume and surface area. This suggests that the students were trying to remember and apply a formula that they didn't understand.

5.5.2 Teacher trainee assessment observations

In order to understand the cause of the poor results trainee mathematics and physics teachers were also asked to attempt the activity and demonstrate how they would teach volume and surface area. Seven trainee teachers attempted the task; 5 out of 7 trainee teachers received a very low score, and 2 received a low score. Once again the recalling of the correct "formula" was problematic:

> *"Based on that formula you can find the overall surface."*
>
> *"Volume… I cannot remember the formula."*

What was most surprising was their suggestion that they did not need to know how to do this basic mathematical calculation, despite it being included in the secondary syllabus. On one occasion a trainee physics teacher became frustrated at being asked to complete this task; "I want to become a physics teacher so I am not at all knowing about these things." Similarly, during casual conversations with teachers it was explained that mathematics is largely taught through the memorization of formulas which the teachers themselves do not need to remember as they are contained within teacher manuals. To be asked to complete this task without a manual was a source of confusion.

Two rather important implications can be drawn from this analysis. The first relates again to epistemological beliefs about mathematics: Since mathematics was understood as a series of memorisable formulas, it is not surprising that participants struggled to apply their knowledge to unfamiliar situations. Without an understanding of why volume is ***height x length x breadth***, the formula cannot be adapted to complete applied tasks. This then impacts teaching style; it is not feasible for a teacher to facilitate a deep exploration of a subject if she herself only has a surface level understanding. She cannot ask probing questions or design tasks that tease out the underlying processes or themes of her subject.

This relates to Shulman's concept of pedagogical content knowledge (PCK) or knowing a subject matter from a pedagogical perspective (1986). PCK allows a teacher to build bridges between his or her sophisticated understanding of the subject matter and the students' developing understanding, and to adapt instruction to the variations in ability and background presented by the students. What a qualitative analysis of the teacher trainee activity would indicate however is that teachers' low understanding of mathematics prohibits them from developing PCK.

The second implication regards the limited potential of teaching style to improve cognitive student learning outcomes. The emphasis on quality education has placed focus on pedagogy and drawn attention to the failure of traditional, lecture style approaches. As a result, teacher training in many developing countries, including India, has shifted from a focus on content to a focus on teaching style.

What data from this study indicates however is that content and pedagogy are intertwined. A number of authors (Akyeampong, Lussier, Pryor, & Westbrook, 2003; J, Akyeampong, J, & K, 2012; Bhattacharjea, Wadhwa, & Banerji, 2011) corroborate this point, when they highlight the lack of teacher subject knowledge in developing countries as a key barrier to effective teaching. Mathematics teachers who lack basic mathematics skills are unlikely to provide quality mathematics education regardless of their teaching approach. In the Indian context time spent on training teachers may therefore be better spent on developing these basic skills.

5.5.3 Summary

Results from the secondary school group mathematics tests found that students' basic mathematical ability was very poor. Video analysis indicated that this might because mathematical knowledge is conceived of as fixed formulas to be memorized. This meant that students were in a weak position to apply that knowledge, and that teachers were unlikely to be able to facilitate SCL around formulas that they didn't understand. Again this points to the importance of changing epistemological beliefs within Indian educational culture before SCL can take root.

A further point of concern was teachers' basic mathematical skills, which calls into question the value of pedagogical training. Data from this study would indicate that the development of teacher content knowledge is a key priority within India.

5.6 Student-centred learning and student learning outcomes

The relationship between SCL and student learning outcomes differ between primary school classrooms and secondary school classrooms, as well as between different activities. Overall, the frequency of student-centred activities had a moderate positive correlation with learning outcomes for primary school students, and no correlation with learning outcomes for secondary school students. For primary school students the frequency of student-centred activities was most strongly correlated with students' abilities to make arrangements with the coins and envelopes and least correlated with their group work skills. Drama and feedback were particularly strong predictors of overall learning achievement. For secondary schools, however, a number of activities had a negative correlation with learning outcomes. Most notably, group work had a strong negative correlation with students' group skills, as did listening to students' ideas and drama. The frequency of student-centred activities was most strongly correlated with students' abilities to calculate surface area, was negatively correlated with group skills, and had no correlation with their ability calculate volume.

What is striking about these findings is the inability of SCL activities to predict behavioural outcomes, such as the ability to work in groups. This is contrary to the literature on SCL, for example a meta-analysis by Cornelius-White (2007) which indicated that SCL has a positive impact on socio-emotional development, qualitative observations reported by NCERT (2011) which point to better cooperation, and a study by Ross (1995) which indicated that students became better at helping each other learn.

5.6.1 Discrepancy between primary school and secondary school correlations

On obvious reason why the frequency of student-centred activities are positively correlated for primary schools but not correlated with secondary schools is that the teachers who are most frequently using student-centred activities in primary schools are more likely to have a very good understanding of SCL, whereas teachers who are most frequently using student-centred activities in secondary schools have a very poor understanding of SCL.

However interview analysis offers two further suggestions as to the discrepancy between primary school and secondary school correlations. The first is in relation to the bigger impact of poverty among primary school students which make SCL more valuable in that context. The second is in relation to the demands of the curriculum and the style of assessment. These considerations are addressed separately below.

5.6.1.1 Needs of the classroom

As discussed in section 5.3.2, problems associated with student poverty were a strong motivating factor in teacher decisions to facilitate SCL. What was noticeable from the interviews, however, was that while both primary school and secondary school teachers spoke about the purpose of SCL in similar ways, primary school teachers spent more time describing the effects of poverty.

Part of this may be explained simply by the secondary school students' greater experience within the school setting during which time they have become accustomed to expectations placed on them. It also may be a feature of a selection bias within secondary schools, whereby children from marginally wealthier families pursue higher levels of education. If the needs relating to poverty in the classroom are less in secondary schools, and if the value of student-centred activities lie in their ability to mitigate student poverty, then arguably their value is less important in secondary schools where student poverty is less of a barrier to learning. This might explain the weak correlation between SCL and student-learning outcomes in secondary schools.

If SCL is perceived as a way of mitigating poverty in the classroom, then it will be facilitated accordingly, and will thus have less impact on classrooms in which poverty is not so problematic.

5.6.1.2 Student assessments

In Section 5.2.1.2 the pressures of student assessments were discussed. It was proposed that the reduced frequency at which SCL was used in secondary schools was as a result of a content heavy syllabus that was better suited to the "drilling method" than to the TESS-India activities. A corollary of this proposal is that the pressure of student assessments also affects the quality of how they are facilitated by the teacher and the seriousness with which they are treated by the students. Even if SCL activities are happening, they may not actually be integrated into the "real" teaching being done in the classroom. They may not be understood by the students as meaningfully contributing to their educational success, and as a result the facilitation of these activities may be of a lower quality than in primary schools. It is hypothesised that this lower quality of facilitation might explain the weaker relationship between SCL and learning outcomes in secondary schools.

5.7 Chapter Summary

In this chapter the findings presented in Chapter 4 were discussed, contextualised, and interpreted through thematic analysis of the interviews and assessments. Not only were TESS-India's assumptions brought into question, particularly Assumption 1, and in the context of secondary schools, but possible explanations were offered.

It was suggested that secondary school assessments and a content heavy curriculum prevent secondary school teachers and students from engaging in student-centred activities both frequently, and in a meaningful way. The layout of classrooms, particularly in urban areas, was hypothesised as being one reason why student-centred activities happen less frequently in urban classrooms. It was shown that teachers' beliefs, particularly in regards to epistemology and the value of SCL, differed from the academic literature and from the beliefs necessary to successfully facilitate SCL. It was also shown how students and teacher trainees' epistemological beliefs regarding mathematics prevented the application of knowledge to new situations. Finally questions were raised about the value of promoting SCL and pedagogical reform in the absence of improved teacher content knowledge.

What this finding suggests is that while SCL can have a positive correlational relationship with student learning outcomes, it is not inevitably the case. A number of barriers may need to be overcome, such as classroom infrastructure, or assessment culture. Harder changes include teachers' beliefs about the nature of knowledge, or "soft" vs. "real" teaching styles. Lastly teachers' content knowledge might need to be improved before they are able to facilitate understanding through SCL.

In regards to efforts in pedagogical reform, these findings suggest that teacher training that only focusses on the mechanics of pedagogy, as opposed to also addressing teacher beliefs, content knowledge, and broader infrastructural or institutional norms may not be effective. The way teachers teach is often intimately tied to broader cultural understandings relating to issues not obviously connected to the classrooms, such as poverty, authority, and human value. Pedagogical reform that doesn't take into consideration the broader cultural context will struggle to take root. What this discussion chapter has outlined are some of the cultural considerations that development agencies working in the Indian context should take into account.

CHAPTER SIX: CONCLUSION

6.1 Implications for the understanding and implementation of student-centred learning

This study assessed 40 classrooms, totalling over 1000 students and 42 teachers in Karnataka State (India) in order to investigate the relationship between SCL and student learning outcomes. The study posed both theoretical and policy-oriented questions, in the context of a specific case study: the TESS-India project. TESS-India aims to encourage SCL in Indian schools through the promotion of ten activities. The present inquiry is framed around the key assumptions held by TESS-India, in the design and delivery of their teacher-training materials.

Data from this study offered three findings, the first two of which undermine TESS-India's assumptions:

1) SCL occurs frequently in Indian classrooms, however more so in primary and rural schools.

2) Despite the frequency of SCL, teachers lack a sophisticated understanding of how this teaching style contributes to student learning which may have implications for the quality of facilitation. Furthermore teacher understanding of SCL is positively correlated with student-centred activity frequency in primary schools, but negatively correlated in secondary schools.

3) A higher frequency of SCL activities was positively correlated with higher learning outcomes in primary schools but not in secondary schools, and was more highly correlated with cognitive ability than behavioural outcomes.

Three key insights from the qualitative analysis of the data help to contextualize and explain these findings:

1) **Context matters:**

Both the infrastructural and cultural context in which teachers operate influence the pedagogy they use. Drama and group work for example are less likely to be performed in space-constrained classrooms with fixed desks. Student-centred activities will not be prioritized in educational cultures which have content-heavy syllabuses and in which assessments favour rote memorization. Programs which aim to promote SCL must therefore make infrastructural and institutional reforms if pedagogical reforms are to take hold.

2) **Teachers' pre-existing beliefs matter:**

Teachers' pre-existing beliefs about pedagogy and learning are likely to effect the successful implementation of projects like TESS-India. Interview analysis showed that teachers a) believed that knowledge was fixed, memorisable, and passed down from more intelligent to less intelligent people, rather than constructed through the experiences of the student. This is in direct contradiction to mainstream understandings of SCL. And b) they thought of SCL as a form of 'proto-learning', necessary to engage students who were not mature, motivated, or experienced enough to engage in teacher-centred learning. SCL was therefore necessary but not desirable, which had implications for where and when it was used.

3) **Teachers' content knowledge matters:**

The teacher trainees that were assessed showed very poor capabilities when asked to perform a simple mathematics task. This may in part explain secondary school students' poor mathematical ability. It

points to the understanding that how teachers teach is not separate from what they know. Promoting pedagogy will not be successful unless teachers also have content knowledge. Teacher training programs that do not focus on developing content knowledge may therefore have limited success.

What these findings and insights indicate is that SCL can improve learning outcomes in India but only within the appropriate intellectual, institutional, and infrastructural environments. The contribution of this thesis has been to highlight what some of the barriers to those appropriate environments might be. The findings have strong implications for international development organizations who wish to create pedagogical reform in India and other developing countries. The message that this data presents is that international development partners, in their support of interventions to improve the quality of education, must recognize pedagogical reform as a requiring a broader shift in mind-set, infrastructure, and assessment than the promotion of ten classroom activities is likely to produce.

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APPENDICIES

Appendix 1: Ethics approval and consent

Appendix 1.1: Research ethics approval

SOCIAL SCIENCES & HUMANITIES
INTER-DIVISIONAL RESEARCH ETHICS COMMITTEE

Research Services, University of Oxford, Wellington Square, Oxford OX1 2JD
Tel: +44(0)1865 616576 Fax: +44(0)1865 280467
ethics@socsci.ox.ac.uk

Co-ordinator of the SSH IDREC
Research Services

30 June 2015

Ms [Candidate name]
Department of Education

Dear [Candidate name]

Research Ethics Approval

Ref No: SSD/CUREC1A/14-SSH_C2_15_018

Title: 'The potential for success of Open Educational Resources (OERs) designed to improve student centred pedagogy in Indian classrooms.'

The above application has been considered on behalf of the Social Sciences and Humanities Inter-divisional Research Ethics Committee (IDREC) in accordance with the procedures laid down by the University for ethical approval of all research involving human participants.

I am pleased to inform you that, on the basis of the information provided to the IDREC, the proposed research has been judged as meeting appropriate ethical standards, and accordingly approval has been granted.

Should there be any subsequent changes to the project, which raise ethical issues not covered in the original application, you should submit details to the IDREC for consideration.

Yours sincerely,

Dr Liesl Osman
Acting Coordinator and Secretary SSH IDREC

cc: David Johnson

Note: The title of this dissertation changed since receiving ethics approval. The methodology and its ethical implications did not change.

Appendix 1.2: College leader ethics consent letter

Department of Education
University of Oxford
15 Norham Gardens
Oxford
UK

[DATE]

Dear College Leader,

I am writing to request your consent for the teacher trainees and teacher trainee educators at your school to participate in research that is being conducted by the University of Oxford and TESS-India, and which is being funded by the UK Department for International Development. The research is interested in understanding how teachers use different types of teaching activities in their classrooms. We will be evaluating three teacher training colleges in Karnataka. With your consent, we would like to evaluate some of the teacher trainees and teacher trainee educators in your college.

We would like to evaluate the teacher trainees and teacher trainee educators from two classes in your college. This evaluation will involve a written survey of the teaching activities that they know about (15 minutes) and an interview with four teacher trainees from each class (20 minutes each). Before we evaluate each teacher trainee and teacher educator we will ensure that they understand the research and also give their consent to participate.

The data that we collect from this research project will be kept securely and confidentially, and when it is published the results will all be anonymized. This means that nobody who reads our report will know which colleges we evaluated or will be able to identify any individual teacher trainee or teacher educator. At the end of the project a report will be written regarding the current state of teacher pedagogy in Karnataka. This report will be publicly available, and if you wish to view the report then please email me (address below) and I will be happy to send it to you.

If you have any questions, complaints or are worried about the questionnaire or interview you can tell the researcher or email me afterwards and we will help you.

All the researchers involved in this project have received ethical training. This research has been reviewed by and received ethics clearing through the University of Oxford Central University Research Ethics Committee.

I would like to emphasize that participation in this evaluation is not obligatory and that we will not evaluate teacher trainees or teacher educators in this college without your explicit consent.

Before we begin the study I would appreciate it if you could answer the following questions:

1. Do you understand the purpose of the research? Yes / No
2. If you have any questions about this research have you received satisfactory answers? Yes / No
3. Do you understand that your school's participation in this study is voluntary? Yes / No
4. Do you understand that the results of the tests and questionnaires will be anonymous?
   Yes / No

5. Do you agree for your college to take part in this research? Yes / No
6. Do you agree for your students to take part in this research? Yes / No
7. Do you understand what to do if you are worried about the research or survey? Yes / No
8. Do you understand that this research has been reviewed by and received ethics clearing through the University of Oxford Central Research Ethics Committee? Yes / No

If you have any questions please just ask.

Thank you for your time.

Yours sincerely,

[CANDIDATE NAME]

MSc Student
Department of Education, University of Oxford

[CANDIDATE EMAIL ADDRESS]

Appendix 1.3: Teacher educator ethics consent letter

Department of Education
University of Oxford
15 Norham Gardens
Oxford
UK

[DATE]

Dear teacher educator,

I am writing to invite you to take part in research which is interested in understanding how teachers use different types of teaching activities in their classrooms. We will be evaluating three teacher training colleges in Karnataka. The research is being conducted by the University of Oxford and TESS-India, and is being funded by the UK Department for International Development.

If you would like to take part in this research we will ask you to fill in a questionnaire (15 minutes). The answers that you give on this questionnaire will be confidential and will not be shown to anyone, including your college leader. They will be stored in a secure location, in a locked filing cabinet and on a password protected computer. Your name and the name of the school will not be present in any published materials. At the end of the project a report will be written regarding the current state of teacher pedagogy in Karnataka. This report will be publicly available, and if you wish to view the report then please email me (address below) and I will be happy to send it to you.

You do not have to take part in this research if you do not want to, and if you begin to do the questionnaire and then decide that you do not want to finish it you can tell the researcher, or simply not hand in the survey when it is collected. If you have any questions, complaints or are worried about the questionnaire or interview you can tell the researcher or email me afterwards and we will help you.

This research has been reviewed by and received ethics clearing through the University of Oxford Central University Research Ethics Committee.

Before we begin the questionnaire and test please answer these questions:

1. Do you understand the purpose of the research? Yes / No
2. If you have any questions about this research have you received satisfactory answers? Yes / No
3. Do you understand that you do not have to do this test and questionnaire, and do not have to finish it if you don't want to? Yes / No
4. Do you understand that the results of your test and questionnaire will be anonymous? Yes / No
5. Do you agree to take part in this research? Yes / No
6. Do you understand what to do if you are worried about the research or survey? Yes / No
7. Do you understand that this research has been reviewed by and received ethics clearing through the University of Oxford Central Research Ethics Committee?

Yours sincerely,

[CANDIDATE NAME]

MSc Student
Department of Education, University of Oxford

[CANDIDATE EMAIL ADDRESS]

Appendix 1.4: Teacher ethics consent letter

Department of Education
University of Oxford
15 Norham Gardens
Oxford
UK

[DATE]

Dear teacher,

I am writing to invite you to take part in research that is trying to understand the kinds of activities that you do with your students in the classroom. The research is being conducted by the University of Oxford and TESS-India, and is being funded by the UK Department for International Development.

If you would like to take part in this research we will ask you to fill in a questionnaire (15 minutes) and an interview (15 minutes). The answers that you give on this questionnaire and survey will be confidential and will not be shown to anyone, including your head-teacher. They will be stored in a secure location, in a locked filing cabinet and on a password protected computer. Your name and the name of the school will not be present in any published materials. At the end of the project a report will be written regarding the current state of teacher pedagogy in Karnataka. This report will be publicly available, and if you wish to view the report then please email me (address below) and I will be happy to send it to you.

You do not have to take part in this research if you do not want to, and if you begin to do the survey or questionnaire and then decide that you do not want to finish it you can tell the researcher, or simply not hand in the survey when it is collected. If you have any questions, complaints or are worried about the questionnaire or interview you can tell the researcher or email me afterwards and we will help you.

For the purposes of this research project we will also ask for your consent for the participation of your students on behalf of their parents. With your permission, we would like to ask them to fill in a questionnaire (15 minutes) and conduct a test of their learning outcomes (15 minutes). Once again their answers will be confidential, stored in a secure location and should the student not wish to participate they can stop the questionnaire or test at any point. You are under no obligation to give consent for the student's participation, particularly if you believe that it would negatively impact the student or if you have reason to believe that the student's parents would be unwilling for them to participate.

This research has been reviewed by and received ethics clearing through the University of Oxford Central University Research Ethics Committee.

Before we begin the questionnaire and test please answer these questions:

1. Do you understand the purpose of the research? Yes / No
2. If you have any questions about this research have you received satisfactory answers? Yes / No
3. Do you understand that you do not have to do this test and questionnaire, and do not have to finish it if you don't want to? Yes / No
4. Do you understand that the results of your test and questionnaire will be anonymous? Yes / No
5. Do you agree to take part in this research? Yes / No
6. Do you agree for your students to take part in this research? Yes / No
7. Do you understand what to do if you are worried about the research or survey? Yes / No
8. Do you understand that this research has been reviewed by and received ethics clearing through the University of Oxford Central Research Ethics Committee?

Yours sincerely,

[CANDIDATE NAME]

MSc Student
Department of Education, University of Oxford

[CANDIDATE EMAIL ADDRESS]

Appendix 2: Operationalisation of student-centred learning

Appendix 2.1: Operationalisation of student-centred learning in the academic literature

Table 7: Table summarising how student-centred learning has been operationalised in the academic literature

Aspect of SCL	Reference
There is an emphasis on deep learning and understanding	(Lea et al., 2003, 322)
There is increased responsibility and accountability on the part of the student	(Lea et al., 2003, 322; Brandes and Ginnis, 1986)
There is an increased sense of autonomy in the learner	(Lea et al., 2003, 322)
There is interdependence between the teacher and the learner	(Lea et al., 2003, 322)
There is mutual respect within the student-teacher relationship	(Lea et al., 2003, 322)
The relationships between the learners and learners, and the learners and teacher are more equal	(Brandes and Ginnis, 1986; Boud et al., 1985, 14)
The teacher becomes a facilitator and a resource person, rather than the bearer of knowledge	(Brandes and Ginnis, 1986)
The learner experiences confluence in his education (affective and cognitive domains flow together)	(Brandes and Ginnis, 1986)
The learner sees himself differently as a result of the learning experience	(Brandes and Ginnis, 1986)
The teacher challenges students to think and make sense of what they are doing	(Bransford et al., 2004)
The teacher challenges students to invent their own strategies for solving problems and discuss why those strategies work	(Bransford et al., 2004; Omoeva, 2012; Megahed et al., 2008)
Students are prompted to think about aspects of everyday life that are potentially relevant for further learning	(Bransford et al., 2004)
Interactive demonstrations are used	(Bransford et al., 2004)

Information is applied to the task at hand	(Omoeva, 2012)
Students collaborate in groups or in pairs	(Veenam et al., 2005; Omoeva, 2012; Westbrook et al., 2013)
Open-ended questions are used to develop a deeper level of learning	(Wells, 1999; Westbrook et al., 2013)
Participants become personally/actively involved in the activities/learning	(Remnet, 1989, 6; Lea et al., 2003, 322; Brandes and Ginnis, 1986; Omoeva, 2012)
There is physical movement, not just sitting	(Burnard, 1989; Omoeva, 2012)
Actions are reflected upon, often through discussion	(Burnard, 1989; Lea et al., 2003, 322; Omoeva, 2012)
There is unhindered, open dialogue with the teacher on the subject matter material that the student is learning	(Omoeva, 2012)
The learning encounter starts with the students ideas and concepts rather than the teacher's or the book	(Burnard, 1989; Arkorful, 2012; Barrett, 2007; Childs et al., 2012; Epstein and Yuthas, 2012, Nyamwe and Mtetwa, 2006)
Personal experiences and personal growth are valued in the classroom	(Burnard, 1989)
Assessment is considered to be a learning experience that the students can learn to do on their own	(Burnard, 1989)
Students are urged to fully understand the content through the analysis of primary sources of the material and/or experiences with the material	(Burnard, 1989)
Emphasis is placed on student's ability to justify or explain a subject rather than recite an expert's testimony	(Burnard, 1989)
Conscious observation of natural phenomena and application of acquired knowledge to their understanding	(Omoeva, 2012)
The application of the scientific method through generating hypotheses and their testing in an experimental setting	(Omoeva, 2012)

Appendix 2.2: TESS-India's operationalisation of student-centred learning

Table 8: Table summarising TESS-India's "ten key resources" and their purpose

Resource	Purpose
Assessing progress and performance	The purpose of assessment is to help students understand what they are expected to learn, know where they are now with that learning, understand how they can make progress, and know when they have reached the goals and expected outcomes. Teachers are encouraged to use assessment to help design lessons that are appropriate for their students.
Monitoring and giving feedback	The purpose of monitoring and giving feedback is to help students to be more aware of their performance, to be able to predict grades, and to take more responsibility for their learning. It also helps the teacher to decide how to interact with the student; whether to praise, challenge, prompt, or question.
Storytelling, songs, role play and drama	Stories and role-play are useful for creating an entertaining and stimulating environment; they help to introduce new ideas, explore feelings, and think through problems in a context that is non-threatening. Teachers are reminded to make eye contact and engage all the students through prompts. Drama is useful for developing self-confidence and motivation, while songs help students to feel included.
Using local resources	Using local resources helps to create links with the local community, demonstrate the value of the local area, stimulate students to see the richness and diversity of their environment, and work towards a holistic approach to student learning where learning occurs both inside and outside the school.
Using pair work	Pair work is useful for helping students to work through new skills and concepts. It is about involving all and it works best when teachers plan specific tasks and establish routines to manage pairs so that all students are included, learning and progressing.
Using group work	Group work can be an effective way of motivating students to learn by encouraging them to think, communicate, exchange ideas and thoughts, and make decisions. It helps students to teach and learn from others. It involves working on and contributing to a shared learning task with a clear objective. Thus group work has to be well-planned and purposeful.
Planning lessons	Planning helps to make lessons clear and well-timed so that students can be

	active and interested. It also includes in-built flexibility so that teachers can respond to what they find out about their students' learning as they teach.
Using questioning to promote thinking	Questioning is generally used to find out what students know, so it is important in assessing their progress. Questions can also be used to inspire, extend students' thinking skills and develop enquiring minds. Open-ended questions encourage students to think beyond textbook-based literal answers, thus eliciting a range of responses.
Talk for learning	By talking about the ideas being learned, those ideas are explored and reasoning is developed and organized. This involves planning lessons so that students can talk more and learn more in a way that makes connections with their prior experience. In particular, students should be encouraged to ask questions themselves.
Involving all	This means that the diversity in culture and in society is reflected in the classroom, and that differences become a vehicle for learning more about each other and the world beyond our own experience.

Appendix 3: School data and interview codes

Table 9: Table showing demongraphic data and interview codes relating to the fifteen schools included in the sample

School number	District	Area	Infrastructure	School type	Grade	Number of students	Number of groups	Number of teachers	Interview code
1	Bangalore South	Rural	Poor	Primary	4th, 5th	80	2	2	1a, 1b
2	Bangalore South	Urban	Good	Primary	4th, 5th, 6th	68	3	4	2a, 2b, 2c
3	Bangalore South	Urban	Poor	Secondary	8th, 9th, 10th	98	3	3	3a, 3b, 3c
4	Bangalore South	Rural	Good	Primary	4th, 5th, 6th	98	3	3	4a, 4b
5	Bangalore South	Urban	Poor	Secondary	9th, 10th	100	2	3	5a, 5b, 5c
6	Bangalore Rural	Urban	Poor	Primary	4th, 5th, 6th	52	3	3	6a, 6b, 6c
7	Bangalore Rural	Rural	Good	Primary	4th, 5th, 6th	30	3	3	7a, 7b, 7c
8	Bangalore Rural	Urban	Good	Secondary	9a, 9b, 9c	87	3	3	8a, 8b, 8c
9	Bangalore Rural	Urban	Poor	Primary	4th, 5th, 6th	86	3	3	9a, 9b, 9c
10	Bangalore Rural	Rural	Poor	Secondary	8th, 9th, 10th	104	3	3	10a, 10b, 10c
11	Ramanagara	Urban	Good	Secondary	8th, 9th	76	3	3	11a,11b,11c
12	Ramanagara	Urban	Good	Primary	5th, 6th	48	2	2	12a,12b
13	Ramanagara	Rural	Poor	Primary	4th, 5th	13	2	2	13a, 13b
14	Ramanagara	Rural	Good	Primary	4th, 5th, 6th	23	2	2	14a. 14b
15	Ramanagara	Rural	Good	Secondary	8th, 9th, 10th	79	3	3	15a, 15b, 15c

Appendix 4: Research instruments

Appendix 4.1: Primary school student questionnaire

1. Look at the picture below. It shows children working in groups to learn.

How often do you work in groups to learn?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

2. Look at the picture below. It shows children working with another classmate to learn.

How often do you work with another person to learn?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

3. Look at the picture below. It shows students sharing ideas in a class.

How often do you share ideas in class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

4. Look at the picture below. It shows a teacher listening to a student's ideas.

How often does your teacher listen to your ideas?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

5. Look at the picture below. It shows students collecting materials to use for learning.

How often do you collect materials to use for learning?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

6. Look at the picture below. It shows some students acting in front of the class to help them learn.

How often do you act in class to learn?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

7. Look at the picture below. It shows a teacher giving a student feedback on her work.

How often does your teacher give you feedback on your work?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

8. Look at the picture below. It shows a teacher asking questions to the class.

How often does your teacher ask questions in your class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

9. Look at the picture below. It shows a student asking a question to a teacher about their school work.

How often do you ask questions about your school work in your class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

10. Look at the picture below. It shows a teacher using songs and stories to help her students learn.

How often does your teacher use songs and stories to help you learn?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

Appendix 4.2: Teacher questionnaire

1. Look at the picture below. It shows children working in groups to learn.

How often do students in your class work in groups to learn?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

2. Look at the picture below. It shows children working with another classmate to learn.

How often do students in your class work with another person to learn?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

3. Look at the picture below. It shows students sharing ideas in a class.

How often do students in your class share ideas?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

4. Look at the picture below. It shows a teacher listening to a student's ideas.

How often do you listen to your students ideas?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

5. Look at the picture below. It shows students collecting materials to use for learning.

How often do your students collect materials to use for learning?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

6. Look at the picture below. It shows some students acting in front of the class to help them learn.

How often do your students act in class to learn?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

7. Look at the picture below. It shows a teacher giving a student feedback on her work.

How often do you give feedback on your students work?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

8. Look at the picture below. It shows a teacher asking questions to the class.

How often do you ask questions in your class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

9. Look at the picture below. It shows a student asking a question to a teacher about their school work.

How often do your students ask you questions about their school work in your class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

10. Look at the picture below. It shows a teacher using songs and stories to help her students learn.

How often do you use songs and stories to help your students learn?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

Appendix 4.3: Secondary school student questionnaire

1. Look at the picture below. It shows children working in groups to learn.

How often do you work in groups to learn Science?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often do you work in groups to learn Maths?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often do you work in groups to learn English?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

2. Look at the picture below. It shows children working with another classmate to learn.

How often do you work with another person to learn Science?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often do you work with another person to learn Maths?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often do you work with another person to learn English?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

3. Look at the picture below. It shows students sharing ideas in a class.

How often do you share ideas in Science class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often do you share ideas in Maths class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often do you share ideas in English class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

4. Look at the picture below. It shows a teacher listening to a student's ideas.

How often does your teacher listen to your ideas in Science class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often does your teacher listen to your ideas in Maths class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often does your teacher listen to your ideas in English class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

5. Look at the picture below. It shows students collecting materials to use for learning.

How often do you collect materials to use for learning in Science class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often do you collect materials to use for learning in Maths class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often do you collect materials to use for learning in English class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

6. Look at the picture below. It shows some students acting in front of the class to help them learn.

How often do you act in Science class to learn?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often do you act in Maths class to learn?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often do you act in English class to learn?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

7. Look at the picture below. It shows a teacher giving a student feedback on her work.

How often does your teacher give you feedback on your work in Science class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often does your teacher give you feedback on your work in Maths class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often does your teacher give you feedback on your work in English class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

8. Look at the picture below. It shows a teacher asking questions to the class.

How often does your teacher ask you questions in your Science class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often does your teacher ask you questions in your Maths class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often does your teacher ask you questions in your English class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

9. Look at the picture below. It shows a student asking a question to a teacher about their school work.

How often do you ask questions about your school work in your Science class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often do you ask questions about your school work in your Maths class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often do you ask questions about your school work in your English class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

10. Look at the picture below. It shows a teacher using songs and stories to help her students learn.

How often do you sing songs or listen to stories in your Science class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often do you sing songs or listen to stories in your Maths class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

How often do you sing songs or listen to stories in your English class?

- ☐ Every day
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Never

Appendix 4.4: Teacher interview schedule

Question 1:

This picture shows children working in groups to learn. Do the students in your class ever work in groups to learn? Can you give an example? Why is it important that students work in groups to learn?

Question 2:

This picture shows children working in pairs to learn. Do the students in your class ever work in pairs to learn? Can you give an example? Why is it important that students work in pairs to learn?

Question 3:

This picture shows a child asking his teacher a question. Do your students ever ask you questions? Can you give an example? Why is it important that students ask questions to learn?

Question 4:

This picture shows a teacher asking questions to his students. Do you ever ask questions to your students? Can you give an example? Why is it important to ask your students questions?

Question 5:

This picture shows a teacher telling stories. Do you ever tell your students stories? Can you give an example? Why is it important to tell your students stories?

Question 6:

This picture shows a teacher doing drama with her students. Do you ever do drama with your students? Can you give an example? Why is it important to do drama with your students?

Question 7:

This picture shows students collecting materials from outside the classroom to use for learning inside the classroom. Do your students ever collect materials from outside the classroom? Can you give an example? Why is it important that your students collect materials from outside the classroom to use when learning inside the classroom?

Question 8:

This picture shows a teacher giving feedback to her students to help them learn. Do you ever give feedback to your students? Can you give an example? Why is it important to give feedback to your students to help them learn?

Appendix 5: Marking taxonomies

Appendix 5.1: Primary school assessment taxonomy

Table 10: Table showing the primary school assessment taxonomy

Student Level	Group skills	Making arrangements	Recording arrangements
Very low (1)	Students do not talk or interact with one another. Most students do not understand what is happening. There is no relationship between the arrangements and what the student records.	No recognizable patterns are made with the coins.	There is no systematic recording of the coin arrangements.
Low (2)	Minimum level of communication or coordination. Students either attempt the task on their own, or are dominated by one student. Little relationship between the arrangements and what the student records. Few students are involved.	Basic patterns are made. Patterns all resemble each other. No engagement with the envelopes or spatial positioning of the coins.	There is no visual representation of the coin arrangements. Instead students use words or numbers.
Medium (3)	Students have a basic discussion regarding how they will arrange the coins. They work together to make patterns. The student who is recording is given time to record the arrangements. Most students are involved	A relatively diverse range of coin patterns are made. There is little engagement with the envelopes or spatial positioning of the coins.	Students use lines to represent the coin arrangements. There is no indication of the number of coins and no precise recording of their spatial positioning in relation to each other or the envelopes.
High (4)	Students discuss both the shape and positioning of the coin arrangements. They build on each other's ideas to make patterns. Students check on how the recording is being done and actively support the student who is doing the recording. All students are involved.	A diverse range of coin patterns are made. There is engagement with the envelopes or spatial positioning of the coins.	Students use circles to represent the coin arrangements. They accurately indicate the number of coins and precisely record their spatial positioning in relation to each other.
Very high (5)	Students discuss in depth both the shape and positioning of the coin	A very diverse range of patterns are made with the coins, with a diverse range	Students use circles to represent the coin arrangements. They

	arrangements. They build on each other's ideas to make patterns. Students discuss the most effective way to record their arrangements. They actively support the student who is recording the patterns. All students are completely involved.	of spatial positioning using the envelopes and available floor space.	accurately indicate the number of coins and precisely record their spatial positioning in relation to each other. They also indicate the coin's positioning in relation to the envelopes.

Appendix 5.2: Secondary school assessment taxonomy

Table 11: Table showing the secondary school assessment taxonomy

Student Level	Group skills	Content knowledge (Volume)	Content knowledge (surface area)
Very low (1)	Students do not talk or interact with one another. Most students do not understand what is happening.	Do not know how to calculate the volume.	Do not know how to calculate the surface area.
Low (2)	Minimum level of communication or coordination. Students either attempt the task on their own, or are dominated by one student. Multiple students are doing the same task. Some students do not understand what is happening.	Identify the measurements that are required to calculate the surface area, e.g length, height and width. Uses the ruler to accurately measure the appropriate vertices. Incorrectly calculates the surface area of the cuboids placed together.	Identify the measurements that are required to calculate the surface area, e.g length and width of each of the six sides. Uses the ruler to accurately measure the appropriate vertices. Incorrectly identify the formula for calculating the surface area, or do incorrect calculations.
Medium (3)	Students work together to check each other's work or to divide the tasks between them. Most students understand the task and what is required. Most students do not fully understand the answer.	Identify the measurements that are required to calculate the volume, e.g length and width of each of the six sides. Uses the ruler to accurately measure the appropriate vertices. Selects the correct formula to calculate the surface area. Accurately calculate the surface area of one side, using correct measurements, e.g. cm^2	Identify the measurements that are required to calculate the surface area, e.g length and width of each of the six sides. Uses the ruler to accurately measure the appropriate vertices. Selects the correct formula to calculate the surface area. Accurately calculate the surface area of one side, using correct measurements, e.g. cm^2 Incorrectly calculates the surface area of the cuboids placed together.
High (4)	Students discuss the conceptual nature of the task and its requirements. They effectively divide the tasks between them and check each other's work. The strong students direct the weak students. Most students understand the conceptual nature of the task. Most students understand/are satisfied with the answer.	Identify the measurements that are required to calculate the volume, e.g length, width and height of the cuboid. Use the ruler to accurately measure the appropriate vertices. Select the correct formula to calculate the volume. Accurately calculate the volume of one cuboid using correct measurements, e.g.	Identify the measurements that are required to calculate the surface area, e.g length and width of each of the six sides. Use the ruler to accurately measure the appropriate vertices. Select the correct formula to calculate the surface area. Accurately calculate the surface area of one side,

		cm^3. Recognize that the volume of two cubes placed together is the volume of one cuboid doubled. Accurately calculate the volume of two/three/four/five cuboids placed together.	using correct measurements, e.g. cm^2 Accurately calculate the surface area of one cube by adding the surface area of each side. Recognize that the surface area of two cuboids placed together is not the same as the surface area of one cuboid doubled. Identify the measurements that are required to calculate the surface area of two/three/four/five cuboids placed together. Accurately calculate the surface area of two/three/ four/five cuboids placed together.
Very high (5)	Students have an in depth discussion about the conceptual nature of the activity and its requirement, which in turn leads to an identification of the necessary tasks and an effective division of those tasks among the group. Strong students explain the nature of the task to weak students so that all students understand the conceptual nature of the activity and its requirements. Students check each other's work. All students understand and are satisfied with the answer.	Identify the measurements that are required to calculate the volume, e.g length, width and height of the cuboid. Use the ruler to accurately measure the appropriate vertices. Select the correct formula to calculate the volume. Accurately calculate the volume of one cuboid using correct measurements, e.g. cm^3. Recognize that the volume of two cubes placed together is the volume of one cuboid doubled. Accurately calculate the volume of two/three/four/five cuboids placed together. Recognize the pattern in the increase of volume as the number of cuboids added increases. Accurately predict the volume of ten cuboids placed together.	Identify the measurements that are required to calculate the surface area, e.g length and width of each of the six sides. Use the ruler to accurately measure the appropriate vertices. Select the correct formula to calculate the surface area. Accurately calculate the surface area of one side, using correct measurements, e.g. cm^2 Accurately calculate the surface area of one cube by adding the surface area of each side. Recognize that the surface area of two cuboids placed together is not the same as the surface area of one cuboid doubled. Identify the measurements that are required to calculate the surface area of two/three/four/five cuboids placed together. Accurately calculate the surface area of two/three/ four/five cuboids placed together.

			Recognize the pattern in the increase of surface area as the number of cuboids added increases. Accurately predict the surface area of ten cuboids placed together.

Appendix 5.3: Teacher interview scoring taxonomy

Table 12: Table showing the teacher interview scoring taxonomy

	Pair work	Group work	Story telling	Drama	Feedback	Collecting materials	Students asking questions	Teachers asking questions
Very Poor (1)	Does not recognize the activity mentioned. Cannot give any examples of activity. Does not understand how the activity might contribute towards learning outcomes.							
	No example. No explanation.	No example. No explanation.	No example. No explanation.	No example. No explanation.	No example. No explanation.	No example. No explanation.	No example. No explanation.	No example. No explanation
Poor (2)	Recognizes the activity mentioned. Offers a basic example of how the activity might be used in the classroom. Has an unsophisticated understanding of how the activity might contribute towards learning outcomes, which is limited to cognitive or academic abilities E.g. "It helps the students to understand"							
	Focus on content Improves understanding. Improves learning. Improves memory.	Focus on content Improves understanding. Improves learning. Improves memory.	Focus on content Improves understanding. Improves learning. Improves memory.	Focus on content Improves understanding. Improves learning. Improves memory.	Focus on content Improves understanding. Improves learning. Improves memory.	Focus on content Improves understanding. Improves learning. Improves memory. Develops a sense of attachment to objects. Teaches basic concepts.	Focus on content Improves understanding. Improves learning. Improves memory. Helps teacher learn content.	Focus on content Improves understanding. Improves learning. Improves memory. Grows intellectually.
Mediocre (3)	Recognizes the activity mentioned. Offers an example of how the activity might be used in the classroom, referring to classroom context. Has a general understand of how the activity might contribute towards learning outcomes, which includes skill development e.g. "When students discuss together their communication skills improve"							
	Student collaboration Strong students help weak students and learning increases.	Student collaboration Strong students help weak students and learning increases.	Student attention Students become interested in the subject. It catches student's attention. It helps students to learn morals.	Student attention Students become interested in the subject. It catches student's attention. Students want to participate and be involved. Students improve communication skills.	Student improvement It helps students to correct their work and to do better work next time. It builds teacher-student rapport.	Student involvement Develops a sense of attachment to objects. Develops the ability to identify and categorize characteristics of objects. Helps students become familiar with things in their daily lives and learn how to protect the environment. Students become interested/ curious/	Content clarification Helps teacher learn content. Students clarify their doubts. Students can express problems. Students are engaged and alert in the classroom.	Student engagement Teachers can evaluate student's learning. Students are interested, alert, motivated and thinking in the classroom. Exchange between teacher and student. Breaks down hard concepts into simple steps.

						motivated/ involved.		
Good (4)	Recognizes the activity mentioned. Offers a specific example of how that activity is used in the classroom, giving procedural details of what would be involved. Has a clear understanding of how the activity contributes towards both learning outcomes and skill development, relating this to the specific needs/barriers faced in the classroom, e.g. "The person in the group who knows the most will be able to help the slower learners catch up, and in the process will develop leadership and presentation skills"							
	Skill development Strong students help weak students and learning increases. *Student who are shy or struggle to express themselves to the teachers can express their opinions while working in pairs.* *Develops leadership and collaborative skills.*	Skill development Strong students help weak students and learning increases. *Student who are shy or struggle to express themselves to the teachers can express their opinions while working in pairs.* *Develops leadership and collaborative skills.*	Skill development Students become interested in the subject. It catches their attention. It helps students to learn morals. *It helps students to visualise what they are learning.* *Students develop better speaking and communication skills.* *Students practice/learn how to frame sentences.*	Skill development Students become interested in the subject. It catches their attention. Students improve communication skills. *Students develop confidence in communication, presentation and it gets rid of stage fear.*	Encouragement It helps students to correct their work and to do better work next time. Builds teacher-student rapport. *The teacher can offer guidance.* *The teacher can assess the level of the students.* *Feedback can encourage and motivate the students, especially when they are sensitive or have low confidence.*	Experiential learning Develops a sense of attachment to objects. Develops the ability to identify and categorize characteristics of objects. Helps students become familiar with things in their daily lives and learn how to protect the environment. Students become interested/ curious/ motivated/ involved. *Students learn skills of observation.* *Students learn through experience and doing.* *Students understand that learning does not only happen in the classroom.*	Self-learning Pushes teacher to learn more content. Students clarify their doubts. Students can express problems. Students are engaged and alert in the classroom. *Students are able to identify their own mistakes and correct themselves.* *Students develop the skill of posing questions.* *Students engage in independent learning.* *Students open up.* *It will help the teacher to understand the level of the students' learning.*	Adaptive teaching Teachers can evaluate student's learning. Students are interested, alert, motivated, confident and thinking in the classroom. Exchange between teacher and student. Breaks down hard concepts into simple steps. *Questions are used to recall/recap lessons.* *Teachers can change teaching technique depending on students' understanding.*
Very Good (5)	Recognizes the activity mentioned. Offers a specific example of how that activity is used in the classroom, giving procedural details of what would be involved. Has a sophisticated understanding of how and why the activity contributes towards both learning outcomes and skill development, relating this to specific needs/barriers faced in the classroom, e.g. "In group work the slow student will not feel shy about asking the strong student for help and so the slow student will learn from the discussion. The strong student will try to learn more because she feels a sense of responsibility, and so her leadership skills will improve."							
	Teaching diverse abilities Strong students help weak students and learning increases. Student who are shy or struggle to express themselves to the teachers can express	Teaching diverse abilities Strong students help weak students and learning increases. Student who are shy or struggle to express themselves to the teachers can express	Teaching diverse literacies Students become interested in the subject. It catches their attention. It helps students to learn morals. It helps students to visualise what they are learning. Students	Teaching diverse literacies Students become interested in the subject. It catches their attention. Students develop better speaking and communication skills. They learn how to frame	Adaptive teaching It helps students to correct their work and to do better work next time. Builds teacher-student rapport. The teacher can offer guidance. The teacher can assess	Applied learning Develops a sense of attachment to objects. Develops the ability to identify and ocategorize characteristics of objects. Helps students become familiar with things in	Inquiry approach Pushes teacher to learn more content. Students clarify their doubts. Students can express problems. Students are engaged and alert in the	Inquiry approach Teachers can evaluate students' learning. Students are interested, alert, confident and thinking in the classroom. Exchange between teacher and student.

	their opinions while working in pairs. Develops leadership and collaborative skills. *Many diverse learning abilities and backgrounds in the classroom which can be managed through group work and peer/support.*	their opinions while working in pairs. Develops leadership and collaborative skills. *Many diverse learning abilities and backgrounds in the classroom which can be managed through group work and peer/support.*	develop better speaking and communication skills. They learn how to frame sentences. *Some students cannot write or they only understand their own language but stories are an easy way that content can be communicated and students can adjust to the school environment.*	sentences. Students develop confidence in communication and get rid of stage fear. *Some students cannot write or they only understand their own language but stories are an easy way that content can be communicated and visualised.*	the level of the students, identify areas of concern. Feedback can encourage and motivate the students, especially when they are sensitive or have low confidence. *Teachers can adopt their teaching approaches to improve areas of concern.*	their daily lives and learn how to protect the environment. Students become interested/ curious/ motivated/ involved. Students learn skills of observation. Students learn through experience and doing. Students understand that learning does not only happen in the classroom. *Students apply their learning to real life and understand the real-life purpose of what they are learning.*	classroom. Students are able to identify their own mistakes and correct themselves. Students develop the skill of posing questions. Students open up. It will help the teacher to understand the level of the students' learning. *Students engage in independent learning. It will create a classroom environment of independent learning and inquiry where students are not hesitant to talk to the teacher or explore ideas and learn through discussion.*	Breaks down hard concepts into simple steps. Questions are used to recall/recap lessons. Teachers can change teaching technique depending on students' understanding. *It will create a classroom environment of independent learning, exploration and inquiry where students are not hesitant to talk to the teacher, engage in discussion or explore ideas.*

Appendix 5.4: Teacher trainee assessment taxonomy

Table 13: Table showing the teacher trainee assessment taxonomy

Student Level	Content knowledge (Volume)	Content knowledge (surface area)
Very low (1)	Do not know how to calculate the volume.	Do not know how to calculate the surface area.
Low (2)	Identify the measurements that are required to calculate the surface area, e.g length, height and width. Uses the ruler to accurately measure the appropriate vertices. Incorrectly calculates the surface area of the cuboids placed together.	Identify the measurements that are required to calculate the surface area, e.g length and width of each of the six sides. Uses the ruler to accurately measure the appropriate vertices. Incorrectly identify the formula for calculating the surface area, or do incorrect calculations.
Medium (3)	Identify the measurements that are required to calculate the volume, e.g length and width of each of the six sides. Uses the ruler to accurately measure the appropriate vertices. Selects the correct formula to calculate the surface area. Accurately calculate the surface area of one side, using correct measurements, e.g. cm^2	Identify the measurements that are required to calculate the surface area, e.g length and width of each of the six sides. Uses the ruler to accurately measure the appropriate vertices. Selects the correct formula to calculate the surface area. Accurately calculate the surface area of one side, using correct measurements, e.g. cm^2 Incorrectly calculates the surface area of the cuboids placed together.
High (4)	Identify the measurements that are required to calculate the volume, e.g length, width and height of the cuboid. Use the ruler to accurately measure the appropriate vertices. Select the correct formula to calculate the volume. Accurately calculate the volume of one cuboid using correct measurements, e.g. cm^3. Recognize that the volume of two cubes placed together is the volume of one cuboid doubled. Accurately calculate the volume of two/three/four/five cuboids placed together.	Identify the measurements that are required to calculate the surface area, e.g length and width of each of the six sides. Use the ruler to accurately measure the appropriate vertices. Select the correct formula to calculate the surface area. Accurately calculate the surface area of one side, using correct measurements, e.g. cm^2 Accurately calculate the surface area of one cube by adding the surface area of each side. Recognize that the surface area of two cuboids placed together is not the same as the surface area of one cuboid doubled. Identify the measurements that are required to calculate the surface area of two/three/four/five cuboids placed together. Accurately calculate the surface area of two/three/four/five cuboids placed together.
Very high	Identify the measurements that are required to calculate the volume, e.g length, width and	Identify the measurements that are required to calculate the surface area, e.g

(5)	height of the cuboid. Use the ruler to accurately measure the appropriate vertices. Select the correct formula to calculate the volume. Accurately calculate the volume of one cuboid using correct measurements, e.g. cm^3. Recognize that the volume of two cubes placed together is the volume of one cuboid doubled. Accurately calculate the volume of two/three/four/five cuboids placed together. Recognize the pattern in the increase of volume as the number of cuboids added increases. Accurately predict the volume of ten cuboids placed together.	length and width of each of the six sides. Use the ruler to accurately measure the appropriate vertices. Select the correct formula to calculate the surface area. Accurately calculate the surface area of one side, using correct measurements, e.g. cm^2 Accurately calculate the surface area of one cube by adding the surface area of each side. Recognize that the surface area of two cuboids placed together is not the same as the surface area of one cuboid doubled. Identify the measurements that are required to calculate the surface area of two/three/four/five cuboids placed together. Accurately calculate the surface area of two/three/four/five cuboids placed together. Recognize the pattern in the increase of surface area as the number of cuboids added increases. Accurately predict the surface area of ten cuboids placed together.

Appendix 6: SPSS variable names, labels and values

Table 14: Table showing the variable names, labels and values as coded in SPSS

Variable Name	Variable Label	Values
School_number_primary	Primary school identification number	1 – School number 1 2 – School number 2 4 – School number 4 6 – School number 6 7 – School number 7 9 – School number 9 12 - School number 12 13 – School number 13 14 – School number 14
School_number_secondary	Secondary school identification number	3 – School number 3 5 – School number 5 8 – School number 8 10 – School number 10 11 – School number 11 15 – School number 15
Grade_number_primary	Primary school grade number	4 – Grade 4 5 – Grade 5 6 – Grade 6
Grade_number_secondary	Secondary school grade number	8 – Grade 8 9 – Grade 9 10 – Grade 10
Class_number_primary	Primary school class identification number	1 – Class number 1 2 – Class number 2 3 – Class number 3 4 – Class number 4 5 – Class number 5 9 – Class number 9 10 – Class number 10 11 – Class number11 14 – Class number 14 15 – Class number 15 16 – Class number 16 17 – Class number 17 18 – Class number 18 19 – Class number 19 23 – Class number

		23 24 – Class number 24 25 – Class number 25 31 – Class number 31 32 – Class number 32 33 – Class number 33 34 – Class number 34 35 – Class number 35 36 – Class number 36 37 – Class number 37
Class_number_secondary	Secondary school class identification number	6 – Class number 6 7 – Class number 7 8 – Class number 8 12 – Class number 12 13 – Class number 13 20 – Class number 20 21 – Class number 21 23 – Class number23 26 – Class number 26 27 – Class number 27 28 – Class number 28 29 – Class number 29 30 – Class number 30 38 – Class number 38 39 – Class number 39 40 – Class number 40
School_type	Primary or Secondary school	0 – Primary school 1 – Secondary school
District	District	0 – Bangalore South 1 – Bangalore Rural 2 – Ramanagar
Area	Rural or Urban school	0 – Rural 1 – Urban

Infrastructure	Good or Poor infrastructure	0 – Poor 1 – Average 2 - Good
Student_Group	Student reported frequency: Group work	1 – Never 2 – Once a month 3 – Once every two weeks 4 – Once a week 5 – Every day
Student_Pair	Student reported frequency: Pair work	1 – Never 2 – Once a month 3 – Once every two weeks 4 – Once a week 5 – Every day
Student_Sharing_Ideas	Student reported frequency: Sharing ideas in class	1 – Never 2 – Once a month 3 – Once every two weeks 4 – Once a week 5 – Every day
Student_Teacher_Listening	Student reported frequency: Teacher listening to ideas in class	1 – Never 2 – Once a month 3 – Once every two weeks 4 – Once a week 5 – Every day
Student_Collecting_Materials	Student reported frequency: Collecting materials to use in the classroom	1 – Never 2 – Once a month 3 – Once every two weeks 4 – Once a week 5 – Every day
Student_Drama	Student reported frequency: Drama	1 – Never 2 – Once a month 3 – Once every two weeks 4 – Once a week 5 – Every day
Student_Feedback	Student reported frequency: Teacher giving feedback	1 – Never 2 – Once a month 3 – Once every two weeks 4 – Once a week 5 – Every day
Student_Teacher_Asking_Questions	Student reported frequency: Teacher asking questions	1 – Never 2 – Once a month 3 – Once every two weeks 4 – Once a week 5 – Every day
Student_Student_Asking_Questions	Student reported frequency: Student asking questions	1 – Never 2 – Once a month 3 – Once every two

		weeks 4 – Once a week 5 – Every day
Student_Stories	Student reported frequency: Stories	1 – Never 2 – Once a month 3 – Once every two weeks 4 – Once a week 5 – Every day
Teacher_Group_Work	Teacher reported frequency: Group work	1 – Never 2 – Once a month 3 – Once every two weeks 4 – Once a week 5 – Every day
Teacher_Pair_Work	Teacher reported frequency: Pair work	1 – Never 2 – Once a month 3 – Once every two weeks 4 – Once a week 5 – Every day
Teacher_Sharing_Ideas	Teacher reported frequency: Sharing ideas in class	1 – Never 2 – Once a month 3 – Once every two weeks 4 – Once a week 5 – Every day
Teacher_Teacher_Listening	Teacher reported frequency: Teacher listening to ideas in class	1 – Never 2 – Once a month 3 – Once every two weeks 4 – Once a week 5 – Every day
Teacher_Collecting_Materials	Teacher reported frequency: Collecting materials to use in the classroom	1 – Never 2 – Once a month 3 – Once every two weeks 4 – Once a week 5 – Every day
Teacher_Drama	Teacher reported frequency: Drama	1 – Never 2 – Once a month 3 – Once every two weeks 4 – Once a week 5 – Every day
Teacher_Feedback	Teacher reported frequency: Teacher giving feedback	1 – Never 2 – Once a month 3 – Once every two weeks 4 – Once a week 5 – Every day
Teacher_Teacher_Asking_Questions	Teacher reported frequency: Teacher asking questions	1 – Never 2 – Once a month 3 – Once every two

		weeks 4 – Once a week 5 – Every day
Teacher_Student_Asking_Questions	Teacher reported frequency: Student asking questions	1 – Never 2 – Once a month 3 – Once every two weeks 4 – Once a week 5 – Every day
Teacher_Stories	Teacher reported frequency: Stories	1 – Never 2 – Once a month 3 – Once every two weeks 4 – Once a week 5 – Every day
Making_Arrangements	Student's ability to make arrangements with coins and envelopes	1 – Very low 2 – Low 3 – Mediocre 4 – High 5 – Very High
Recording_Arrangements	Student's ability to record arrangements	1 – Very low 2 – Low 3 – Mediocre 4 – High 5 – Very High
Calculating_Surface_Area	Student's ability to calculate surface area	1 – Very low 2 – Low 3 – Mediocre 4 – High 5 – Very High
Calculating_Volume	Student's ability to calculate volume	1 – Very low 2 – Low 3 – Mediocre 4 – High 5 – Very High
Group_Skills_Mean	Student's ability to work in a group	1 – Very low 2 – Low 3 – Mediocre 4 – High 5 – Very High
Learning_Outcome_Total_Mean	Mean of student's learning outcome	1 – Very low 5 – Very High
Student_Activity_Frequency_Mean	Mean of student reported activity	1 – Never 5 – Every day
Teacher_Activity_Frequency_Mean	Mean of teacher reported activity	1 – Never 5 – Every day
Teacher_Understanding_Total	Total of teacher understanding score	1 – Very poor 5 – Very Good
Teacher_Understanding_Pairwork	Teacher understanding of pair work score	1 – Very poor 2 – Poor 3 – Mediocre 4 – Good 5 – Very Good

Teacher_Understanding_Groupwork	Teacher understanding of group work score	1 – Very poor 2 – Poor 3 – Mediocre 4 – Good 5 – Very Good
Teacher_Understanding_Storytelling	Teacher understanding of storytelling score	1 – Very poor 2 – Poor 3 – Mediocre 4 – Good 5 – Very Good
Teacher_Understanding_Drama	Teacher understanding of drama score	1 – Very poor 2 – Poor 3 – Mediocre 4 – Good 5 – Very Good
Teacher_Understanding_Feedback	Teacher understanding of feedback score	1 – Very poor 2 – Poor 3 – Mediocre 4 – Good 5 – Very Good
Teacher_Understanding_Collecting_Materials	Teacher understanding of collecting materials score	1 – Very poor 2 – Poor 3 – Mediocre 4 – Good 5 – Very Good
Teacher_Understanding_Students_Asking_Questions	Teacher understanding of students asking questions score	1 – Very poor 2 – Poor 3 – Mediocre 4 – Good 5 – Very Good
Teacher_Understanding_Teacher_Asking_Questions	Teacher understanding of teacher asking questions score	1 – Very poor 2 – Poor 3 – Mediocre 4 – Good 5 – Very Good

Appendix 7: SPSS inter-rater reliability scores

Table 15: Table showing the inter-rater reliability scores for the three teacher interview markers

	Interclass Correlation	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	Df1	Df2	Sig
Single Measures	.657	.497	.787	6.749	38	76	.000
Average Measures	.852	.748	.917	6.749	38	76	.000

Appendix 8: Descriptive data

Table 16: Table showing the frequencies at which student-centred activities are used in the classroom, as reported by primary school students

		Number of students according to reported frequency	Percentage of students according to reported frequency	Total number of students
Group work	Every day	443	88	505
	Once a week	47	9	
	Once every two weeks	9	2	
	Once a month	3	1	
	Never	3	1	
Pair work	Every day	343	68	504
	Once a week	90	18	
	Once every two weeks	22	4	
	Once a month	39	8	
	Never	1	0	
Students share ideas	Every day	325	64	504
	Once a week	93	18	
	Once every two weeks	58	12	
	Once a month	18	4	
	Never	10	2	
Teachers listen to ideas	Every day	365	72	505
	Once a week	74	15	
	Once every two weeks	30	6	
	Once a month	16	3	
	Never	20	4	
Collect materials	Every day	221	44	503
	Once a week	197	39	
	Once every two weeks	36	7	
	Once a month	31	6	
	Never	18	4	
Drama	Every day	231	46	501
	Once a week	176	35	
	Once every two weeks	47	9	
	Once a month	32	6	
	Never	15	2	
Feedback	Every day	330	66	502
	Once a week	98	20	
	Once every two weeks	39	8	
	Once a month	16	3	
	Never	19		
Teachers ask questions	Every day	374	75	502
	Once a week	66	13	
	Once every two weeks	29	6	
	Once a month	21	4	
	Never	12	2	
Students ask questions	Every day	326	65	503
	Once a week	91	18	
	Once every two weeks	38	8	
	Once a month	34	7	
	Never	14	3	
Stories/Songs	Every day	259	52	500
	Once a week	162	32	
	Once every two weeks	33	7	
	Once a month	27	5	
	Never	19	4	

Table 17: Table showing the frequencies at which student-centred activities are used in the classroom, as reported by secondary school students

		Number of students according to reported frequency	Percentage of students according to reported frequency	Total number of students
Group work	Every day - Once a week	392	71	550
	Once a week - Once every two weeks	137	25	
	Once every two weeks - Once a month	19	3	
	Once a month - Never	2	0	
Pair work	Every day - Once a week	458	83	550
	Once a week - Once every two weeks	76	14	
	Once every two weeks - Once a month	13	2	
	Once a month - Never	3	1	
Students share ideas	Every day - Once a week	444	81	550
	Once a week - Once every two weeks	85	15	
	Once every two weeks - Once a month	13	2	
	Once a month - Never	8	1	
Teachers listen to ideas	Every day - Once a week	479	87	549
	Once a week - Once every two weeks	56	10	
	Once every two weeks - Once a month	8	1	
	Once a month - Never	6	1	
Collect materials	Every day - Once a week	178	32	550
	Once a week - Once every two weeks	283	51	
	Once every two weeks - Once a month	69	13	
	Once a month - Never	20	4	
Drama	Every day - Once a week	176	32	549
	Once a week - Once every two weeks	196	36	
	Once every two weeks - Once a month	104	19	
	Once a month - Never	73	13	
Feedback	Every day - Once a week	453	83	546
	Once a week - Once every two weeks	83	15	
	Once every two weeks - Once a month	8	1	
	Once a month - Never	2	0	
Teachers ask questions	Every day - Once a week	491	90	546
	Once a week - Once every two weeks	49	9	
	Once every two weeks - Once a month	5	1	
	Once a month - Never	1	0	
Students ask questions	Every day - Once a week	411	76	542
	Once a week - Once every two weeks	112	21	
	Once every two weeks - Once a month	15	3	
	Once a month - Never	4	1	
Stories/Songs	Every day - Once a week	201	37	542
	Once a week - Once every two weeks	197	36	
	Once every two weeks - Once a month	81	15	
	Once a month - Never	63	12	

Table 18: Table showing the frequencies at which student-centred activities are used in the classroom, as reported by primary school teachers

		Primary school teachers frequency	Primary school teachers percentage	Total number of teachers
Group work	Every day	20	83	24
	Once a week	4	17	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	0	0	
Pair work	Every day	24	100	24
	Once a week	0	0	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	0		
Students share ideas	Every day	19	79	24
	Once a week	5	21	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	0	0	
Teachers listen to ideas	Every day	24	100	24
	Once a week	0	0	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	0	0	
Collect materials	Every day	6	25	24
	Once a week	15	63	
	Once every two weeks	2	8	
	Once a month	1	4	
	Never	0	0	
Drama	Every day	11	48	23
	Once a week	1	48	
	Once every two weeks	1	4	
	Once a month	1	0	
	Never	0	0	
Feedback	Every day	0	96	24
	Once a week	23	4	
	Once every two weeks	1	0	
	Once a month	0	0	
	Never	0	0	
		0		
Teachers ask questions	Every day	24	100	24
	Once a week	0	0	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	0	0	
Students ask questions	Every day	22	92	24
	Once a week	2	8	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	0	0	
Stories/Songs	Every day	13	57	23
	Once a week	9	39	
	Once every two weeks	1	4	
	Once a month	0	0	
	Never	0	0	

Table 19: Table showing the frequencies at which student-centred activities are used in the classroom, as reported by secondary school teachers

		Secondary school teachers frequency	Secondary school teachers percentage	Total number of teachers
Group work	Every day	10	59	17
	Once a week	7	41	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	0	0	
Pair work	Every day	13	76	17
	Once a week	3	18	
	Once every two weeks	0	0	
	Once a month	1	6	
	Never	0	0	
Students share ideas	Every day	15	88	17
	Once a week	1	6	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	1	6	
Teachers listen to ideas	Every day	15	88	17
	Once a week	1	6	
	Once every two weeks	0	0	
	Once a month	1	6	
	Never	0	0	
Collect materials	Every day	4	24	17
	Once a week	11	65	
	Once every two weeks	1	6	
	Once a month	0	0	
	Never	1	6	
Drama	Every day	3	19	16
	Once a week	5	31	
	Once every two weeks	2	13	
	Once a month	4	25	
	Never	2	13	
Feedback	Every day	15	88	17
	Once a week	1	6	
	Once every two weeks	1	6	
	Once a month	0	0	
	Never	0	0	
Teachers ask questions	Every day	17	100	17
	Once a week	0	0	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	0	0	
Students ask questions	Every day	15	88	17
	Once a week	1	6	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	1	6	
Stories/Songs	Every day	4	24	17
	Once a week	7	41	
	Once every two weeks	3	18	
	Once a month	2	12	
	Never	1	6	

Table 20: Table showing the teacher reported frequencies at which student-centred activities are used in urban classrooms

		Urban teachers frequency	Urban teachers percentage	Total number of teachers
Group work	Every day	15	65	23
	Once a week	8	35	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	0	0	
Pair work	Every day	19	83	23
	Once a week	3	13	
	Once every two weeks	0	0	
	Once a month	1	4	
	Never	0	0	
Students share ideas	Every day	20	87	23
	Once a week	2	9	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	1	4	
Teachers listen to ideas	Every day	21	91	23
	Once a week	1	4	
	Once every two weeks	0	0	
	Once a month	1	4	
	Never	0	0	
Collect materials	Every day	4	17	23
	Once a week	16	70	
	Once every two weeks	2	9	
	Once a month	0	0	
	Never	1	4	
Drama	Every day	6	27	22
	Once a week	10	45	
	Once every two weeks	1	5	
	Once a month	3	14	
	Never	2	9	
Feedback	Every day	20	87	23
	Once a week	2	9	
	Once every two weeks	1	4	
	Once a month	0	0	
	Never	0	0	
Teachers ask questions	Every day	23	100	23
	Once a week	0	0	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	0	0	
Students ask questions	Every day	21	91	23
	Once a week	1	4	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	1	4	
Stories/Songs	Every day	10	45	22
	Once a week	9	41	
	Once every two weeks	2	9	
	Once a month	1	5	
	Never	0	0	

Table 21: Table showing the teacher reported frequencies at which student-centred activities are used in rural classrooms

		Rural teachers frequency	Rural teacher percentage	Total number of teachers
Group work	Every day	15	83	18
	Once a week	3	17	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	0	0	
Pair work	Every day	18	100	18
	Once a week	0	0	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	0	0	
Students share ideas	Every day	14	78	18
	Once a week	4	22	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	0	0	
Teachers listen to ideas	Every day	18	100	18
	Once a week	0	0	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	0	0	
Collect materials	Every day	6	33	18
	Once a week	10	56	
	Once every two weeks	1	6	
	Once a month	1	6	
	Never	0	0	
Drama	Every day	8	47	17
	Once a week	6	35	
	Once every two weeks	2	12	
	Once a month	1	6	
	Never	0	0	
Feedback	Every day	18	100	18
	Once a week	0	0	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	0	0	
Teachers ask questions	Every day	18	100	18
	Once a week	0	0	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	0	0	
Students ask questions	Every day	16	89	18
	Once a week	2	11	
	Once every two weeks	0	0	
	Once a month	0	0	
	Never	0	0	
Stories/Songs	Every day	7	41	17
	Once a week	7	41	
	Once every two weeks	2	12	
	Once a month	1	6	
	Never	0	0	

Table 22: Table showing the frequency of teachers who achieved a very poor-poor, poor-mediocre, mediocre-good, or good-very good level of understanding in regards to the relationship between student-centred activities and student learning, according to activity

	Ranking	Frequency	Percentage	Total number of teachers interviewed
Group work	Very Low - Low	1	3	36
	Low - Medium	1	33	
	Medium - High	2	33	
	High - Very High	12	31	
Pair work	Very Low - Low	11	3	35
	Low - Medium	1	29	
	Medium - High	10	51	
	High - Very High	18	17	
Collect materials	Very Low - Low	6	5	38
	Low - Medium	2	18	
	Medium - High	7	61	
	High - Very High	23	16	
Drama	Very Low - Low	6	3	37
	Low - Medium	1	41	
	Medium - High	15	38	
	High - Very High	14	19	
Feedback	Very Low - Low	7	3	38
	Low - Medium	1	26	
	Medium - High	10	55	
	High - Very High	21	16	
		6		
Teachers ask questions	Very Low - Low	3	9	33
	Low - Medium	10	30	
	Medium - High	18	55	
	High - Very High	2	6	
Students ask questions	Very Low - Low	3	8	36
	Low - Medium	5	14	
	Medium - High	21	58	
	High - Very High	7	19	
Stories/Songs	Very Low - Low	2	6	36
	Low - Medium	17	47	
	Medium - High	14	39	
	High - Very High	3	8	

Table 23: Table showing the frequency and percentage of teachers who achieved a very poor-poor, poor-mediocre, mediocre-good, or good-very good level of understanding in regards to the relationship between student-centred activities and student learning

Interview Ranking	Frequency	Percentage
Very poor – poor	0	0
Poor – Mediocre	11	28
Mediocre – Good	28	72
Good – Very Good	0	0

Table 24: Table showing the frequency and percentage of primary school student groups who attained a very low-low, low-medium, medium-high, or high-very high overall score in the assessment

Grading Levels	Number of student groups according to total learning outcome	Percentage of student groups according to total learning outcome
Very Low – Low	5	21
Low - Medium	6	25
Medium - High	10	42
High – Very High	3	12.5

Table 25: Table showing the frequency and percentage of secondary school student groups who attained a very low-low, low-medium, medium-high, or high-very high overall score in the assessment

Grading Levels	Number of student groups according to total learning outcome	Percentage of student groups according to total learning outcome
Very Low - Low	8	35
Low - Medium	12	52
Medium - High	3	13
High – Very High	0	0

Table 26: Table showing the frequency of primary school student groups who attained a very low, low, medium, high, or very high score in the assessment according to three different metrics

Grading Levels	Group Skills	Making Arrangements	Recording Arrangements	Total number of groups
Very Low	5	3	4	24
Low	5	2	8	24
Medium	5	15	2	24
High	7	3	8	24
Very High	2	1	2	24

Table 27: Table showing the percentage of primary school student groups who attained a very low, low, medium, high, or very high score in the assessment according to three different metrics

Grading Levels	Group Skills	Making Arrangements	Recording Arrangements
Very Low	20.8	12.5	16.7
Low	20.8	8.3	33.3
Medium	20.8	62.5	8.3
High	29.1	12.5	33.3
Very High	8.3	4.1	8.3

Table 28: Table showing the frequency of secondary school student groups who attained a very low, low, medium, high, or very high score in the assessment, according to three different metrics

Grading Levels	Group Skills	Calculating Surface Area	Calculating Volume	Total number of groups
Very Low	1	4	3	16
Low	1	11	6	16
Medium	7	1	5	16
High	4	0	2	16
Very High	3	0	0	16

Table 29: Table showing the percentage of secondary school student groups who attained a very low, low, medium, high, or very high score in the assessment, according to three different metrics

Grading Levels	Group Skills	Calculating Surface Area	Calculating Volume
Very Low	6.3	25	18.8
Low	6.3	68.8	37.5
Medium	43.8	6.3	31.3
High	25	0	12.5
Very High	18.8	0	0

Table 30: Table showing the frequency of trainee teachers who attained a very low, low, medium, high, or very high score in the secondary school problem solving test

Grading Levels	Calculating Surface Area	Calculating Volume	Total number of teacher trainees
Very Low	5	5	7
Low	2	2	7
Medium	0	0	7
High	0	0	7
Very High	0	0	7

Table 31: Table showing the percentage of trainee teachers who attained a very low, low, medium, high, or very high score in the secondary school problem solving test

Grading Levels	Calculating Surface Area	Calculating Volume
Very Low	71.4	71.4
Low	28.6	28.6
Medium	0	0
High	0	0
Very High	0	0

Appendix 9: Sample teacher interview transcript

Secondary school teacher, Bangalore South (Interview 5a)

Pair work

Working in pairs, yes they do. We have good ones who read and do so we pair them with the ones who are not doing very well, so these will teach. Sometimes they are not able to reach me. They don't understand what I say or they don't come to me, they don't open up so easily so we pair them with those kind of students who are able to do. They are their own peer so they are able to understand and do. Poetry is easily done through this. They read line by line and teach them, they would have followed me, and they would be able to teach. These children, they feel shy. So when it's difficult for them, the words are easily accessible from their peer work. So they ask them and they learn. Reading and things. Then assignments they do it together, project which we give following some grammar they look at each other and they find out the answers.

Group work

Definitely, my 10th standard students have done collage work, they have done it, the last lesson of 10th standard text book have cook for survival. At the beginning they find it difficult to do. They got so much information, they can see also. Group work is here also again there's a mixture of students, above average, average, below average. I want all of them to work. Above average they will be able to write. This medium, get them the pictures, collect paper, as they are into that work they come to know what is happening, we are collecting something about science, technology, how science is helpful to us. All these things they come to know. Good ones already they know, the good ones already know, they know what I'm telling, the little ones they get interacting with them and they know what is.

Drama

9th standard students have already done drama. two students have already presented me drama. One is Sleeping Beauty and the other is Cinderella, the headmistress was a witness to that. they have done the script on their own. I group them for all the things, the fairy tales, but two of them make it bold and they presented it. Just to encourage their conversation skills, their communication skills. Because otherwise English is very less spoken. These children back home they are not exposed to English at all, there is no environment of English, so here at least in his activity of drama they are able to talk and understand.

Stories

I use stories as examples to my lesson. First lesson of 9th standard of enchanted book so related to that I have to tell them why the pandas came to forest. So I have to tell, I have to take the link, then I have to start that story. Why all they are in the forest. There are two sections. They get the link. The story is not abrupt for them, why are they in the forest. They got the link, why they are in the forest, they get the link.

Collecting things outside

In college work we have done, newspaper cuttings. These children also, they have scrapbook to bring and paste. Science we have this, bringing plants for science classroom. Self-learning takes place. they not only bring it they find out what is relevant and they bring it to the class, they understand that and

they bring it to the class. what has to be brought to the class. when I ask them to do the work on collage, they were bringing so many pictures. newspaper has so many pictures I was very particular they should get the science pictures where science is advantages and disadvantages at this point of time. In one picture there was lamb which they use for cloning and they stuck it on disadvantage and called it disadvantage. That way of fertilisation is disadvantage. They are not very clear in telling but they have that idea behind it.

Feedback

Definitely. After the collage work some of our teachers gave feedback. I gave feedback in regard to the language. Science teachers gave regarding to the science and things also, how better they can make it, things they can use and show the differences, science how it is advantages and disadvantages so they were able to mark both very nicely. Some of the teachers gave them helping notes so they can improve on that. Oral feedback is more and then written. For written children don't even read what it is, for them it's the star and that is all, something we have written they don't wait to see what is written so we give it orally. Next time they will tell us "you told me that time these things, so this time I did that" so they are able to remember. Interaction also takes place, teacher interaction, the students interact with us. Written not so much but verbally they are able to talk to us, there is a closeness between the teacher and student, unless that is not developed they won't come near us. 8th standard students they come first time to the school, immediately they don't come to us, they are away from us, they come close to us, then they will like the subject also I think.

Asking/answering questions

Both of these things happen, some of the lessons later we ask, in 10th standard we have a poem, so that poem first into the class I ask them how they are with their grandmother and all those things they were able to tell me, some of them told me in English, some in Kannada, how they miss them, so that way they are able to tell, so questions they are able to tell, in lesson the land is talking it's a personified object, the children don't understand so easily this poem, it is beyond their understanding, so the children ask why has the poet written it this way, things when they don't understand really. Asking questions is to keep them alert and keep them on track of their learning and teaching and learning, their mind should not go out of my classroom and teaching, the second is that they have to follow the lesson.

They are opening up, in class of 60, 10 may ask. 50 are not actively participating and asking but when I turn them into smaller groups some might ask, group of 15, I will go to one particular group and other teachers will go to other particular groups, the group which I go most of them are interacting with me, but the same students which putting back in the 60/65 they don't interact so well, the good ones only ask the questions, it's always that. The smaller group interaction is better. We want each of them to ask, this English is reading writing listening, and all the 4 activities should take place there. Only listening and writing is not good, they have to speak up, these skills are very important in our language so that sake we are very much particular they read out something, they tell what one sentence in these things is.

Appendix 10: Sample teacher interview answers according to score

Very Poor

"As teachers we should motivate the children to ask more questions. When the teacher is teaching in the class the teacher asks the questions throughout." (Interview 6b)

"Depending on the lesson as and when the need arises she uses stories." (Interview 3c)

Poor

"When she gives pictures of different objects, students don't know what to do, she has to give feedback and give input. Her feedback is very valuable, why it has to be, on what basis. Giving feedback is very important because it develops a competitive spirit among the students. Even if there is a comparison it pushes them to perform better. She observes them, how the perform, for example if there is a poem and the stanzas need to be memorized, the group will get together and each person will memorize a different stanza and perform in front of the whole class. And she is there constantly giving feedback, how it needs to be done. So that way group activity with proper feedback at the right time maximizes learning." (Interview 9a)

"Yes, they work in groups. We are giving to discuss the questions and answers and they will write in groups and then in some activities we are giving some word building puzzles, all they are given and in that time they will sit in groups. Their concentration also is there then many have no idea about that, to do the word building so they will discuss and write in groups. Then group study competitive mind, oh! You wrote first, I will write first." (Interview 7b)

Mediocre

"Both of these things happen, some of the lessons later we ask, in 10th standard we have a poem, so that poem first into the class I ask them how they are with their grandmother and all those things they were able to tell me, some of them told me in English, some in Kannada, how they miss them, so that way they are able to tell, so questions they are able to tell. Asking questions is to keep them alert and keep them on track of their learning and teaching and learning, their mind should not go out of my classroom and teaching, the second is that they have to follow the lesson." (Interview 5a)

"Daily happens each and every moment. It keeps the classroom lively. No one is passive. Everyone is happy with the questions and another it makes it more interesting in learning. It helps us as a teacher to move easily. If no one questions we will think they don't know the topic or they don't want to know the topic. If they ask the questions then they will ask to know something is important about the topic for the student. If we open up it means oh we are happy." (Interview 5b)

Good

"Asked to collect something from environment they end up taking something from neighbours plants and so will have to face the consequences later so she starkly advises students not to bring anything from outside. but in the school we have some plants and some things she demonstrates certain things and showing pictures that is done in the class, but even carry things from home does not happen and the teaching aids that are there that is used in years to come, she sees that they don't spoil it. More than teaching concepts theoretically you have to use teaching aids. Teaching aids joins the theoretical with the practical experience. For example cows or animals outdoors. By showing the picture in the class the student will related the things with the learning that happens in the class so this kind of association helps the child to remember." (Interview 2b)

"They are very clever and they ask more number of questions. Most will ask few will not ask. They don't ask questions because of fear or because they think they may ask a silly question. If they have learnt something in newspaper or heard near their parents that type of question will be asked by the teacher. So to understand the situation to know the problems faced by these students or to have better life in the future. So by asking questions they will be able to stand on their own legs and be more independent." (Interview 15a)

Very good

"As Hindi teacher she focusses on students working in groups, paired activity is very rare. Sometimes but not always, mostly it is group activity that takes place, one bring child tries to pick up quickly the concepts from the teacher, whatever the teacher asks to the bright student the others in the group will be informed through the bright learner. Main purpose of having group activity is to develop leadership skills among students, one student not only teaches the other in the room but also he sees to it that very one learns and he also can extract work. He may not be very good at extracting studies but he will be able to extract certain things from others, learning concepts where students are able to learn and perform better. So somewhere their skills are honed." (Interview 11a)

"Students ask more questions to the teacher because they don't know or because they are curious, students keep asking questions to their teachers. There is a lot of exchange of information that takes place so simultaneous learning through these questions." (Interview 9a)