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Working Paper

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An International Study of Childhood Poverty

Learning Environments in Andhra Pradesh, India:

Children's 'Academic Self-Concept' and Mathematics Achievement

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Abstract

There is a growing realisation that good-quality education can only be assured if both the academic and the social and emotional developmental needs of learners are met within schools. This study investigates the relationship, at primary school level, between a child's beliefs about their ability to perform academic tasks i.e. 'academic self-concept' and achievement in mathematics, as well as between academic self-concept and aspects of the observed classroom environment. Using Young Lives quantitative as well as qualitative data from Andhra Pradesh, India, the results show a significant and positive correlation between the academic self-concept and the progress in mathematics of students in primary schools. We find from the analysis of the learning environment that more time spent by teachers on discussion and interaction with the whole class is significantly associated with better 'academic self-concept' in students. Disciplinary action taken by the teacher and the temporary absence of the teacher are seen to have a negative significant association with students' 'academic self-concept'. On the other hand the preparation and use of teaching and learning material (TLM) by the teacher improves academic self-concept significantly. These results have important implications for educationists, school leaders, teachers, parents and policymakers, since they all need to work together to create learning environments that foster the self-concept of children and provide fertile ground to help it develop.

The Authors

Renu Singh has over 25 years' experience in teaching, teacher education, education policy analysis and research, both in India and abroad. Trained as a Montessorian and special educator, her doctoral study was on the inclusion of marginalised children. Her special interests remain early childhood development, teacher education, inclusion and gender. She has held a number of prestigious positions at NGOs, including Save the Children, and in university departments. She has also advised the Indian Government by serving on a variety of working groups, committees and boards. Currently she is the Country Director at Young Lives India and Visiting Professor at Jamia Millia Islamia University, New Delhi.

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About Young Lives

Young Lives is an international study of childhood poverty, following the lives of 12,000 children in 4 countries (Ethiopia, India, Peru and Vietnam) over 15 years. **www.younglives.org.uk**

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1. Introduction

As India is close to meeting the Millennium Development goal of providing universal primary education for all children aged 6 to 14 years, the focus of its education policy is shifting from enrolment towards the provision of 'equitable, quality education'. There is also a growing realisation that quality education can only be assured if both the academic and the social and emotional developmental needs of learners are met within schools, as the National Curriculum Framework (2005) suggests:

> Children will learn only in an atmosphere where they feel they are valued. Our schools still do not convey this to all children. The association of learning with fear, discipline and stress, rather than enjoyment and satisfaction, is detrimental to learning. (NCERT 2005: 14)

The past three decades have seen an immense amount of attention being given in developed countries, by both psychologists and educational researchers, to key psychological well-being constructs, including self-concept, and their role in educational performance (see, for example, Burns 1982). A healthy sense of self, or what is termed 'self-concept', is vital to psychological well-being, as people who feel good about themselves and their abilities are likely to be more effective than individuals with low self-concepts (Craven and Marsh 2008). The enhancement of self-concept has therefore been accepted as a key factor in meeting educational goals across diverse settings because it is seen as being critical for the realisation of full human potential because it is considered important for addressing social inequities experienced by disadvantaged groups (Craven and Marsh 2008). Though there are studies related to self-concept in India, there exists minimal empirical exploration of the factors within the learning environment that relate to academic self-concept. This paper attempts to analyse the relationship between children's academic self-concept and their mathematics achievement, as well as to understand how various aspects of the classroom learning environment are associated with children's academic self-concept.

2. Understanding 'self-concept'

Rosenberg (1979) defined self-concept as 'the totality of the individual's thoughts and feelings having reference to himself as an object' (p. 7). Shavelson et al. (1976) highlighted that self-concept is formed through experiences with the environment and is influenced by environmental reinforcements and significant others, and that self-concept should be seen as an important construct that is useful for predicting and explaining how an individual may act in any given situation. Bong and Skaalvik (2003) posit that students judge their ability by comparing themselves to peers and therefore reflective appraisal plays a key role in academic self-concept formation.

It is important to highlight that the construct of self-concept differs from that of self-efficacy, though both are concerned with an individual's perception of his or her own competence (Lee 2009). As Bong and Sklaavik (2003) suggest, 'While self-concept represents one's general perceptions of the self in given domains of functioning, self-efficacy represents individuals' expectations and convictions of what they can accomplish in given situations' (p. 5). The distinction between self-concept and self-esteem is fundamental to understanding the

distinction between multidimensional and unidimensional perspectives to self-concept (Marsh and Martin 2011).

Shavelson et al. (1976) developed a theoretical model of a multidimensional, hierarchical self-concept, in which general self appears at the apex and is divided into academic and non-academic components that are further divided into more specific components at the lower level. Self-concept is a multidimensional construct that is differentiated across domains of functioning (Bong and Skalvik 2003). Shavelson et al. (1976) highlighted that seven characteristics can be identified as critical to the definition of the construct of self-concept – it is organised, multifaceted, hierarchical, stable, developmental, evaluative and differentiable (p. 411). This was further elaborated by Bracken (1992) who proposed that self-concept is composed of six domains, which are interrelated and combine to comprise a global self-concept: social, affective, competence, academic, family and physical. Students' self-concept is propounded to become more stable as they grow older (Lee 2009) and gender differences between the academic self-concept of boys and girls have been noted (Lindberg et al. 2013)

2.1. Relationship between academic self-concept and mathematics achievement

Psychologists have recognised the important role of self-concept in an individual's personal adjustment, while educators are becoming increasingly aware that a students' perception of themselves may have a significant influence on their academic performance in school (Tan and Yates 2007). Several researchers have demonstrated a positive association between students' achievement and their self-concept (Byrne 1984; Valentine et al. 2004; Marsh and Craven 1997; Craven et al. 2003; McInerney and Ali 2006; Bankston and Zhou (2002); Lockett and Harrell (2003); Ross and Broh (2000); Schmidt and Padilla (2003); and Verkuyten and Brug (2002). A distinction between global self-concept and a distinct view of self within specific areas has also been propounded by various researchers (Byrne and Shavelson 1986; Harter 1982). Marsh and Shavelson (1985) have suggested that an individual has distinct views of self within various areas, including general self-concept, social self-concept and academic self-concept. Academic self-concept refers to a person's 'perception of self with respect to achievement in school' (Reyes 1984: 559). These academic self-concept domains are further sub-divided into language and mathematical self-concept. Academic self-concept is distinct from global self-concept and reflects an aggregated judgment or overall impression of one's competence in given academic domains such as the verbal domain or mathematics (Bong and Sklavik 2003: 29). While a large number of researchers have investigated the direction of causality between academic self-concept and achievement outcomes, results have not been decisive. Three popular models have emerged to describe different causal relationships between self-concept and academic achievement: the skill-development model, the self-enhancement model and the reciprocal effect model (Rosen et al. 2010). Many researchers have subscribed to the reciprocal effect model (Marsh and Martin 2011); and a meta-analysis of self-belief measures undertaken by Valentine et al. (2004, 2005) found clear support for a reciprocal relationship between academic self-concept and achievement. High academic achievement appears to be associated with improvements in academic self-concept, and a high academic self-concept appears to be associated with improvements in academic performance (Seaton et al. 2011.

2.1.1. Mathematical self-concept

Mathematical and verbal self-concepts have been associated with school achievement on the premise that children's view of themselves as learners would lead to those who feel confident getting better scores than their peers who have low self-concept (Kurtz-Costes and Schneider 1994 Marsh et al. 1985; Marsh and Yeung 1998). Mathematical self-concept refers to how a person perceives his/her ability and prowess to learn and perform in mathematics, based on past experiences. Wong (1992) and Davis (1994) were among the first to reveal that mathematics achievement is closely related to self-concept, which in turn was significantly predicted by self-expectation.

Kupari (2006), using the TIMMS 1999 dataset from Finland, proved that students' self-concept in mathematics had a strong association with achievement. This was extended by Kupari and Nissinen (2013), who examined both TIMSS 1999 data (from seventh-graders) and TIMSS 2011 data (from eighth-graders) to analyse changes and factors affecting student achievement. Interestingly, students' mathematics self-concept – expressing confidence in their ability to learn mathematics – was by far the most significant predictor of their performance (Kupari and Nissinen 2013: 14). This was prefigured by studies in various countries including in East Asia, where a longitudinal study of high school students in Grades 10 and 11 in Hong Kong found that mathematical self-concept was a significant predictor of subsequent achievement (Rao et al. 2000). Similarly, Guay et al. (2004) used data from a ten-year longitudinal study that was conducted among three cohorts of elementary school French Canadian children in the third, fourth, and fifth grades (465 children in total). Results from structural equation modelling revealed that academic self-concept predicted educational attainment level ten years later over and above prior achievement. Mutodi and Ngirande in research in South Africa suggest that children's levels of interest, efficiency, motivation and pleasure in performing tasks in mathematics constitute a positive 'self-concept' and lead to success or failure in maths (p.433).

Irrespective of global variations, it has also been found that, within most countries, there is an overall positive relationship between self-concept and achievement (Wilkins 2004). In India, several studies have found self-concept to be related to academic achievement (Desai and Uchat 1983; Shanmugasundaram 1983). Panwar (1986), in his research among students of the Kumaun Hills, found that academic achievement, home background and school environment had a significant correlation with self–concept. Mehta (1968) and Tiwari and Bansal (1984) also showed that high achievers demonstrated higher self-concept than low achievers in India.

The above has implications for classroom instruction. Given the focus in recent years of the reciprocal model, it becomes evident that the teacher cannot afford to focus either on only enhancing self-concept or on only increasing the learning levels of children. It is important that teachers build both these critical domains, since they are seen to be mutually reinforcing. This is supported by recent research that has demonstrated the reciprocal relationship between mathematics self-concept and mathematics anxiety using structural equation modelling (Ahmed et al. 2012). The authors found that adolescents with a lower maths self-concept had higher mathematics anxiety and vice versa and as mathematics anxiety increased, mathematics self-concept was lowered.

2.2. Self-concept and classroom environment

Learning mathematics is critical to prepare children for their current and future life course. Dimarakis et al. (2014) have suggested that the mathematics curriculum provides students

with fundamental knowledge and skills applicable to contexts both inside and outside the classroom. Both self-concept and interest in mathematics are influenced by educational settings and teaching styles. While classroom environments have been studied extensively for their association with the cognitive and academic development of children (Mashburn et al. 2008; Pianta et al. 2008), Larsen (2013) states that 'learning mathematics is not only a cognitive challenge, but also an affective one' (p.1). The teacher can be regarded as a major contributing factor to students' mathematics achievement (Kele 2014).

It has also been suggested that self-concept is not innate but is developed or constructed by the individual through interaction with the sociocultural environment (Shavelson et al. 1976). Kilmer (1977) examined the effects of classroom environment and teacher influence on student self-concept and studied variables relating to classroom environment which included (1) individualisation and (2) the variety of materials and activities. Recent research suggests that particular aspects of instruction in mathematics classrooms, such as classroom management, classroom climate and cognitive activation are associated with students' attitudes and emotions concerning mathematics (Frenzel et al. 2010; Chen et al. 2011; Brown et al. 2010). The development of a supportive classroom environment and the selection of effective learning examples are known to enhance student motivation for learning mathematics (Boyer 2002). Granström (2006) highlighted that different teaching approaches in classrooms influence the outcomes for students in different ways and students found most success in settings where they were allowed and encouraged to cooperate with classmates. Having their contributions valued was a very significant factor that influenced the way in which students viewed their relationship with mathematics (Anthony and Walshaw 2007). Teachers must organise and manage classroom routines to ensure that all students diverse needs are addressed and they are provided through experiential learning opportunities to clarify mathematical concepts (Anthony and Walshaw 2009). Effective mathematics organisation promotes active learning as students manipulate materials to investigate, discuss and construct concepts within a range of mathematics experiences (Booker et al. 2004). Ding et al. (2007) further highlighted that group or partner arrangements were seen as useful not only for enhancing engagement but also for exchanging and testing ideas and generating a higher level of thinking.

3. Research questions

It is amply clear from the previous section that there exists a positive correlation between children's academic self-concept and their academic achievement and that certain aspects of the learning environment are associated with self-concepts of children. This paper attempts to study the relationship between children's academic self-concept in mathematics and their mathematics achievement as well as understand how various aspects of the classroom learning environment are associated with children's academic self-concept in primary classrooms in Andhra Pradesh, India. The characteristics of the learning context can be studied from a number of different perspectives, so we study various aspects of the classroom environment to try to analyse the factors that contribute to the development of children's academic self-concept. While Section 4 provides details about Young Lives, Section 5 presents the methodology, Section 6 consists of the analysis and its results and Section 7 provides the conclusion.

4. Methodology

Young Lives is an international longitudinal study of childhood poverty that follows 3,000 children in each of the four study countries – Ethiopia, India (Andhra Pradesh), Peru and Vietnam) – over 15 years. The study collects information on two cohorts of children (1,000 Older Cohort children who were aged 7 to 8 years in 2001–02 and 2,000 Younger Cohort children who were 6 to 18 months old). Qualitative data are also collected on a sub-sample of 48 children in each of the four countries. To date Young Lives has collected four rounds of quantitative and qualitative data. Quantitative rounds were conducted in 2002, 2006–07, 2009–10 and 2013–14. In Andhra Pradesh, the 3,000 sample households for the study were randomly selected from 100 communities across three regions: Telangana, Coastal Andhra and Rayalaseema. The qualitative research took place in four communities (in 2007, 2008, and 2010) with a nested sample of 24 children from each cohort, plus their caregivers and other key figures in the community.

An additional school survey was carried out with Younger Cohort children in 2010–11, with a set of 247 schools (government and private) attended by 950 of the 2,000 Younger Cohort children, then aged 9 to 10 years, to investigate these children's experience of school; (however after dropping observations with missing values, we are left with 884 observations for our regression analysis- footnote). The school survey was based on questionnaires administered to children, teachers, headteachers and education officials, as well as on classroom observations and assessments of children's learning.

We also draw on data from a qualitative sub-study conducted in 2011 to investigate reasons for children's frequent school changes, conducted with a sub-sample of 30 children and their caregivers (mostly mothers, but occasionally both parents). Young Lives qualitative research uses a range of qualitative methods, including one-to-one interviews, group discussions and creative activities (such as drawings of a child 'doing well'/'doing badly', and body-mapping). Qualitative interviews were recorded, transcribed and translated (see Crivello et al 2014).

This paper draws on all sources of Young Lives data. While the school survey data are cross-sectional, we have the advantage of also being able to use child- and household-level data from Round 3. In this way, while we mainly look at indicators from the school survey, we can control for background characteristics of the children and their families by using data from Round 3.

For the school survey, a teacher questionnaire was administered collecting information on 400 mathematics teachers regarding their educational qualifications, experience, preparation of instructional material, teaching practices, etc. The teachers were also observed in 490 classrooms while taking mathematics classes attended by Young Lives children. These observations provide a wealth of information about the teaching method a teacher followed in one particular class during a 30-minute time span. Teaching practices were observed in every minute and recorded. Each of the sampled children was administered a child questionnaire, from which we have gathered information on their academic self-concept and school experience. A four-point scale was used for their responses, ranging from 1, representing 'strongly disagree', to 4, representing 'strongly agree'.

5.1. Construction of academic self-concept index

Items related to academic self-concept (presented in Table 1) have been used to construct an aggregate index. Since the classroom observations were limited to mathematics classes, we have focused on academic self-concept statements particularly related to mathematics. Negative statements are recoded and all the statements are converted into binary numbers. The aggregate of all the statements has been taken and then it has been normalised to construct the index.

Table 1. *Statements on academic self-concept*

Academic self-concept index	Mean
I am really good at learning maths	0.754
Doing maths is very difficult for me (negative)	0.671
Most children in my class score better than me (negative)	0.449
I am proud of my achievements in school	0.763
I can do well in school if I work hard	0.794
I cannot do well in school even if I try hard (negative)	0.712

Source: Young Lives school survey, Andhra Pradesh, 2010–11.

5.2. Relationship between academic self-concept and academic achievement: Evidence from Young Lives

Using Young Lives data, Abhijeet Singh (2013) found a significant positive effect of general self-efficacy/academic self-concept on academic achievement, while highlighting the endogenous relationship between the two. We begin with testing the correlation between a child's academic self-concept index and their achievement score in mathematics.[1] In our case the correlation coefficient is 0.435 and highly significant. Although test score and self-concept are correlated, it is difficult to identify any causal relationship between them as they are both determined simultaneously. This direction of causality is debated in the literature. Here, we consider academic self-concept as an academic outcome, without being drawn into the debate of directionality of this association. In our view self-concept is a multidimensional, fluid and dynamic construct and must be given due importance within learning setting. Hence we try to explore how academic self-concept is associated with different class-level, school-level and child-level factors.

Analysis of qualitative data provides some insight into how children were performing in mathematics and how they felt about their performance. Children who felt that mathematics was easy and that they were 'good at it', reported that they were doing well in the subject, while those who 'fear[ed] mathematics', reporting poor teaching, ended up performing badly, unsurprisingly. For example, Srikanth,[2] a Scheduled Tribe[3] boy attending a private school,

1 To capture learning outcomes for children, scores from a mathematics test which was conducted during the school survey are used. The mathematics achievement test consisted of two sections. The first section was aimed at measuring basic quantitative and number concepts. It included seven items on number identification, seriation and simple problem sums, with no time limit. The second section consisted of 14 items, which included two-digit and three-digit addition, subtraction, multiplication and division with a time limit of six minutes.

2 All names of children and communities are pseudonyms, in order to preserve the anonymity of children and their families.

was in Grade 4. He has a high academic self-concept in mathematics and proudly stated "I know mathematics well", adding that "my teachers praise me" (for his achievement). Srikanth was extremely confident about doing well in mathematics, since it was his favourite subject. He said that he was doing very well and coming first in the class, rather than second or third, as he had in previous grades. On the other hand, Sarada aged 15, who was in Grade 10, told us that ever since Grade 8, she had been "afraid of mathematics and [had] score[d] well in all subjects except mathematics". Even though in Grade 10 she was getting encouragement and support from her teacher and classmates, she continued to perform poorly and score low marks and was "barely passing in mathematics".

Since Young Lives is tracking two cohorts of children, some of the older children provide us with a longitudinal insight into how they have performed in mathematics as they have grown older and gone from elementary to secondary school. Govindh, a Backward Class Older Cohort boy living in Katur, a rural area of Rayalseema, reported his inability to do well in mathematics at each round of qualitative research, from age 13 in Grade 9. In 2007, he said he was "poor in mathematics". In 2008, Govindh was in Grade 10 and he was open about the fact that he did not have faith that he would realise his aspiration of becoming an engineer. His mother, who was very keen that he should become an engineer, worried about Govindh: "[H]e is little bit poor in mathematics … They [his teachers] say he should be good in mathematics to take MPC [mathematics, physics and chemistry]" in Grade 12. By 2010, Govindh was pursuing MPC in junior college (Grade 12), but was not happy with the subjects he had taken. He had failed in mathematics in Grade 11, but retook the exam and passed. He says, "My parents forced me to take up MPC … I find it very difficult, since I do not like math." In Grade 10, he lacked confidence in being able to study mathematics and in Grade 12 would have preferred to drop the subject at senior secondary level, but had to continue with it, to meet his family's aspiration to see him study to become an engineer.

The above case studies offer examples of how some children may have a fear of mathematics, leading to a poor performance in the subject. In many cases, this may be primarily due to poor teaching, but repeated poor performance may lead to what might be termed a weak academic self-concept in mathematics, which may lead to children further disliking the subject. In early grades children have no choice but to learn mathematics, since it is a compulsory subject, but at higher secondary level children can choose to drop this subject and opt for a stream that is aligned to their self-concept. However, as seen in the case of Govindh, despite failing in mathematics, he is forced to continue studying the subject to meet his family's aspirations of his becoming an engineer.

5.3. How does the classroom environment influence academic self-concept?

Academic self-concept is influenced by the classroom environment, the learning setting and, most importantly, the instructional processes. The characteristics of the learning context can be studied from a number of different perspectives. While educational psychologists have focused on describing the psychological climate of the learning context, termed the classroom or learning environment (Fraser and Walberg 1991), there has also been a focus by educational researchers on aspects of classroom management as an antecedent of the overall classroom climate (Jones and Jones 2000). A learning environment can be

3 Scheduled Tribes (STs), Scheduled Castes (SCs), and Backward Classes (BCs) are official groupings recognised in the Constitution of India as historically disadvantaged. Other Castes are more privileged and socially and educationally advantaged.

conceptualised as observable characteristics such as classroom infrastructure, school facilities and externally observed interaction between students and teachers in the classroom (Frenzel et al. 2010). As mentioned earlier, Young Lives has data on classroom learning environment collected from observations carried out by field surveyors during the school survey.

In the present study we aim to analyse the association between the classroom learning environment and children's academic self-concept. Therefore we employ an ordinary least square (OLS) method to estimate the partial correlation between classroom learning environment and the academic self-concept of primary school students, controlling for other factors, such as school type, household monthly per capita expenditure (MPCE), caste and educational level of parents, as well as urban/rural location of residence.

6. Analysis and results

The descriptive statistics of the classroom environment are presented in Table 2. The mean time spent by the teacher on 13 possible teaching processes observed in a lesson of 30 minutes is presented in both Table 2 and Figure 1, which shows them visually.[4] Results show that, on average, teachers spent more time on lecturing than on any other activity. Although teachers appear to spend very little time correcting work (0.4 minutes), this needs to be interpreted cautiously. Singh and Sarkar (2012), drawing on data from the school survey, where the field surveyors checked the students' books in order to determine how many teachers were regularly providing feedback to students by marking their books, found that half of the children's homework books were checked/marked by the teachers.[5] Classroom observation also revealed that 19 per cent of the classrooms contained children from different grades, i.e. they were multi-grade classrooms. Among the materials and strategies used in the classroom transactions and reported by the teachers, 87 per cent reported that they had prepared teaching/learning material (TLM), 75 per cent said they had prepared remedial teaching material especially for slow learners and 69 per cent reported that they had prepared projects for children. This was not confirmed by the field surveyors and therefore could be due to over reporting.

4 The teaching methods observed in a class do not necessarily represent the methods followed by the teachers on a typical day. It is likely that having prior information about the classroom observation, teachers might have exerted more effort than usual and the teaching process adopted in that day might be better than that in a normal day.

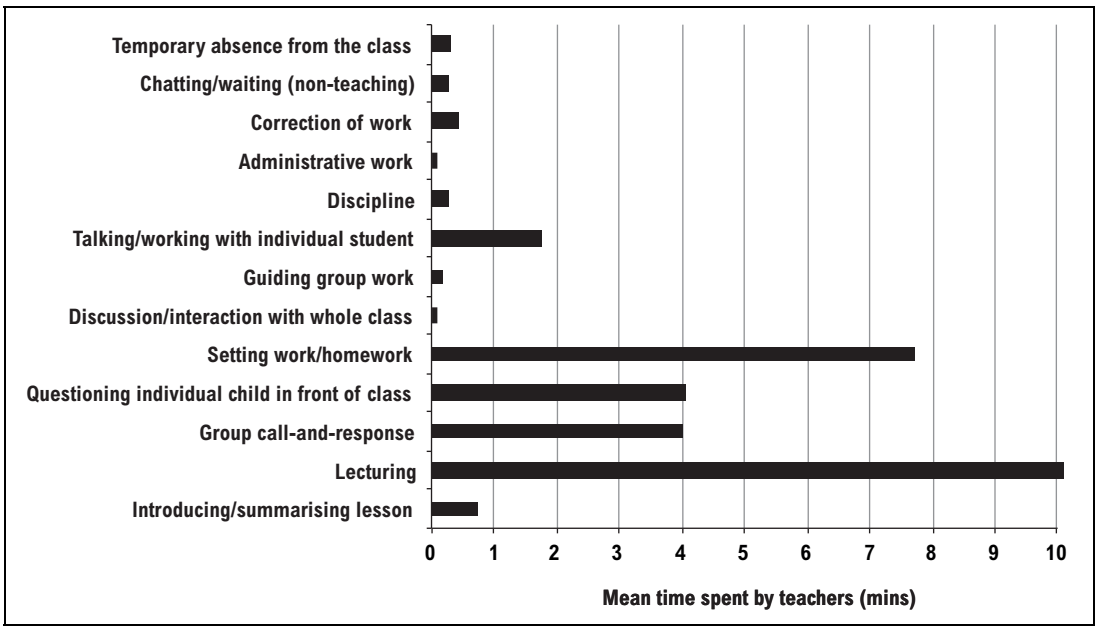
5 Teachers may be correcting books outside the time allocated for teaching. This suggests that spending less time on correcting work in the classroom does not necessarily mean that teachers do not correct the children's books.

Table 2. *Classroom environment (observed in the class)*

	Mean
Teaching processes (minutes)	
Introducing/summarising lesson	0.73
Lecturing	10.10
Group call-and-response	4.00
Questioning individual child in front of class	4.06
Setting work/homework	7.71
Discussion/interaction with whole class	0.11
Guiding group work	0.16
Talking/working with individual student	1.76
Discipline	0.27
Administrative work	0.08
Correction of work	0.44
Chatting/waiting (non-teaching)	0.26
Temporary absence from the class	0.32
Classroom observation	
Classroom infrastructure index (PCA)*	0.97
Multi-grade classroom	0.19
N (Number of classrooms)	488
Instructional material (reported by teacher)	
Preparing TLM	0.87
Preparing remedial teaching material for slow learners	0.75
Preparing projects for the children	0.69
Using new method of teaching	0.86
N (Number of teachers)	389

*A classroom infrastructure index has been generated by principal component analysis (PCA). It includes availability of chair, table, desk, bench, blackboard, mat in the classroom.
Source: Young Lives school survey, Andhra Pradesh, 2010–11.

Figure 1. *Teaching activities observed in a 30-minute lesson*



Source: Young Lives school survey, Andhra Pradesh, 2010–11.

Since the 30-minute time span of a class is divided across different teaching processes, we consider 'lecturing' or the traditional method of teacher-directed instruction as the reference category, and include all the other processes in the regressions. Therefore, the interpretation of the coefficients of these teaching process variables is made in comparison with lecturing, popularly known as the 'chalk-and-talk method'. Besides, the model also includes school- and class-level controls such as school facility index, whether the school is located in an urban or a rural area and the number of students in the class; child-level controls such as the child's gender, age, class grade, parental education and caste; and household-level controls such as monthly per capita expenditure and household wealth.

Results from the OLS regression presented in Table 3 show that 'discussion/interaction with whole class' is significant and positively associated with academic self-concept when compared with lecturing. The coefficient implies that taking one minute from lecturing and spending that extra minute on discussion/interaction with the whole class is associated with better children's academic self-concept (0.16 standard deviation).

Analysis of qualitative data gathered in interviews with children supplement this finding. Kumari, a Scheduled Tribe girl at a residential school, said that she preferred a particular teacher since "Sir facilitates reading … others just take the attendance and go away … he helps us to learn … he would explain and give us answers … he adopts easy methods … we can recollect the subject [content] and tell [recall the answers]."

Chandani, a Scheduled Tribe girl child attending a residential school in Grade 4, was not doing well in mathematics and expressed herself eloquently: **"**I want to study well … . I get good marks in all the subjects, but in maths I get much lower marks." She said:

> "I learn everything but [mathematics] does not get into my head … the madam tell us to write those [sums] and goes off, before we could ask … . It does not get into our head. …. If we don't answer she hits us … I feel very bad."

Table 3. *OLS result*

Variables	OLS-site fixed effect
Introducing/summarising lesson	0.030
	(0.032)
Group call and response	-0.014
	(0.012)
Questioning individual child in front of class	-0.003
	(0.009)
Setting work/homework	0.007
	(0.008)
Discussion/interaction with whole class	0.162**
	(0.071)
Guiding group work	-0.008
	(0.032)
Talking/working with individual student	-0.005
	(0.016)
Disciplining	-0.125***
	(0.045)
Administrative work	-0.031
	(0.080)
Correction of work	-0.010
	(0.017)
Non-teaching activities	0.047
	(0.042)
Temporary absence	-0.045*
	(0.021)
Preparing TLM	0.214*
	(0.107)
Preparing remedial teaching material for slow learner	0.095
	(0.091)
Preparing projects for the children	-0.029
	(0.092)
Using new methods	0.061
	(0.104)
Multi-grade classroom	-0.121
	(0.092)
Class infrastructure index	-0.031
	(0.035)
Observations	884
R-squared	0.219

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at site level. After dropping observations with missing values, we are left with 884 observations for regression.

Note: Control variables at child, household, school and class level are included in the regression but the coefficients are not reported in this table. The complete result is presented in Table A2 in the appendix.

Source: Young Lives school survey, Andhra Pradesh, 2010–11.

Whole class discussion is critical since it provides children with an opportunity to 'clarify their doubts'/check their understanding. When children are confronted with difficult questions, whole class discussions offer them a 'safe place' to listen to reasoning offered by peers and

an avenue to hear another student's perspective. Whole class discussion also enables key ideas from individual or group work to be brought to the surface (Grouws and Cebulla 2000). Cirillo (2013) describes discussion as a strategy that can support teachers in understanding what students already know and in determining what they still need to learn. In other words, listening to students' ideas in discussions can serve as formative assessment that helps teachers make decisions about instruction. NCTM (2000) expands on this by emphasising that 'teachers need to move beyond a superficial "right or wrong" analysis of tasks to a focus on how students are thinking about the tasks' (NCTM 2000: 24).

Many other factors might affect children's feelings about school/their 'academic self-concept'. One of these is corporal punishment, another is teacher absence. Also, spending one extra minute on disciplinary action or being temporarily absent from class as compared to lecturing is negatively related with children's academic self-concept (measured respectively by a 0.12 and 0.04 SD fall in academic self-concept). There is considerable evidence that children respond negatively to corporal punishment. Other evidence from the school survey shows that corporal punishment was common in the schools attended by children in the sample. Morrow and Singh (2014) found that 63 per cent of children aged 9 to 10 in the school survey reported that their teachers used corporal punishment, with a higher rate of incidence within private schools. Children described being beaten for a myriad of reasons, including absence (through work, illness or attending family celebrations), missing classes, not doing homework, not reading well, making mistakes, getting poor marks in exams, not wearing uniform, not having the right equipment and not paying the teacher for extra lessons. One girl told the researchers, "My teacher beats me if I don't go to the private class."

Some children have decided not to continue schooling because they were subjected to corporal punishment and Morrow and Singh (2014) illustrate this with an example of a 10-year-old boy who no longer wanted to continue at school following a beating, His mother said:

> "My son discontinued going to a private school when he fell sick after being beaten by the teacher. He does not wish to continue schooling any more. I am not allowed to enter the school to even meet the headmaster and am too scared to complain against the teacher. After spending so much money, my son is not studying."

Burnett (1999, 2003) demonstrated the importance of teachers' verbal statements and showed that positive feedback from teachers was more beneficial than negative feedback to academic self-concept.

In terms of teacher temporary absence from class, the Young Lives children recall their school experiences related to teachers leaving them unattended during school. This is a problem frequently reported by children attending government schools. Shiridi, a Scheduled Caste child from a rural area, who was in Grade 4 in a government school, had previously attended a private school, from which he was withdrawn due to "lack of money", since his father had suffered an accident at work and the family had borrowed a lot of money for his treatment. Shiridi's grandmother said that in the government village school:

> "… [the teachers] don't come. Sir [the teacher] comes only at 10 in the morning. The children will be fighting and go around trees … but there [in private school] they [the teachers] will be inside [the school] … so the students learn well there."

Kumari, an 8-year-old Scheduled Tribe girl living in Perembulur, a rural tribal mandal in a southern forest area of Telangana, was moved to a girls' government hostel in Grade 4 because her father feared she was not learning anything in the village government primary

school. Kumari said that in the village school the students were kept sitting in the classroom, while the teachers would roam outside. "Our teachers … they would leave the 3rd class … and they would only teach the 5th class [since it was the highest grade in the school] … all teachers would go outside, leaving us in the [class] room". It is important to note that 85 per cent of the education officials interviewed during the school survey were of the view that teacher absenteeism was a major problem in government schools and attributed this to reasons such as lack of transport, long-distance travel and involvement in their personal activities (Singh and Sarkar 2012).

Kavya Sri, another Scheduled Tribe girl, in Perembulur enrolled in Grade 4 in a government school, found mathematics difficult and scored lower marks in the subject. She complained that "the teachers don't come … they eat, they roam all the villages, and they don't teach us. There are three teachers but only one stays in school, while others roam about."

Further, government schools are of differing size and many rural government schools have very small numbers of children due to parents opting to enrol their children into low-fee private schools if they can afford it. Singh and Sarkar (2012) highlight from analysis of the school survey data that around half the government schools in the sample had fewer than 60 students enrolled at primary level, with an average of two teachers, and only 5.5 per cent of government schools had more than 250 students at primary level (Grades 1–5). This phenomenon was reversed in the case of private schools, where fewer than 1 per cent, i.e. a single private school, had fewer than 60 students and more than half had more than 250 students, with an average of 12 teachers. Therefore government primary schools had on average two teachers who had to teach all five grades, whereas sufficient teachers existed in the private schools

Lack of effective governance of the government schools is evident from an interview with one of the district education officers, who reported that:

> "it is mainly the teachers of primary schools who are absent from work. This is due to insufficient monitoring of primary schools. The teachers are irregular because the primary schools are located in remote areas and some primary schools are far away from tribal areas where transportation is very less … we should increase the monitoring of these schools. In addition, appropriate punishments should be given to teachers who are irregular to the school. Only then, they will work with total dedication."

The analysis has clearly highlighted that preparing TLM has a significant positive association with children's academic self-concept and improves the academic self-concept by 0.22 SD. The NCERT position paper on teaching of mathematics highlighted that textbook teaching has dulled teachers' mathematics activity (NCERT 2006). The use of instructional material such as TLM has unfortunately remained neglected in majority of classrooms across the country, with the exception of Activity Based Learning (ABL) classrooms adopted by government schools in certain states.[6]

A teacher in a primary school when interviewed agreed that "it is not possible to teach Grade 1 and 2 with lecturing method". In his opinion "to teach Grade 1–5 [teachers] need a lot of patience, must plan lessons, prepare charts. TLM help[s] the child to learn well." However he

6 Activity Based Learning (ABL) is a child-centred, activity-based method of pedagogical practice which utilises a large array of didactic apparatus. In Tamil Nadu, ABL has transformed classrooms across 37,000 primary-level government schools (Niesz and Krishnamurthy 2012).

explains that teachers do not have the time to prepare lessons with TLM because they are involved in a lot of 'office work'.

Chandani complained about the teaching methods adopted by the mathematics teacher in her government residential school. She said that "the madam will not teach … will say work from chapter 5 to 10 and go away … they do not teach, we do it our self, looking at the guides." Guides are available in the market and provide answers to all the mathematical problems given in the textbooks. Chandani further elaborated that these guides are purchased by all the students with their own money as an aid, a clear indication of the lack of TLM as well as explanation of mathematical concepts by the teacher in question.

The analytical model also makes provision to control for some household-, child- and school-level characteristics (reported in Table A1 in the appendix). It also takes into account the sub-district- or site-level unobserved heterogeneity by including site fixed effects in the regressions.

Among the control factors, school type (private), household monthly per capita expenditure (MPCE), father's education and child's grade have come out as positive and significant. Children who are in private schools have a significantly higher academic self-concept than their counterparts in government schools. The household's MPCE and fathers with higher levels of education are also observed to play an important role explaining the variation in academic self-concept. In short, children from households with higher MPCE and whose fathers have higher levels of education have a higher academic self-concept. This indicates that richer families have more resources to invest in children's education. Similarly, educated fathers invest more in their children's human capital because they consider it to be valuable. Also, educated fathers can support their children with their homework and by providing explanations, which may lead to the children developing a higher academic self-concept.

This finding points towards the growing inequities related to education choices that Young Lives findings have been highlighting (Renu Singh 2013b; Woodhead et al. 2013). Many children are faced with familial circumstances that can adversely affect their schooling because they have no support with their schoolwork and have to cope with violence at home. For example, Krishna, a Scheduled Tribe child living in Manipur, a tribal mandal in north coastal Andhra, was in Grade 4. Krishna's father studied up to Grade 5, while his mother did not attend school. His mother was a daily wage labourer and struggled to pay the household expenses since her husband was addicted to alcohol and was often abusive. Krishna tried to complete his homework on his own. He had no one to help him with his homework and if he failed to answer the questions in class, the teachers beat him and asked him to learn the answers again. He said, "I feel very bad and find it very difficult when I am unable to learn certain question and answers."

A few children, such as Shankar and Supraja, were enrolled in a private school, and they gave positive accounts of their experiences. Shankar described the classroom environment:

> "The teachers teach us well here … they teach us very nicely and very clearly, in such a way that we can understand it very easily. In case if we have any doubts we get it clarified by them. On joining here [private school], I made friends with everyone within the first two days and that made me very happy … The teachers did not beat me and clarified my doubts. I like maths. The classrooms are really good and we can sit freely. They are not congested but very airy. There is a separate place to keep our lunch bags. All the classrooms are warm and cosy. They are very nice."

Supraja's mother, whose daughter had changed school three times and was attending a private school, described her expectations about schools and her views about government and private schools:

> "Children can learn everything very easily from their teachers as they spend more time with them than with their parents. They [teachers] should pay individual attention towards the children and improve their educational standards. They should instil confidence in the children. In government schools, the teachers are not at all bothered whether the students turn up or not to school. However, here in this school even if my daughter is absent even for a single day they send a message home. They [teachers] do not motivate the child to study well in the government schools. Whereas the private school teachers are scrupulously particular about all these things."

Mehraj, a Muslim girl in Grade 4, had attended four schools. She joined a government-aided Urdu school and then moved to a private school since her mother felt that "the Urdu school did not offer brighter prospects. The child might face problems as there are not many schools and colleges offering higher studies through Urdu medium" and therefore made her join an English-medium school in lower kindergarten. Supraja complained that in the private school she attended the teacher used to beat her and other students with a stick for not doing their homework. She complains that "everything was bad about that school. I dislike[d] everything there even my friends". She says that she "did not study well and was playing all the time". She performed badly in the entrance exam to the next private school and had to repeat a year which "made me feel bad". She then moved to a different school, which she liked since the teachers "taught well", and scored 24/25 marks. In Grade 3 she had to return to her previous school once again, since the school did not have classes beyond Grade 2. She continued to have complaints about the teachers "who swear at me … and simply write on the blackboard and go away they are not teaching us anything about the lesson". In Grade 4 she once again moved to yet another private school and her mother explained that "in the earlier school she was very dull and lazy and now after coming to this school she has improved a lot and is very much aware of everything".

One of the teachers in a government secondary school described what she saw as the role of teachers: "We [teachers] must definitely encourage the children to express their doubts … there is a saying [that teachers need to be] 'a friend, philosopher, guide'." However, the teacher complained that the very large student population that hampered this:

> "[L]ast year there were 192 (students), so we divided into two sections. … there will be some problem [particularly for] children who are backward in studies …. If there are 120, 130 students, then to complete our syllabus is also a problem."

Unlike government primary schools, which are located within a 1km radius of the habitation and have small student populations, secondary schools follow the 5–7km norm and have large student populations.

7. Conclusion

In line with earlier research, our results show significant and positive correlation between academic self-concept and academic achievement of students in primary schools.

The results from our analysis of the learning environment show that components which have significant positive association with academic self-concept are clearly 'discussion/interaction with whole class' and as well as 'preparation of TLM', which have emerged as important factors within schools. This is supported by an NCERT position paper on mathematics teaching which proposed:

> a shift in focus from mathematical content to mathematical learning environments, where a whole range of processes take precedence… . Giving importance to these processes also helps in removing fear of mathematics from children's minds. A crucial implication of such a shift lies in offering a multiplicity of approaches, procedures, solutions. We see this as crucial for liberating school mathematics from the tyranny of the one right answer, found by applying the one algorithm taught. Such learning environments invite participation, engage children, and offer a sense of success. (NCERT 2006: v–vi)

On the other hand, disciplinary action by the teacher and temporary absence of the teacher from the class have negative significant association with students' academic self-concept. Our analysis found that besides the classroom environment, aspects of children's backgrounds, such as the level of household consumption expenditure, father's education, the grade and the type of school the child attends, also emerged as important in influencing 'academic self-concept'. While an association has been established between self-concept and certain classroom environment factors, we are not establishing causation between the same. Young Lives is very privileged to gather longitudinal data regarding children's well-being and self-concept and in view of the dynamic nature of self-concept, we hope that further rounds of data will lend themselves to further research on this subject.

Based on the above, we conclude that mathematical self-concept is significantly correlated with achievement, and that both *teaching practices* such as use of TLM, positive reinforcement and whole class discussion and *familial factors* such as socio-economic status and father's educational level are associated with higher self-concept. This is aligned to the socio-cultural perspective of learning (Brown et al. 1989; Lave and Wenger 1991; Vygotsky 1994).

It is evident that school learning environments contribute to developing students' self-concept and therefore it is critical that students from the most disadvantaged backgrounds, who are most in need of a nurturing classroom environment, should not be denied a socially caring environment. This was emphasised by the Yashpal Committee Report *Learning without Burden* which highlighted that that 'covering' the syllabus seems to have become an end in itself, unrelated to the philosophical and social aims of education (GOI 1993: 3). More recently the National Curriculum Framework for Teacher Education also suggested that there needs to be a focus on the young child: psychological development, processes of thinking and learning, socialisation processes in pre-primary, primary and upper primary stage of teacher education, along with engagement with subject-content and questions of epistemology' (NCFTE 2009: 25). Classroom approaches must not only emphasise academic learning but also aim to create a caring classroom environment that furthers students' academic self-concept. These results have important implications for

educationalists, school leaders, teachers and parents since they all need to work together to create learning environments that foster children's self-concept and provide fertile ground for it to develop. It is time that researchers and policymakers in India, recognised that social and emotional constructs such as self-concept are central to any discussion on high-quality education and ensure that all schools build supportive learning environments, since academic self-concept has important implications for students' academic success. This echoes the words of Tharp et al. (2000: 45):

> In schools, then, dedicated to the transformation of minds through teaching and learning, the social processes by which minds are created must be understood as the very stuff of education.

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Appendix

Table A1. *Descriptive statistics*

Variable	Mean	Std. Dev.	Min	Max
Introducing/summarising lesson	0.83	1.12	0	12
Lecturing	9.73	6.22	0	30
Group call-and-response	4.22	3.9	0	22
Questioning individual child in front of class	4.01	4.31	0	25
Setting work/homework	7.89	5.7	0	23
Discussion/interaction with whole class	0.11	0.48	0	6
Guiding group work	0.20	1.19	0	11
Talking/working with individual student	1.66	2.99	0	20
Discipline	0.21	0.76	0	10
Administrative work	0.08	0.37	0	5
Correction of work	0.5	2.09	0	18
Chatting/waiting (Non-teaching)	0.21	0.68	0	7
Temporary absence from the class	0.36	1.45	0	14
Classroom infrastructure index (PCA)	1.2	1.2	-2.6	3.4
Multi-grade classroom	0.23	0.42	0	1
Preparing TLM	0.89	0.32	0	1
Preparing remedial teaching material for slow learner	0.76	0.43	0	1
Preparing projects for the children	0.73	0.44	0	1
Use new method of teaching	0.89	0.32	0	1
School facility index *	-0.29	1.3	-3.86	1.53
Location: Urban	0.2	0.4	0	1
School type: Private	0.36	0.48	0	1
Child gender: Female	0.46	0.5	0	1
Child age	8.84	0.39	8	10
Child's class grade	3.55	1.09	1	6
Mother's years of schooling	2.95	4.02	0	14
Father's years of schooling	4.91	4.77	0	14
ST/SC	0.31	0.46	0	1
Backward Caste	0.52	0.5	0	1
Other Caste	0.17	0.38	0	1
Monthly per capita expenditure (Rs.)	844.4	436.08	238.42	3,463.2
Wealth index	0.49	0.17	0.01	0.89
Class size (population)	23.14	13.13	2	80

* A classroom infrastructure index and a school facility index have been generated by principal component analysis (PCA). The first includes availability of chair, table, desk, bench, blackboard, mat in the classroom and the second index includes the facilities of library, electricity, drinking water, toilets and playground.

Source: Young Lives school survey, Andhra Pradesh, 2010–11.

Number of observations: 884

Table A2. *Regression result – full model*

Variable	OLS-site fixed
Introducing/summarising lesson	0.030
	(0.032)
Group call-and-response	-0.014
	(0.012)
Questioning individual child in front of class	-0.003
	(0.009)
Setting work/homework	0.007
	(0.008)
Discussion/interaction with whole class	0.162**
	(0.071)
Guiding group work	-0.008
	(0.032)
Talking/working with individual student	-0.005
	(0.016)
Discipline	-0.125***
	(0.045)
Administrative work	-0.031
	(0.080)
Correction of work	-0.010
	(0.017)
Non-teaching activities	0.047
	(0.042)
Temporary absence	-0.045**
	(0.021)
Preparing TLM	0.214**
	(0.107)
Preparing remedial teaching material for slow learner	0.095
	(0.091)
Preparing projects for the children	-0.029
	(0.092)
Using new methods	0.061
	(0.104)
Multi-grade classroom	-0.121
	(0.092)
Classroom infrastructure index*	-0.031
	(0.035)
School facility index (PCA)*	-0.026
	(0.035)
Child gender: Female	0.001
	(0.063)
Child age	0.021
	(0.087)
Location: Urban	-0.099
	(0.160)
School type: Private	0.355***
	(0.116)
Backward caste (ST/SC=0)	0.046
	(0.083)
Other caste	0.014
	(0.110)
Monthly per capita expenditure	0.000***
	(0.000)
Wealth Index	0.117
	(0.293)
Mother's education	-0.002
	(0.011)
Father's education	0.030***
	(0.009)
Class size (number of students)	-0.006
	(0.004)
Present class grade of child	0.175***
	(0.038)
Constant	-1.460*
	(0.813)
Observations	884
R-squared	0.220

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 Standard errors are clustered at site level.

* A classroom infrastructure index and a school facility index have been generated by principal component analysis (PCA). The first includes availability of chair, table, desk, bench, blackboard, mat in the classroom and the second index includes the facilities of library, electricity, drinking water, toilets and playground.

Learning Environments in Andhra Pradesh, India: Children's 'Academic Self-Concept' and Mathematics Achievement

There is a growing realisation that good-quality education can only be assured if both the academic and the social and emotional developmental needs of learners are met within schools. This study investigates the relationship, at primary school level, between a child's beliefs about their ability to perform academic tasks i.e. 'academic self-concept' and achievement in mathematics, as well as between academic self-concept and aspects of the observed classroom environment. Using Young Lives quantitative as well as qualitative data from Andhra Pradesh, India, the results show a significant and positive correlation between the academic self-concept and the progress in mathematics of students in primary schools. We find from the analysis of the learning environment that more time spent by teachers on discussion and interaction with the whole class is significantly associated with better 'academic self-concept' in students. Disciplinary action taken by the teacher and the temporary absence of the teacher are seen to have a negative significant association with students' 'academic self-concept'. On the other hand the preparation and use of teaching and learning material (TLM) by the teacher improves academic self-concept significantly. These results have important implications for educationists, school leaders, teachers, parents and policymakers, since they all need to work together to create learning environments that foster the self-concept of children and provide fertile ground to help it develop.

Young Lives
An International Study of Childhood Poverty

About Young Lives

Young Lives is an international study of childhood poverty, involving 12,000 children in 4 countries over 15 years. It is led by a team in the Department of International Development at the University of Oxford in association with research and policy partners in the 4 study countries: Ethiopia, India, Peru and Vietnam.

Through researching different aspects of children's lives, we seek to improve policies and programmes for children.

Young Lives Partners

Young Lives is coordinated by a small team based at the University of Oxford, led by Professor Jo Boyden.

- *Ethiopian Development Research Institute, Ethiopia*
- *Pankhurst Development Research and Consulting plc, Ethiopia*
- *Save the Children (Ethiopia programme)*
- *Centre for Economic and Social Studies, Hyderabad, India*
- *Save the Children India*
- *Sri Padmavathi Mahila Visvavidyalayam (Women's University), Andhra Pradesh, India*
- *Grupo de Análisis para el Desarollo (GRADE), Peru*
- *Instituto de Investigación Nutricional, Peru*
- *Centre for Analysis and Forecasting, Vietnamese Academy of Social Sciences, Vietnam*
- *General Statistics Office, Vietnam*
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