

Motivation and Academic Performance: A SEM Approach

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ABSTRACT

Many models in educational have tried to clarify the causal relationships of motivation variables on student performance, by presenting hypothesized models, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) under structural equation modeling (SEM). Based on the literature, this model inspected the most robust stimuli of motivation: intrinsic, extrinsic, amotivation, self-efficacy and achievement motivation alongside with other variables like parental education, location, musculoskeletal pain (MSP), student body mass index (BMI), bag weights and tuition. SEM (unmodified and modified) is used to clarify the interrelationships of these variables and their relative contributions to academic performance. The sample consists of 324 students from Forest-Side State Secondary School (Boys). The results show that as predicted the latent variable motivation, mother education, private tuition and weights of bags have direct effects on students' performance using the modified standardized coefficients.

Keywords: motivation, academic performance, students, SEM

INTRODUCTION

Academic performance is the basic criterion used to assess students' success in their studies, making it vital to understand the factors responsible for determining, predicting, mediating and causing variance in academic achievement (Ahmed & Bruinsma, 2006). Students are admitted into schools from the society and transformed as output back to the society. Good academic performance is crucial to both students and educational institutions. The quality of students' academic performance is influenced by a range of environmental factors and psychological factors within the learners like motivation and the self apart from simple teacher and ability (Kumar & Karimi, 2010). Academic performance is principally measured in terms of scores in varied assessments and examinations and this information mass are referred to as performance data. The research by Dodd (2006) is indisputable about the role of performance data in effective schools and this avenue is the first indicator under analysis by the various educational stakeholders to measure academic performance. Mathematics is the language of science and technology, and early basis of mathematics skills is essential so as to achieve high academic performance (Richardson, 2000).

EMPIRICAL LITERATURE REVIEW

Motivation

Motivation is defined as the process that initiates, guides, and maintains goal-oriented behaviors (Cherry, 2016). There are five different constructs reflecting motivation (Ryan & Deci, 2000; Weiner, 1990) namely intrinsic, extrinsic, amotivation, self-efficacy and achievement (IEASAch). These constructs are discussed as

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follows: Intrinsic motivation is defined as motivation in which the source is the “*inherent satisfaction*” an individual derives from the behaviour (Deci & Ryan, 2008). Extrinsic motivation relates to a wide variety of behaviours from external sources and these behaviours are engaged in as a means to an end and not for their own sake (Deci, 1975). Amotivation is defined as a state in which individuals cannot perceive a relationship between their behavior and that behavior’s subsequent outcome (Deci & Ryan, 1985). It is a state of lacking impulse whereby amotivated people either do not act or act without intent (Ryan, 1991). Along with Bandura (1995), self-efficacy is defined as a personal judgement or expectation of how well an individual can execute courses of action required to deal with prospective situations. Achievement motivation refers to the affinity to work hard to meet personal aims within a social environment (Cassidy & Lynn, 1989). It signifies a complex, multidimensional concept (Hart *et al.*, 2008) or simply a drive or degree of motivation (Gwynn, 2012). It is characterized by the responsibility of the individual for the outcome (success or failure), anticipates unambiguous knowledge of the outcome results, and there is some degree of uncertainty or risk (McClelland, 1961).

Motivation constructs (IEASAch) and performance

There is much evidence to advocate that some types of motivation enhance academic performance (Cokley, 2003; Deci & Ryan, 1985; Prospero and Vohra-Gupta, 2007; Roeser *et al.*, 2013). It is well-accepted that the relationship between motivation and academic performance is multifaceted, and many studies have been inspected about the effectiveness of motivation as a driving force in the educational sector. Meta-analysis by Robbins *et al.* (2004) finds achievement motivation and academic self-efficacy, as well as academic achievement, to be significant predictors of GPA. Intrinsic motivation positively impacts on academic performance (Bouffard & Couture, 2003; Bong, 2004, 2007; Diseth *et al.*, 2010; Taylor *et al.*, 2014). Extrinsic motivation also has a positive impact on academic performance (Ryan, 2001; Sigfusdottir *et al.*, 2006; Bakhtiarv and *et al.* 2010; Hornstra *et al.* 2013; Helker and Wosnitzka, 2016; Passini *et al.*, 2015). In contrast, amotivation has an overall negative effect on academic performance (Pajares & Valiante, 2001; Sigfusdottir *et al.*, 2006; Arbabi *et al.*, 2014) but a few positive impacts are uncovered (Chow & Young, 2013; Mega *et al.*, 2014). Self-efficacy (Abu Bakar *et al.*, 2010; Du Toit *et al.*, 2011; Feldman & Kubota, 2014; Skaalvik *et al.*, 2015) and achievement motivation have positive comparable effect (Bong, 2004; Waseka & Simatwa, 2016).

Student Location and Academic Performance

The impact of student location on academic performance is an ongoing issue, and a clear cut verdict is ambiguous due to different research results. There is confusion between student location and school location and in Mauritius students are free to access either urban or rural schools due to free education and free transport. Therefore, the student location is preferred in this review. According to Ajai (2013), rural students performed better than their urban counterparts although the absence of effective teaching methods and argues that attendance is not the cause.

Another study indicates no significant difference in academic performance of rural and urban students and stresses that teachers have more objective looks to education and parents should no longer feel the difference (Alokan and Arijesuyo, 2013). A study shows significant differences between urban and rural locations of students in favour of urban students suggests that bridging the gap in educational resources could be a possible solution (Opoku-Asare and Siaw, 2015).

Parental Education and Academic Performance

Parental education is an indicator of parent’s income as income and education are highly correlated (Hauser & Warren, 1997). The degree and variety of parental interest are strongly predisposed by family upbringing, maternal level of education, maternal psycho-social health and single parent status and to a minor extent by family ethnicity (Desforges & Abouchaar, 2003). According to Chevalier *et al.* (2013) parental education are larger for maternal education than for paternal because mothers are more likely to be the key giver of care within the family circle. Socio-economic status like parents’ education, profession, revenue and standard of living are related to students’ performance, whereby middle to upper class family learners performs better than students from less privileged milieu (Baliyan & Nenty, 2015). It is very important that educated families impart their knowledge to their children in order to translate acquired know how into excellent performance (Machebe *et al.*, 2017).

Musculoskeletal Pain (MSP)

Musculoskeletal pains (MSP) are health problems associated with the locomotion system, such as muscles, tendons, bony skeleton, cartilage, ligaments, and nerves. These enclose all types of complaint, from minor and ephemeral pain to permanent and unbearable injuries (WHO, 2017)¹¹. Such musculoskeletal health problems arise when the mechanical effort surpasses the level of resistance of the components of the locomotor structure (Marras and Hancock, 2014). MSP symptoms include pains of the neck, shoulders, back, and upper members associated with awkward posture (Lapointe *et al.*, 2009). Developing back pain (BP) at an early age is a significant risk factor for experiencing BP in adult life (Harreby *et al.*, 1999). For instance, BP in adolescents varies up to 52.1% (Mackenzie *et al.*, 2003) and among students it ranges between 32.9% and 89.3% in different parts of the world (Abledu and Offei, 2015). This may in the long run lead to disability, decrease quality of life and lead to time lost from work in adulthood (Duthey, 2013). MSP is associated with academic performance (Du *et al.*, 2017).

BMI and Academic Performance

Academic performance is interrelated to cognitive and memory functions (Aguirre-Perez *et al.*, 2007). There is a negative association between obesity and cognitive memory functions on the academic achievement of adolescents (Kim and So, 2013). A balanced diet is normally recommended to people of all age and a deviation from healthy eating is normally associated health problems. According to the World Health Organization (2016) infancy obesity is linked with a higher chance of early death and disability in later life (Khadaee and Saeidi, 2016). The consumption of fast food by students is an example of poor nutrition which may lead to inadequate performance in the classroom (Alswat *et al.*, 2017). Students consuming above the average amount of fast food and students who are overweight have lower scores in math and reading in contrast to with their normal-weight peers (Tobin, 2013). Also, students with low level of physical activity tend to be obese and are more likely to be less performing (Naticchioni, 2013). Obese students may develop low self-esteem which may be translated into missed school with short term loss in performance outcome (Geier *et al.*, 2007).

Weights of Bags and Academic Performance

Weight of bags is mainly due to school materials like books, copybooks, pencil case and laptops in some cases. The amount of schooling materials that students carry is almost the same per grade but differs across grades. The weight of students varies greatly due to many reasons including age and genetics. Each student is differently affected by the weight of their bags. This exposes students to many health issues, mainly MSP (George *et al.*, 2015). The recommended bag pack weight by health organizations diverges ranging from not exceeding 5 % to 20% of the student's body weight (Rai and Agarawal, 2013) but the most convincing figures is not to exceed 10% of their body weight (Drzał-Grabiec, 2013; Goodgold *et al.*, 2002; Moore *et al.*, 2007). Perceiving high learning burden due to the heavy weight of the school bag negatively impacts academic performance (Panigrahi, 2018). However, weights due to instructional materials are positively correlated to academic performance (Krukru, 2015; Tety, 2016).

Tuition and Academic Performance

According to Dang and Hai-Anh (2008) private tuition is defined as fee based tutoring that offers extra instruction to children in academic subjects relative to mainstream education system. Investment in education plays a significant role in human development through empowerment of people to improve their well-being and participate actively in nation building (Nafula, 2002). So, tuition is perceived as a long term investment by parents but for students this may be the case as part of their precious time is being sacrificed. The private tutoring division is growing so rapidly that it is being considered the third rising education sector other than public and private school sectors (Dang & Rogers, 2008). A research study recommends private tuition as the analysis indicates a significant positive impact of tuition in Mathematics at secondary school level (Suleman & Hussain, 2014). In some cases, even professional tutors are selected for tutoring the children at home and this tendency of tutoring is turning into a tradition rather an academic necessity (Atta *et al.*, 2011). The term shadow education is also used to illustrate private tuition as it mimics normal schooling (Lee *et al.*, 2012). The tuition effect is so promising in academic performance that recommendations are being made to legalize private tuition, to prefer one-to-one private tuitions and to fearlessly invest in tuition (Kilonzo, 2014).

¹ Online at: www.who.int/mediacentre/factsheets/musculoskeletal/en/.

Table 1. Some recent studies using SEM to model motivation and performance

Study (Year) (N)	Dependent variable	Independent variables	Cronbach α
Arbabi <i>et al.</i> (2014) N=1125	Grades	Motivation Learning, etc.	0.68 0.75
Badiee <i>et al.</i> (2014) N=360	Mathematics achievement	Mastery goals Performance goals, etc.	0.75 0.82
Bergamin <i>et al.</i> (2010) N= 309	Psychology performance	flexibility of time flexibility of teacher contact	
Boon (2007) N=879	Achievement	Parenting goals Self-efficacy etc.	-
Caprara <i>et al.</i> (2011) N=879	Achievement	Self-efficacy, Traits	0.89 0.79
Chik and Abdullah 2018 N=260	Additional Mathematics	Motivation Learning, etc.	- -
Di Giunta <i>et al.</i> (2013) N=187,206,188			
Diseth <i>et al.</i> (2010) N=422	HSGPA, Grades etc.	Deep, Surface etc.	0.76 0.68
Guay <i>et al.</i> (2010) N=925	Grades	Academic self-concept Motivation etc.	0.78 0.72
Khalaila(2014) N=170	Grade average	self-concept Intrinsic etc.	0.91 0.81
King (2013) N=1026	GPA	Parent support Work avoidance etc.	0.77 0.71
Mega and De Beni (2014) N=5805	Academic achievement	Strategies Self-efficacy etc.	0.59 0.74
Skaalvik <i>et al.</i> (2015) N=823	Mathematics	Self-efficacy Intrinsic motivation etc.	0.92 0.91
Taylor <i>et al.</i> (2014) N=514	Math and Science Grades	Intrinsic motivation Amotivation etc.	0.73 0.75
Tongsilp (2013) N=840	GPA	Classmate relationships Self-directed learning etc.	- -
Um <i>et al.</i> (2005) N=4566	Mathematics	intrinsic motivation external regulation	0.78 0.68
Wilson and Trainin (2007) N=198	Literacy Achievement	Self efficacy Perception of competence	- -
Wormington <i>et al.</i> (2011) N=1067	GPA	Intrinsic motivation Perceived competence etc.	0.91 0.61

Motivation and Performance using the SEM Approach

Structural Equation Modeling (SEM) as a statistical technique has gained increasingly recognition since it was first envisioned by Wright (1918), a biometrician who developed the path analysis method to examine genetic theory in biology (Teo & Khine 2009). The SEM approach offers some advantages to researchers compared to other statistical method. It is founded on regression, ANOVA and correlation techniques but demarks itself by allowing analysis of hypothesized interconnection between latent constructs (Kline, 1991). It also permits for a higher level of generalization through the development of structural models of theorized constructs. SEM allows illustrating direct and indirect effects from observed variables based on hypotheses of casual effects (Stage *et al.*, 2004). It permits measurement and structural models between latent variable (a group of independent variables). The path coefficients are corrected for measurement error as hypothetical variables are measured by several indicators where measurement error is “averaged out” (Bentler, 1982; Kline, 2005, Violato & Hecker, 2007). Reliability of a statistical method is crucial in quantitative analysis and numerous types of reliability exist as regard to SEM: internal consistency, split-half reliability, test-retest reliability and homogeneous reliability (Ursachi *et al.*, 2015). The internal consistency reliability is calculated using the Cronbach Alpha coefficient which is believed to indirectly specify the degree to which a group of items computes a single unidimensional latent construct. There are many questions when considering minimum sample sizes and a proposal of 100 comes from simulation studies (Anderson & Gerbing, 1984; Kyriazos, 2018). In the issue of factor loadings in confirmatory factor analysis (CFA) factors such as the overall sample size (> 200-400) and magnitude of the loadings (standardized value > .60) is more important (Jackson, 2007). A common conventional rule is that Cronbach Alpha of 0.6-0.7 indicates a satisfactory level of reliability, and 0.8 or greater is a very good level. Still, values higher than 0.95 are not automatically good, since they might be a suggestion of redundancy (Hulin *et al.*, 2001). SEM is extensively used in the education field (Khine, 2013; Marsh & Hau, 2007). So with so many benefits the SEM method poses as an indispensable tool in an educational research and **Table 1** shows some studies using the SEM approach to model motivation and

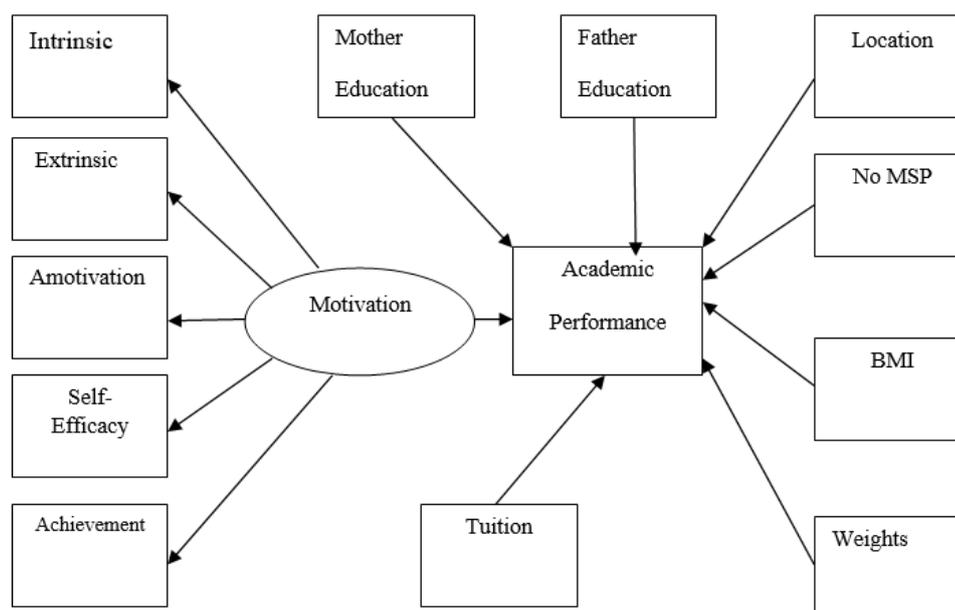


Figure 1. Hypothesized model for motivation and other variables influence on performance

performance. The studies are from 2005 and above to keep track of the latest trends in education research. The Cronbach alpha values range from 0.59 to 0.91. This study tries to follow the same pattern in an attempt to model motivation and performance in the presence of other moderator variables. The sample sizes vary from a minimum of 270 to a maximum of 4566 students. All the studies use measures of student academic performance as dependent variables and many motivation constructs are used as independent variable.

DATA AND METHODOLOGY

The Model Hypotheses

- H1: Motivation constructs (IEASAch) positively and significantly affects student's performance.
- H2: Mother education positively and significantly affects student's performance.
- H3: Father education positively and significantly affects student's performance.
- H4: Living in urban location positively and significantly affects student's performance.
- H5: Absence of MSP positively and significantly affects student's performance.
- H6: BMI positively and significantly affects student's performance.
- H7: Weights of bags positively and significantly affects student's performance.
- H8: Tuition positively and significantly affects student's performance.

The model is hypothesized based on the literature review and a model proposed and tested by Kusurkur *et al* (2013).

Sample

Students are from a secondary school (Forest Side Boys State Secondary School) in Mauritius, cohort 2017. The respective rector of the schools approved the measurement protocol. A description of the study's procedures was provided to parents, and written parental consent was obtained prior to participation. A group-administered survey was conducted in each class in the presence of the educator in charge at any particular period of the school day.

The Questionnaire and Selection Criteria

The questionnaire consists of five sections (A, B, C, D and E) which are found to be most relevant to the study. The first section includes questions regarding socio-economic indicators (location and parental



Figure 2. a) Measuring student’s bag weight; b) Measuring student’s BMI; c) Students filling questionnaire; d) A pen as token

education). The second section deals with performance and school facilities (Mathematics performance, extrinsic motivation and private tuition). Section C captures the motivation constructs (Self-efficacy, achievement and amotivation). Section D is on health status and it captures anthropometric measures (height and weight of students; weight of bags) and symptoms of potential MSP. The construct intrinsic motivation is captured from section E. In a pilot study, the questionnaire was distributed to 90 randomly chosen students, 30 educators and 5 rectors for corrections and proofreading and the required changes were made to enhance reliability. After the anthropometric measures, students completed questionnaires consisting of Likert scale, close-ended and branching questions.

The analysis and detection of musculoskeletal symptoms of different persons in different parts of the globe using indirect methods (questionnaires) requires the standardization of the evaluation questions (López—Aragón *et al.*, 2017). Such a questionnaire has been developed by Holman, (1966) and it is widely used under the name of Nordic Musculoskeletal Questionnaire (NMQ). Another interesting questionnaire is composed of closed questions on BP and social, economic, demographic, and behavioral variables (Detsch *et al.*, 2007). The actual study’s questionnaire utilizes concepts from both questionnaires as it adapts part of NMQ to capture MSP in its health section. **Figure 2(a-d)** shows the survey being carried with grade 9 students whereby bag weights, BMI measurements, questionnaire fillings and a pen is being given to a student after completing the survey.

The questions selected to represent motivation (IEASAch) are based on literature but it is adapted to the classroom environment so as to facilitate understanding for easy responses. The respective questions and the closest related references are given:

I am often cheerful and energetic (I)

Interest and enjoyment are both emotions that describe intrinsic motivation (Deci & Ryan, 1985; Nix *et al.*, 1999). Intrinsic motivation depends on inner pressure and surfaces from a person's enjoyment or interest in the duty being accomplished. It does not involve working on actions for the purpose on an external reward but it rather entails the feeling of inner pleasure in the activity itself. Malone and Lepper (1987) view intrinsic motivation as a force that involves doing activities without exterior incentive². For example, a person is eager to act provided that he is involved or individually enjoys the task. Intrinsic motivation illustrates behaviors that are fun, interesting, and optimally challenging (Legaut, 2016).

Educators are good at explaining things (E)

Extrinsic motivation is as an external strength in the form of expectation, praise and rewards that power students in learning (Kong, 2009). When educators encourage best practices like incorporating a range of teaching methods and complementary exhibits verbal and non-verbal behaviours that create a positive feeling and stimulate learners' curiosity (Falout *et al.*, 2009; Kistnasamy, 2014). In some forms of extrinsic motivation the person feels more self-endorsed and self-concordant than others. Extrinsic motivation is an extensive class of motivations that range in the extent to which they are self-directed stemming from an internal perceived locus of causality and sense of personal choice. Therefore, even if an action is not fun or enjoyable it may nevertheless be internally regulated as opposed to externally controlled (Legaut, 2016).

I really feel that I am wasting my time at school (A)

According to the self-determination theory the lowest stage in feeling self-determination is amotivation (Deci & Ryan, 2000). Amotivation describes the state where the actor perceives his or her behavior as being determined by external forces completely out of his or her own control (Cokley, 2000). Individuals lurking in such a stage lack apparent competence because they do not feel capable to perform the behavior, or they lack the supposed control as they think their actions are not enough to achieve a desired result (Wang *et al.*, 2016). Amotivation is linked with a range of negative outcomes and feelings. It is accompanied by an intention to drop out and the respective individual actually actual drops out (Utvær & Haugan, 2016).

When I make a mistake, I try to find out why (Ach)

Atkinson and Feather (1966) state that a person's achievement oriented behavior is based on three parts: the individual's predisposition to achievement, the probability of success, and the individual's perception of value of the task. The power of motivation to perform some act is supposed to be a multiplicative function of the strength of the motive, the expectancy (subjective probability) that the act will have as a consequence the attainment of an incentive, and the value of the incentive. An achievement behavior is a behavior directed at developing or indicating high rather than low ability. Ability is rated high or low with reference to the person's own past performance or comprehension and a gain in mastery specifies competence. Ability is also the capacity relative to others where one must achieve more with equal effort or use less effort than do others for an equal performance (Nicholls, 1984).

Whether the subject content is difficult or easy, I am confident that I can understand it (S)

Self-efficacy is as the power to produce an effect. It also reflects a person's judgments of his or her ability to fruitfully participate in an activity and the effect the view has on future activities. Students with positive self-efficacies feel in control of their learning condition and deem they have the essential capabilities to succeed (Scott, 1996). Self-efficacy beliefs decide how people feel, think, motivate themselves and behave. Such beliefs produce these diverse effects through cognitive, motivational, affective and selection processes. The most useful method of creating a strong sense of efficacy is through mastery experiences. Accomplishments build a strong belief in one's personal efficacy whereas failures weaken it, mainly if failures happen before a sense of efficacy is confidently established. Social models too can boost self-efficacy that is if someone similar to him or her can succeed, he or she can also do it³.

² Online at: <https://explorable.com/intrinsic-and-extrinsic-motivation>

³ Online at: Source: <http://www.des.emory.edu/mfp/BanEncy.html>

Table 2. Description and Summary Statistics

Variable	Description	Mean	Std. Dev.	Minimum	Maximum
<i>Dependent</i>					
<i>maths</i>	second term score in mathematics	57.199	17.994	10	95
<i>Independent:</i>					
Motivation					
q44	I am often cheerful and energetic	4.095	0.932	1	5
q9	educators are good at explaining things	4.034	0.824	1	5
q28	I really feel that I am wasting my time at school	1.629	1.050	1	5
q30	whether the subject content is difficult or easy, I am confident that I can understand it	4.025	0.978	1	5
q33	when I make a mistake, I try to find out why	4.200	0.878	1	5
fed	father's education level	2.862	0.853	1	4
med	mother's education level	2.920	0.675	1	4
urban	student lives in an urban region	0.212	0.409	0	1
nomsp	student does not have musculoskeletal pain	0.175	0.380	0	1
bmi	student's body mass index	19.598	4.948	12.163	43.445
weights	weight of bag	4.063	1.776	0.5	9.9
y	student takes private tuition	0.571	0.496	0	1

Data Collection

Out of the 395 students (7th – 10th grade, aged 11-14 years) requested to participate in the study, parental consent was obtained by of them. 347 questionnaires were collected but due to incompleteness and bias⁴, 48 questionnaires were discarded. The final sample size contains 324 questionnaires. Data were collected during a typical day at school so that actual schoolbag weight could be recorded. Height was measured to an accuracy of 0.5 cm using a meter rule, and standing height was measured with the student shoes to avoid reluctance in participation.

Body and schoolbag weight were measured with electronic balances with an accuracy of ± 0.1 kg. To ensure reliability of the protocol, the weight measurements were taken on the same day and by the same investigator, and the average value out of three measurements was recorded. With this data, each student's BMI was estimated in kg/m², and the relative schoolbag weight was estimated as a percentage of student weight (% of BW). The time spent in carrying school bags were recorded in minutes and it accounts only standing and walking positions. On completion of the questionnaires, the investigator gave a pen as a token to each student and the students were notified that they can withdraw from the survey at any stage of the study.

Descriptive Statistics

Table 2 presents the descriptive and summary statistics for the data used in this paper. About 65% of the students scored at least 50 marks and 13% of the students scored less than 40. A 5-point Likert-scale has been used to construct the indices except for MSP where two categories are present. Only the amotivation construct under motivation has a mean of about 1.6 showing that most students have positive feelings about their schooling. The other forms of motivation (IESA) have means of about 4 on a scale of 5 indicating that these forms of motivation are strongly present in students. Parental education is slightly higher for mother compared to father. About 21% of the students are from urban regions and only about 18% of the students do feel MSP in any body region due to the carriage and standings with bags on their journey. The average BMI of the students is about 20 and the weight of bags ranges from 0.5Kg to 9.9Kg. About 57% of the students get recourse to private tuition in general.

⁴ Some respondents reported figures such as Rs 25.00 with respect to Tuition fees. These values do not fit the actual context for private tuition. A few bag weights were written as 2 -5 grams instead of kilograms and they were omitted. Any flawed or partial responses were excluded from the final dataset.

Table 3. Correlation matrix for the model variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	
maths	1.00													
q44	0.29***	1.00												
q9	0.22***	0.26***	1.00											
q28	-0.07	-0.20***	-0.10*	1.00										
q30	0.15***	0.28***	0.44***	-0.23***	1.00									
q33	0.18***	0.27***	0.20***	-0.12**	0.32***	1.00								
fed	-0.07	-0.16***	-0.05	-0.003	-0.12	0.003	1.00							
med	0.10	-0.03	0.02	0.02	0.01	0.08	0.34***	1.00						
urban	-0.01	-0.03	-0.04	0.03	-0.03	0.03	0.13**	0.13**	1.00					
nomsp	0.09*	0.12**	-0.03	-0.03	0.04	0.03	-0.13**	-0.01	0.02	1.00				
bmi	0.04	0.05	-0.03	0.01	-0.01	-0.03	0.07	-0.10*	-0.01	-0.03	1.00			
weights	0.17***	0.14**	0.20***	-0.01	0.10*	0.08	-0.10*	-0.05	0.04	-0.19***	0.12	***	1.00	
y	-0.01	-0.12**	-0.24***	0.11*	-0.13**	0.01	0.13**	0.07	-0.02	0.04	-0.004	-0.19	***	1.00

Note. *p < 0.1, ** p < 0.05, ***p < 0.01

Table 4. Cronbach alpha values under latent variable motivation

Constructs under Motivation	Cronbach alpha
I am often cheerful and energetic (I)	0.552
Educators are good at explaining things (E)	0.553
I really feel that I am wasting my time at school (A)	0.625
Whether the subject content is difficult or easy, I am confident that I can understand it (S)	0.4837
When I make a mistake, I try to find out why (Ach)	0.572
Test scale	0.614

Descriptive statistics and correlations

Table 3 shows the correlation coefficients for each of the variables evaluated in the study based on the hypotheses H1 up to H7 described above. The table displays a positive correlation between motivation variables (intrinsic, extrinsic, self-efficacy and achievement motivation) and performance as observed in earlier studies (Helker & Wosnitza, 2016; Robbins *et al.*, 2004; Skaalvik *et al.* 2015; Taylor *et al.*, 2014) but in contrary to Chow and Young (2013) and Arbabi *et al.* (2014) and neither positive nor negative correlation is found between amotivation and performance. The correlations reveal that the absence of MSP and performance are positively correlated and its presence may disturb academic performance (Du *et al.*, 2017). The correlation between weights of bags and performance is in contrast to the findings of Panigrani (2018) whereby perceiving high learning burden due to the heavy weight of the school bag negatively impacts academic performance (Panigrani, 2018). Results show high level of correlations among motivation mechanisms (IEASAch), mother's and father's education, urban location and parental education, weights and absence of MSP, BMI and weights, weights and tuition. These correlations formed the basis for testing the model proposed in **Figure 1**.

Data analysis

The descriptive statistics are evaluated using StataSE14 for Windows. The SEM analysis is carried out in two stages, the measurement model and the structural model (Anderson & Gerbing, 1988). Firstly, a preliminary technique is employed to reveal the essential constructs in the data by Exploratory Factor Analysis (EFA). Factors identified through literature review and proposed in the questionnaire are subjected to EFA that shrinks data, with an extraction method of Maximum likelihood (ML) and factor rotation. Factors with loadings above 0.5 are preferred in shaping the latent variables (Pawaskar and Goel, 2016). The variables IESAA under the latent variable motivation signified a Cronbach alpha value of 0.6138 as given in **Table 4** which is in line with Hulin *et al.* (2001) and Field (2009) stating that a factor with four or more loadings greater than 0.6 "is reliable regardless of sample size."

The Bartlett's test of sphericity indicated a Chi-square value of 378.033 with 78 degrees of freedom and p-value = 0.000 showing that the variables are not intercorrelated. The measure of Sampling, KMO, has a value of 0.648 concerning the factors discussed and it is an acceptable value (Kaiser 1974; Hof, 2012; Sulaiman and Zahoni, 2016).

Next, the model fit is assessed using a variety of indicators and tests, more famous being the goodness-of-fit index (GFI), comparative fit index (CFI), the incremental fit index (IFI), the Tucker Lewis Index (TLI), root mean square error of approximation (RMSEA) and Chi-square and degree of freedom. The goodness-of-fit

Table 5. Confirmatory Factor analysis

Fit statistic	Value Description
Likelihood ratio p > chi2 degrees of freedom=38	45.133 (0.198)
Population error Root mean squared error of approximation RMSEA <= 0.05	0.024
Information criteria Akaike's information criterion (AIC) Bayesian information criterion (BIC)	12564.177 12813.706
Baseline comparison Comparative fit index (CFI) Tucker-Lewis index (TLI)	0.969 0.954
Size of residuals Standardized root mean squared residual (SRMR) Coefficient of determination (CD)	0.034 0.699

Table 6. SEM models before and after modification

Variables	Model 1 (Before modification)	Model 2 (After modification)
	Coefficient	Coefficient
motivation	12.173 (2.939) *	12.835 (3.053) *
fed	-2.132 (0.588)	-2.282 (1.566)
med	3.417 (1.501) +	3.316 (1.497) +
urban	-0.748 (0.321)	-0.573 (2.315)
nomsp	4.378 (2.548) ‡	3.978 (2.565)
bmi	0.169 (0.192)	0.187 (0.191)
weights	1.475 (0.561) *	1.127 (0.587) ‡
y	2.268 (1.962)	3.353 (2.033) ‡
Constant	42.198 (6.934) *	43.393 (6.939) *

of the proposed model is evaluated using the universally-accepted statistical indices, such as Goodness-of-Fit Index (GFI) with a value closer to 1 indicating good fit (Byrne, 2001). In this case, the value of Goodness-of-Fit Index (GFI) as indicated by **Table 5**, the TLI and CFI values of 0.954 and 0.969 are respectively consistent in suggesting that the hypothesized model represented an adequate fit to the data [values above 0.90 being indicative of good fit. The proposed model has a value of 0.024 for its Root Mean Square Error of the Approximation (RMSEA) (which should be less than 0.08), implying that the model is an acceptable fit. The ratio of Chi-square to degrees of freedom is within the recommended fit of less than 3. Thus, all the tests and measures, taken together support our structural model and indicate that the model has a good level of fit and can be used for further analysis. Therefore, the hypothesized model proposed in the study fits the sample data satisfactorily. Next, SEM analysis is used to estimate all of the parameters using the maximum likelihood method.

RESULTS

Table 6 displays two models with their respective structural coefficients for the latent variable motivation and the other observed variables. On a first look both seem alike but a closer look at the overall test revealed opposing results. Model 1 and Model 2 are discussed below.

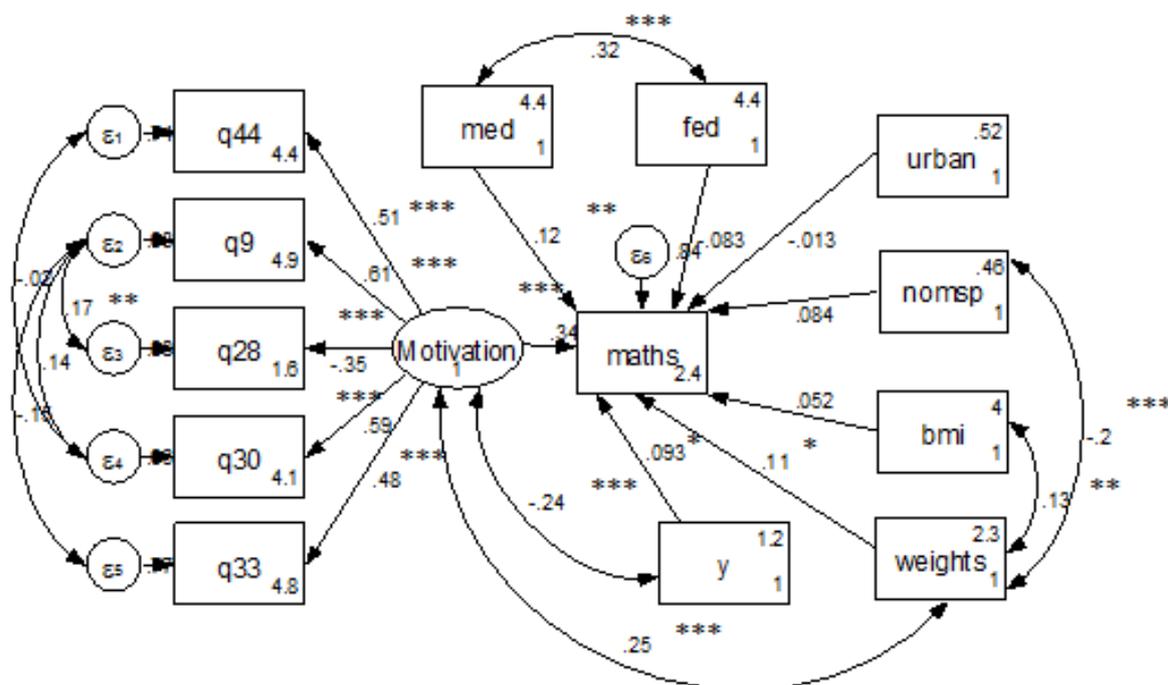


Figure 3. Standardized path analysis

Model Choice (Proposed Model versus Modified Model)

Model 1 was tested with three sets of covariance between med/ fed, weights/nomsp and BMI/weights but the overall model was not good (LR test of model vs. saturated: $\chi^2(44) = 81.61$, $\text{Prob} > \chi^2 = 0.0005$) although the motivation measurements and the mean of other variables were highly significant. We then tested a modified factor model based on the suggestion of the modification indices command (Kline, 2005). Seven pairs of covariances were included as follows $\text{cov}(e.q44, e.q30)$, $\text{cov}(e.q44, e.maths)$, $\text{cov}(e.q9, e.q28)$, $\text{cov}(e.q9, e.q30)$, $\text{cov}(e.q9, e.q33)$, $\text{cov}(\text{weights}, \text{Motivation})$ and $\text{cov}(y, \text{Motivation})$. Although it could be debatable whether these items would be somewhat redundant, the fact is that higher scores in one of the items imply higher scores in its related pair. Consequently, we considered the theoretical framework which supported the decision of adding covariances to find a better-fitting model (LR test of model vs. saturated: $\chi^2(38) = 45.13$, $\text{Prob} > \chi^2 = 0.1984$). Thus, the resulting improved model showed a good fit and was the most adequate for our data.

Interpretation of the Path Analysis Coefficients

SEM provides both standardized and unstandardized options for coefficients but this study employs the standardized coefficients although the initial gains from defining and using the relevant range for standardization may be modest (Grace & Bollen, 2005). The standardized values are values converted into the same unit (standard deviation). Using standardized values are preferable because it provides comparability between values but unstandardized values are needed to obtain the significance of indirect effects. Figure 3 illustrates the path analysis of the standardized model of the direct and indirect effects of the various independent variables on math performance.

Motivation is positively (standard coefficient = 0.34) associated academic performance in Mathematics. If motivation is increased by one standard deviation, academic would be expected to increase by 0.34 standard deviations. Mother education is positively related to academic performance and an increase in one unit standard deviation would increase performance by 0.12 standard deviations. Similarly, weights of bags and tuition are positively linked to performance with respective increase in standard deviations. The other observed variables have insignificant relations on math performance in this particular study but this does not mean the absence of correlation in general. The same variables may give different results in different context of study.

DISCUSSIONS

This article addresses the different types of motivation (IEASAch) as the main predictor of academic performance alongside with other independent variables. The path coefficients for the full model as illustrated with mainly positive and highly significant (p-value < 0.001) except for the paths of amotivation (q28) to motivation. The results of the study signify that hypothesis H1 H2, H7, and H8 are accepted while hypothesis H3, H4, H5 and H6 are rejected with insignificant p-values. All the five variables under the latent variable motivation are highly significant and motivation is a strong predictor of academic performance (B=12.84, SE=3.05 and Pearson correlation=0.34) in line with literature (Arbabi *et al.*, 2014; Helker & Wosnitza, 2016; Robbins *et al.* 2004; Skaalvik *et al.* 2015; Taylor *et al.*, 2014). The result also show that mother education is directly associated with academic performance as the result of Chevalier *et al.* (2013) stressing that parental education are larger for maternal education than for paternal because mothers are more likely to be the key giver of care within the family circle. The weight of bags of students are directly related to performance indicating that weight of bags is mainly due to school materials like books, copybooks, pencil case and laptops in some cases. These facilities are referred to as instructional materials and it is positively correlated to academic performance (Krukru, 2015; Tety, 2016). The results points toward the importance of private tuition in the dissemination of extra knowledge to students with respect to academic performance as revealed by the study of Suleman and Hussain (2014).

Future Research

The use longitudinal and experimental studies (Burton *et al.*, 2006) on motivational processes and academic performance is required. This will permit an assessment of how students attain the motivation, behavioral choice, analytical strategies, strength, persistence, commitment, success or failure of subsequent performance (Taberero & Hernández, 2011). Additionally, to the variables studied in the present study, the model can be extended by adding other related school variables like extracurricular, socioeconomic features of students, resiliency and financial politics of government on education.

Strengths and Limitations

One of the strengths of our study is that we used a SEM approach and have found a well-fitting model for the relationship between motivation, mother education, weights of bags, tuition and academic performance. Positivity is the use of primary data in the survey to add to existing literature. Only male students have been used, therefore the effect of gender is not examined which is very important in educational studies. Another limitation is that the findings require replication to show that they are not unique to the current study sample (Rugutt & Chemosit, 2005).

CONCLUSION

It is important for researchers to explore motivational models as it is complex but crucial to understand the student and performance nexus. The SEM model has shown that there are causal relationships between motivation, mother education, weight of bags and private tuition and proposes one possible way to improve math performance. Educational stakeholders need to identify, potential student's internal and external motives for performance, and integrate them in their sharing of good practices agenda.

Disclosure statement

No potential conflict of interest was reported by the authors.

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