

A Meta-Analysis of the Combined Effects of Motivation, Learning and Personality Traits on Academic Performance

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ABSTRACT

Domains of motivation, learning and personality traits (MLP) have emerged as vital constructs in studies of academic performance. Although there are abundant studies on the relationships of the three aforementioned dimensions on performance, no systematic synthesis of the empirical literature has been done regarding how three determinants jointly influence academic performance. Random-effects meta-regression analysis with a restricted maximum likelihood estimator is applied to 54 papers with 344 estimates. Summarization of effect sizes reveal a mean effect size for the study of $r=0.22$. The forest plot suggests a significant amount of study heterogeneity. No evidence of significant publication bias is uncovered. The achieved results show the significance of MLP as associated variables and also on an individual basis and they can positively impact student's academic performance. Other mediator variables, including income level, year, main methodology used, cohort gender, sample size, publication type and citations are found to be important variables in understating academic performance. Future work is needed to develop an integrated approach to examine educational objectives and explore the correlates of combined MLP and academic performance.

Keywords: learning, motivation, meta-analysis, performance, personality traits

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 (Ahmad & Bruinsma, 2006). There seems to be general agreement among scholars as to what influences academic achievement, especially educational and personality psychology. On one extreme, predictors of academic achievement rest on a variety of cognitive measures, intelligence and mental abilities and on the other one, non-cognitive variables like personality characteristics, socioeconomic status, etc. (Hakimi et al., 2011).

Educational psychology is the scientific field which draws on and combines numerous psychological and behavioural theories to improve the understanding of teaching as well as learning strategies. It is involved with the concepts of motivation, intelligence, memory, cognition, intellectual development, evaluation and assessment (Larson, 2009). Personality psychology is the branch of psychology that described by a set of traits or fixed set of patterns of the thought patterns, feelings, and behaviours that make each individual unique (Feldt et al., 2010). Some complex and systematic overlapping between these educational and personality psychology dimensions is possible (Busato et al., 2000; Komaraju et al., 2011).

Indeed, a variety of educational studies have considered a holistic approach. Motivation and personality linkage can be explained by Maslow's Hierarchy of Needs (Maslow, 1943) represented by physiological, safety, belongingness, esteem and self-actualization levels. Bloom et al. (1956) was among the first to conceptualize higher forms of learning. The Bloom et al. (1956) theory complements with two other strands which have been broadly applied in clarifying performance in terms of motivation and personality traits. The interaction between learning and personality can be explained by Eysenck's (1967) theory which predicts a relationship between extraversion, neuroticism and intelligence. Following the expectancy-value theory, expectancies and values play a central role in determining the future choices, commitment, persistence and achievement (Atkinson & Birch, 1978). Weiner's (1980) attribution theory incorporates the notion about learners being motivated by positive outcome of their achievement. The Reversal Theory comes under the textbook headings of motivation, emotion, and personality (Apter, 1989). It can provide a structure for understanding certain types of psychopathology such as attention-deficit or hyperactivity disorders. Schmeck (1988) advocates a general idea whereby personality traits are expressed in learning styles that are eventually reflected in learning strategies and tactics. Learning styles are motivated by traits such as self-efficacy, self-control and self-confidence.

Motivated individuals are inspired to complete a project, accomplish an objective or a degree of qualification in their professions (Mohamadi, 2006). Therefore, the paper aims to synthesize the effect of motivation, learning and personality MLP in order to find the principal factors that affect academic performance. The MLP constructs are discussed below.

Motivation Constructs

Motivation is defined as the process that initiates, guides, and maintains goal-oriented behaviors (Cherry, 2016). The inherent interaction between education psychology (motivation and learning) and personality (traits) psychology allows for an integrative approach to explain the factors affecting academic performance. The MLP model applies five constructs for each dimension. The five constructs reflecting motivation (Ryan & Deci, 2000; Weiner, 1990) are intrinsic, extrinsic, self-efficacy, achievement and amotivation (IESAA). These constructs are discussed as 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). 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).

Learning Constructs

Learning is identified as “*to think using the brain*” (Yap, 2012, pp. 442). The five constructs¹ for learning are cognitive, psychomotor, affective, social and health (CPASH). They are discussed as follows: Cognitive learning occurs when knowledge stored in long-term memory is shifted to short-term memory to integrate new information into the mind (Bell-Gredler, 1986). It explains how mental processes are influenced by both intrinsic and extrinsic factors, which bring about learning in an individual. Psychomotor learning posits physical movement, coordination and use of the motor-skill areas. Those skill developments involve practice and are measured in terms of speed, precision, distance, procedures, or techniques in execution (Dalkir, 2011; Bialik et al., 2015). Affective learning describes learning objectives that emphasize a feeling tone, an emotion or a degree of acceptance or rejection (Krathwohl et al., 1964). Social learning theory stipulates new learning behaviours and abilities by observing others (Bandura, 1977). Health connects to school readiness long before a child begins formal education. Lindström and Eriksson (2011) conceptualize healthy learning as a lifelong process where people improve their mental health, wellbeing, and quality of life through the creation of learning environments characterized by a strong sense of coherence and healthy behaviours regarding exercise, food habits and stress-resistance.

Personality Constructs

Personality is defined as innate tendencies from biological and environmental features channelled by a set of habitual behaviours, cognitions and emotional patterns (Corr & Matthews, 2009). The Big-Five personality trait model (Goldberg, 1990) constitutes of openness, conscientiousness, extraversion, agreeableness and neuroticism (OCEAN). Openness trait relates to active imagination, aesthetic sensitivity, alertness, intellectual curiosity and independence of judgement. Open individual is curious and unconventional. Conscientiousness refers to the level of responsibility, planning, organizing and task-orientation. Conscientious people may be tidy, fastidious and workaholic. Extraversion includes traits such as sociability, assertiveness, sensation-seeking and talkativeness. Extraverts are energetic, friendly and optimistic. Agreeableness involves with empathy, affectionate and optimistic. Agreeable individuals behave in a socially acceptable manner and follow social norms. Neuroticism is defined by characteristics such as stress and anxiety. Neurotic people experience negative emotions such as fear, sadness and anger.

LITERATURE REVIEW

Motivation Constructs and Academic Performance

There is much evidence to advocate that some types of motivation enhance academic performance (Prospero & Vohra-Gupta, 2007; Roeser et al. 2013). It is well-accepted that the motivation-academic performance nexus is multifaceted. A 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; Boon, 2007; Diseth et al., 2010; Taylor et al., 2014). Extrinsic motivation also has a positive impact on academic performance (Bakhtiarvand et al. 2010; Helker & Wosnitza, 2016; Hornstra et al. 2013; Passini et al., 2015; Ryan, 2001). The same applies to self-efficacy (Abu Bakar et al., 2010; Du Toit et al., 2011; Feldman & Kubota, 2014; Skaalvik et al. 2015; Wilson & Trainin, 2007). Achievement motivation has comparable effect (Bong, 2004; Waseka & Simatwa, 2016). In contrast, amotivation has an overall negative effect on academic performance (Arbabi et al., 2014; Pajares & Valiante, 2001; Sigfusdottir et al., 2006) but a few positive impacts are uncovered (Chow & Young, 2013; Mega et al., 2014).

Learning Constructs and Academic Performance

An examination of the learning domains and academic performance reveals mainly positive correlation results consistent with our prior expectations (Furst, 1981; Markle & O'Banion, 2014). Van Iddekinge et al. (2018) carry out a meta-analysis of the interactive, additive, and relative effects of cognitive ability and motivation on performance. They find a stronger ability-

¹ Online at: <https://www.supportrealteachers.org/the-3-domains-of-learning.html>

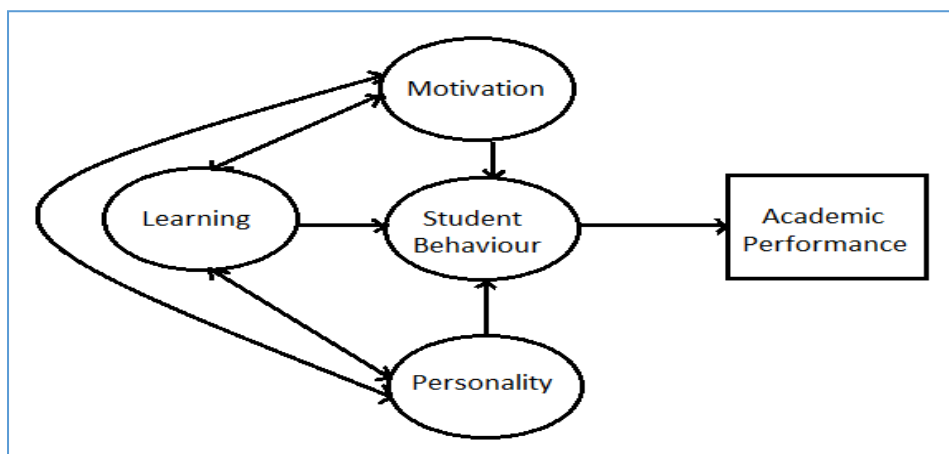


Figure 1. The link between the MLP and academic performance

performance relation when motivation is higher. The relationship between cognitive domains and academic performance indicates a positive value (Guay et al., 2010; Hornstra et al., 2013; Waseka & Simatwa, 2016). The psychomotor and academic performance association shows similar results (Du Toit et al., 2011; Skaalvik et al., 2015; Stoeber & Eismann, 2007). Mixed results are found for the affective and academic performance connection (Fritea & Fritea, 2012; Helker & Wosnitza, 2016; Ryan, 2001). Social domains and academic performance generally share a positive link (Ali et al., 2014; Bossaert et al., 2011; Passini et al. 2015). The bond between healthy domains and academic performance imparts a mixed outcome (Doshi & Yogesh, 2014; Hoseinzadeh & Shoghi, 2013).

Personality Constructs and Academic Performance

Latest meta-analyses have revealed that there are consistent links between personality and academic performance (Poropat, 2009; Richardson et al., 2012). A scrutiny of the literature dealing with personality traits and academic performance reveals a significant connection (Ciorbea & Pasarica, 2013; Shakir et al., 2014). Openness and academic performance are positively related (Caprara et al., 2011; Putwain et al., 2012). Conscientiousness and academic performance show a strong positive bond (Bipp & Dam, 2014; Di Giunta et al., 2013). The relationship between extraversion and academic performances has been rather undetermined (Feldman & Kubota, 2014; Poropat, 2009). Agreeableness and academic performance tend to correlates positively (Richardson et al., 2012; Önder et al., 2014). Neuroticism and academic performance are negatively interrelated (Chamorro-Premuzic & Furnham, 2003; Ciorbea & Pasarica, 2013).

Moderator Variables

Studies by country income-level classification and democratic level disclose varying size effects (Erten, 2014; King, 2013; Rucker, 2012). Size effects are found to vary in terms of literacy, science or mixed cohorts (Bozack & Salvaggio, 2013; Taylor et al., 2014; Wormington et al., 2011). There is much evidence suggesting gender differences in academic capabilities are mixed (Eisenberg et al., 1996; Schiefele et al., 1992; Steinmayr & Spinath, 2008). Various techniques (e.g., correlation, regression and SEM) have been applied to capture the size effects (Mega & De Beni, 2014; Passini et al., 2015). Large differences have been observed in sample sizes and these tend to affect the size effects (Du Toit et al., 2011; Suárez-Álvarez et al., 2014).

Linking MLP with Performance

This study focuses on the interaction between MLP as depicted in **Figure 1**. MLP theories have great impacts on the behavior of students and they can jointly optimize academic performance.

METHOD

Our approach is based on the recommendations of the Meta-Analysis of Economics Research Network (Stanley et al., 2013) for meta-regression analysis.

Information Search

The search strategy is twofold: First, a systematic search of major online databases (EBSCO, ERIC, JSTOR, Psycinfo and Science Direct) was conducted. Since research in the field of academic performance is interdisciplinary (education, economics, management, psychology and sociology), publications are unlikely to be kept in only one database but various ones. Several variations of key words such as “*motivation, extrinsic, intrinsic, learning domains, cognitive, psychomotor, affective, social, health, OCEAN personality, academic, performance*” were combined with variations of “*academic achievement*” and “*academic performance*”. Second, a random and unsystematic search was made using Google, Google Scholar and Research gate in a view to look for any unpublished articles, dissertations, or in-press studies not yet indexed on the databases.

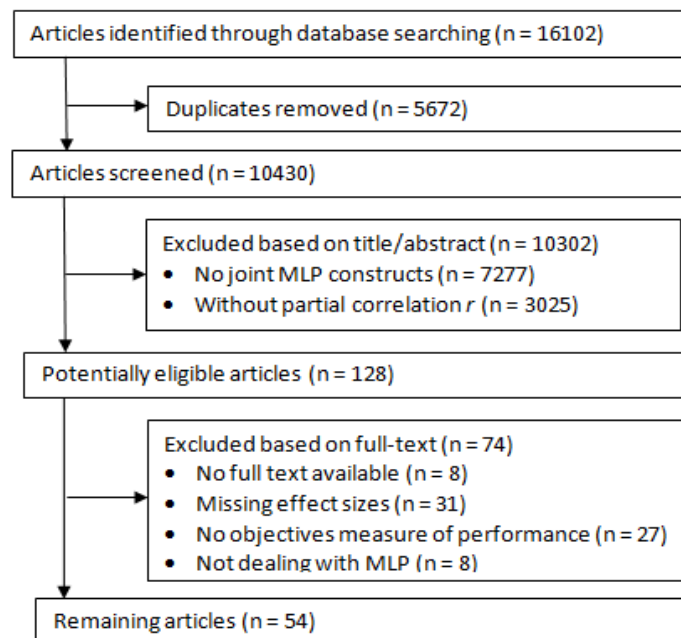


Figure 2. Schematic Selection Process

Inclusion and Exclusion Criteria

A reference list of relevant articles was screened by first author and substantiated again by the second author to ensure none of these studies were ignored. Only studies in English full text version are included. There are several effect size measures such as mean standardized mean differences, odds and risk ratios in addition to partial correlation coefficients. The list was narrowed down to those studies reporting partial correlation coefficients as they are easily computed with only limited information. With the intention of providing references to latest research (Machts et al., 2016), we only included studies published from 2001 on. Data retrieval was completed in November 2017. Studies had to provide standard measures of academic performance and partial correlation coefficient r can serve as the effect size.

Selection of Studies

There are prior meta-analyses that address very similar topics with comparable samples such as Machts et al. (2016 where $n = 33$), and Vo et al. (2017, where $n = 40$). Those studies with effect sizes not jointly related to the MLP were excluded. The selection process is diagrammatically illustrated in **Figure 2**.

Measurement of Performance

Some of the performance scores used in the study are: Achievement Motivation Scale (AMS), ACT-Reading (American College Testing), Average, Certificate of Secondary Education, CGPA (Cumulative grade point average), ELA (English Language Arts), grade point, grades in mathematics, high-school grades, HSGPA (Higher School grade point average), indirect effect achievement, mathematics achievement, number of awards, direct effect achievement, science grades, etc.

Keywords for Construction of MLP Sub-Scales

As reported in **Table 1**, to construct the MLP sub-scales, objective keywords that closely mirror these sub-scales are selected. Each term fits one of the three categories of MLP sub-scales.

The main facets of extrinsic motivation following Ryan and Deci (2000a) are external regulation, introjection, identification and integration. The common denominators are external regulation, identified regulation and introjected regulation, among others. This list is not exhaustive and other relevant associations have been considered. Surface approach refers to "... a motive or intention that is extrinsic to the real purpose of the task, Sternberg and Zhang (2015)." The major facets of affective learning (Krathwohl et al., 1964) are receiving, responding, valuing, organization and characterization. Keywords such as students like subjects, students like going to school, student wants degree, etc. are related to the term *responding* as its verbs fall in the category of "*find pleasure in*". The main facets of openness³ personality as per the Educational Testing Service (ETS) are fantasy, aesthetics, feelings, actions, ideas and values. Individuals with a deep approach to learning, have a genuine curiosity in the subject. Curiosity⁴

² Online at: https://cdn.ymaws.com/www.apsna.org/resource/resmgr/2014/apsna_guidelineshowcompletef.pdf

³ Online at: https://www.ets.org/s/workforce_readiness/pdf/21332_big_5.pdf

⁴ Online at: <https://www.managementtoday.co.uk/upside-neurotic/your-career/article/1464282>

Table 1. Examples of Classifications of Keywords for MLP Constructs

Variables		Keywords
Motivation	Intrinsic	Ability Beliefs, Cognitive Ability, Competition, Conscientiousness, Deep Approach, Intelligent Quotient, Intrinsic Value, Judgement, Knowledge, Mastery.
	Extrinsic	Classroom Participation, External Regulation, Extroversion, Identified Regulation, Introjected Regulation, Parent Support, Recognition, Surface Approach, Warmth Involvement.
	Self-Efficacy	Autonomous, Self-Determination, Self-Concept, Self-Directed Learning, Self-Efficacy, Self-Esteem, Self-Evaluation, Self-Regulated Strategies, , Striving For Perfection.
	Achievement	Academic Achievement, Academic Integration, Approach Achievement Goals, Educational Level, Junior High-School Grades, Performance, Reading Running Record, Student Meets Teacher’s Expectations, Task Value, Test-Taking.
	Amotivation	Avoidance, Apprehension, Assessment Anxiety, Boredom, Depressed Mood, Dissatisfied, Lifetime Drinking, Negative Emotions Related To Study Time, Neuroticism, Reprimanding, Uncertain, Work Avoidance.
Learning	Cognitive	Ability Beliefs, Competence, Creativity, Deep Approach, Fluid Intelligence, , Judgement, Knowledge, Mastery, Mastery Goal Orientation, Meta-Cognition, Problem Solving,.
	Psychomotor	Flexibility, Knee Push-Ups, Physical Activity, Physical Function, Reading, Spelling, Writing, Sit-Ups, Stand. Long-Jump.
	Affective	Enjoyment, Negative Emotions Related To Study Time, Neuroticism, Optimism, Positive Emotions Related To Self, Positive Emotions Related To Study Time Student Likes Subjects, Student Likes Going To School, Test Anxiety.
	Social	Classmate Relationships, Classroom Participation, Compliance, Friendly, Help-Seeking Behavior, Parent Support, Participation In Co-Curricular Activities, Peer Influence, Social Functioning, Socioeconomic Status.
	Health	Bad Food, BMI, Body Fat %, Chronotype, Depression, Fruits And Vegetables, Global Sleep Quality Index, Lifetime Drinking, Mental Health, Midpoint Of Sleep, Physical Symptoms.
Personality	Openness	Cognitive Ability, Confidence In One’s Intelligence, Creativity Self-Beliefs, Curiosity, Deep Approach, interest, Intrinsic Motivation To Experience, Intrinsic Motivation To Know, Judgement, Knowledge, Mastery-Goal Orientation, Originality.
	Conscientiousness	Ability Beliefs, Competence, Efficacy, Motive To Achieve Success, Need For Power, Self-Determination, Self-Regulated Strategies, Striving For Perfection, Task-Orientation,
	Extraversion	Enjoyment, Extrinsic, Extroversion, Optimism, Outward, Participation In Co-Curricular Activities , Positive Emotions Related To Achievement, Positive Emotions Related To Study Time, Student Likes Subjects, Students Wants Degree, Student Likes Going To School.
	Agreeableness	Classmate Relationships, Classroom Participation, Compliance, Family Structure, Friendly, Help-Seeking Behavior Involvement, Mentor, Peer Influence, Social Functioning, Warmth Involvement,
	Neuroticism	Amotivation, Anxiety, Apprehension, Avoidance Performance, Boredom, Depressed Mood, Dissatisfied, Negative Emotions Related To Self, Uncertain, Work Avoidance.

is another facet of openness. Other common denominators like intrinsic motivation, fluid intelligence and strategic revolve around the ideas or intellect facet of openness.

Effect Size Coding

Effect sizes for correlations *r* are directly reported. As per Anderson *et al.* (2018), the partial correlation coefficient *r* is truncated at -1 and +1 which can cause problems. To overcome this problem, meta-regressions should be run on the Fisher’s *Zr* transformation (Hedges & Olkins, 1985). Hunter and Schmidt (2004) cast doubt on the use of the Fisher’s *Zr* transformation as it replaces a negative bias with an upward one. It is formulated as: $ES_{Zr} = 0.5 \log_e \left[\frac{1+r}{1-r} \right]$, Where ES_{Zr} is the Fisher’s z-transformed correlation and *r* is the reported correlation.

Heterogeneity of Effect Size

Heterogeneity of effect sizes is assessed by means of the *Q* statistics. The *I*² statistics, which indicated the total variance attributable to between-study is computed as: $I^2 = 100\% \frac{Q-df}{Q}$, where *df* is the degree of freedom. The cut-offs percentages for low, medium and high heterogeneity is 25%, 50% and 75% respectively (Higgins *et al.*, 2003). Heterogeneity can lead to Type I error (Brockwell & Gordon, 2007) but any amount is acceptable, providing that both the predefined eligibility criteria are sound (Higgins, 2008). The restricted maximum likelihood (REML) estimator has been found to be less downwardly in the presence of heterogeneity (Sidik & Jonkman, 2007).

Data Coding

The description of the variables is described in **Table 2**.

Table 2. Variable Description for the Meta-Analysis

Variable Name	Description
<i>r</i>	Partial correlation of educational psychology and academic performance
SE	Standard error
Year	Year of publication
<i>Region:</i>	
Developed	= 1, if the study is conducted in a developed country or 0 otherwise
<i>Political System</i>	
Democracy	= 1, if country of study is democracy or 0 otherwise
<i>Motivation:</i>	
Amotivation	= 0, if study deals with amotivation
Intrinsic	= 1, if study deals with intrinsic motivation
Extrinsic	= 1, if study deals with extrinsic motivation
Self-Efficacy	= 1, if study deals with self-efficacy
Achievement	= 1, if study deals with achievement motivation
<i>Learning:</i>	
Health	= 0, if study uses with health feature
Cognitive	= 1, if study uses cognitive feature
Psychomotor	= 1, if study uses psychomotor feature
Affective	= 1, if study uses affective feature
Social	= 1, if study uses health feature
<i>Personality Traits:</i>	
Neuroticism	= 0, if study makes use of neuroticism
Openness	= 1, if study makes use of openness traits
Conscientiousness	= 1, if study makes use of conscientiousness traits
Extraversion	= 1, if study makes use of extraversion traits
Agreeableness	= 1, if study makes use of agreeableness traits
<i>Subject Type:</i>	
Both	= 0, if study utilizes both literacy and science subjects
Literacy	= 1, if study utilizes linguistic subjects (e.g., English language)
Science	= 1, if study utilizes science subjects (e.g., Mathematics)
<i>Type of Institution:</i>	
Co-education	= 0, if study related to both male and female students
Boys	= 1, if study relates to male students
Girls	= 1, if study relates to female students
<i>Main Study Method:</i>	
Regression	= 0, if study deals with ordinary least-squares (OLS) regression analysis
Correlation	= 1, if study employs correlation as the main method of analysis
SEM	= 1, if study employs structural equation modeling (SEM) as the main method of analysis
<i>Educational Level:</i>	
Tertiary	= 0, if study applies to studies at tertiary level
Primary	= 1, if study applies to studies at primary level or lower (e.g., Kindergarten)
Secondary	= 1, if study applies to studies on secondary level
<i>Sample Size:</i>	
large	= 0, if study makes use of a large sample size (more than 500)
Small	= 1, if study makes use of a small sample size (less than 100)
Medium	= 1, if study makes use of a medium sample size (between 100 and 500)
<i>Publication Type:</i>	
Published	= 1, if study was published in a peer-reviewed journal or 0 otherwise
<i>Impact Factor</i>	Impact factor of the study (by November 2017)
<i>Citations</i>	Number of citations of the study as per Google Scholar (by November 2017)

RESULTS

Summarization of Effect Sizes

The descriptive statistics of the of the size effects per study is described in **Table 3**. Summarization of the mean effect size for the 54 papers is $r = 0.22$ ($Zr = 0.24$) with a range of $-0.38 \leq r \leq 0.81$ ($-0.40 \leq Zr \leq 1.23$).

Table 3. Summary Statistics

Authors	Country	Year	N	Frequency	Mean (r)	Std. dev. (r)
Abu Bakar et al.	Malaysia	2010	1484	4	-0.061	0.262
Amrai et al.	Iran	2011	252	4	0.205	0.039
Arbabi et al.	Germany	2014	1125	9	-0.0003	0.272
Areepattamannil	India	2014	363	2	0.120	0.014
Ayub	Pakistan	2010	400	1	0.563	0.000
Badiee et al.	Iran	2014	360	7	0.429	0.320
Bakhtiarvand et al.	Pakistan	2011	200	3	0.177	0.483
Bipp & Dam	Netherlands	2014	120	5	0.418	0.222
Bong	Korea	2004	389	14	0.554	0.207
Boon	Australia	2007	879	10	0.165	0.217
Bossaert et al.	Belgium	2011	115	4	0.438	0.090
Bouffard & Couture	Canada	2003	60	3	0.093	0.376
		2003	61	3	0.393	0.125
		2003	105	3	0.117	0.291
Bozack & Salvaggio	USA	2013	347	8	0.155	0.125
Broussard & Garrison	USA	2004	129	4	0.195	0.033
Caprara et al.	Italy	2011	412	7	0.300	0.081
Choi & Kim	USA	2013	422	13	0.179	0.071
Chow & Young	Brunei	2013	324	6	0.263	0.087
Clark et al.	USA	2014	81	8	0.023	0.188
Di Giunta et al.	Italy	2013	187	1	0.340	0.000
		2013	188	1	0.340	0.000
		2013	206	1	0.170	0.000
Diseth et al.	Norway	2010	442	9	0.203	0.233
Doshi & Yogesh	India	2014	80	1	0.81	0.000
Du Toit, et al.	South Africa	2011	12	1	0.510	0.000
		2011	19	2	0.495	0.007
		2011	21	5	0.596	0.039
		2011	30	2	0.380	0.000
		2011	44	4	0.263	0.409
Erten	Turkey	2014	256	4	0.118	0.219
Feldman & Kubota	USA	2015	89	5	0.418	0.213
Fritea & Fritea	Romania	2013	187	3	-0.060	0.243
Guay et al.	Canada	2010	925	5	0.494	0.196
Helker & Wosnitza	Germany	2016	271	11	0.196	0.134
Hornstra et al.	Netherlands	2013	722	11	0.339	0.167
Hoseinzadeh & Shoghi	Iran	2013	360	5	-0.138	0.060
Khalaila	UAE	2014	170	3	0.247	0.535
Khoshnam et al.	Iran	2013	341	2	0.224	0.138
King	Philippines	2013	1028	2	0.076	0.275
Komaraju et al	USA	2009	308	7	0.184	0.067
Lasagabaster	Spain	2011	191	3	0.291	0.071
Mega & De Beni	Italy	2014	5805	14	0.081	0.140
Moenikia & Zahed-Babelan	Iran	2010	1670	2	0.305	0.110
Önder et al.	Turkey	2014	1343	10	0.034	0.171
Pajares & Valiante	Canada	2001	497	5	0.080	0.300
Passini et al.	Italy	2015	614	9	0.072	0.269
Putwain et al.	UK	2012	122	8	0.211	0.244
Rucker	Netherlands	2012	146	1	-0.221	0.000
Ryan	USA	2001	331	8	0.263	0.062
Sigfusdottir et al.	Iceland	2006	5810	9	-0.006	0.211
Sivandani et al.	Iran	2013	240	2	-0.003	0.193
Skaalvik et al.	Norway	2015	823	6	0.414	0.138
Stoeber & Eismann	Germany	2007	145	3	0.253	0.144
Suárez-Álvarez et al.	Spain	2014	7729	8	0.336	0.092
Taylor et al.	Canada	2014	524	7	0.179	0.380
Tongsilp	Thailand	2013	840	3	0.148	0.070
Waseka & Simatwa	Kenya	2016	176	2	0.522	0.327
Washington	USA	2016	83	2	0.234	0.018
Wilson & Trainin	USA	2007	198	24	0.198	0.111
Wormington et al.	USA	2011	1067	5	0.064	0.197
Yuet	Hong-Kong	2008	33	6	0.488	0.113
Overall				344	0.219	0.247

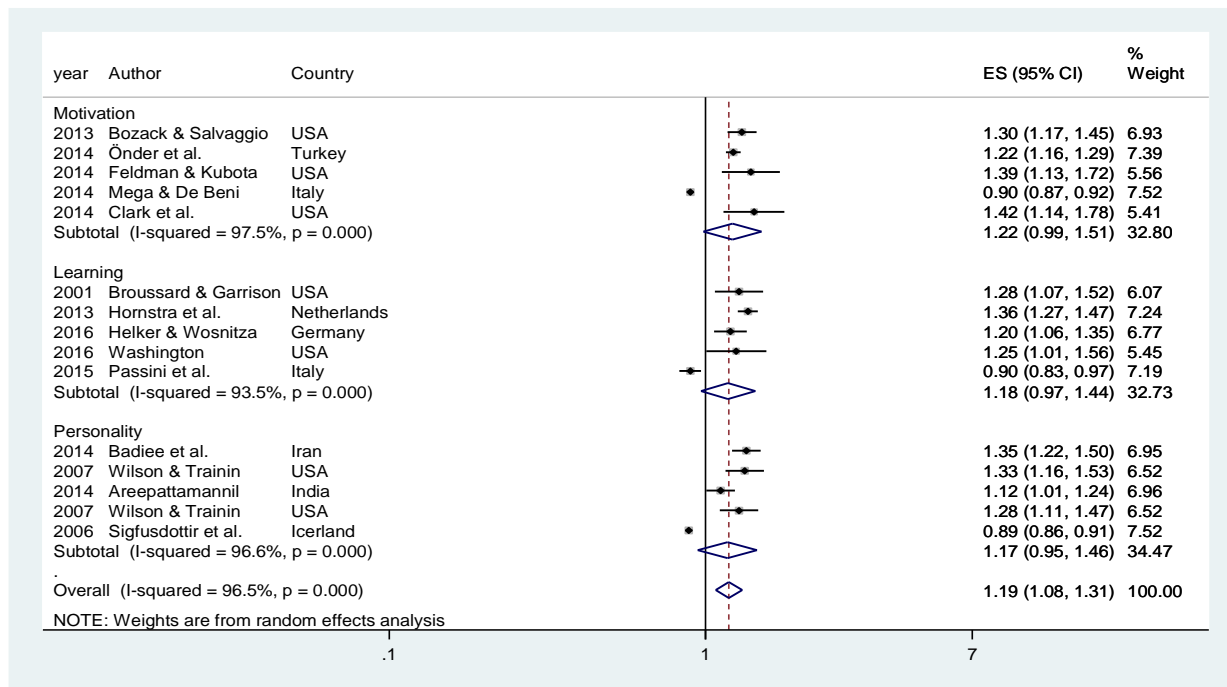


Figure 3. Forest Plot for Z_r

Testing for Publication Selection Bias

Publication bias can severely distort statistical inference. This issue can arise as researchers report only statistically significant results and published papers. Some authors (Begg, 1994) suggest to include as many as possible unpublished and grey literature to minimize the effect of publication bias. Begg and Mazumdar (1994) adjusted rank-correlation test without continuity correction (Takagi et al., 2012) is computed. The test statistic is $z = 1.27$ with p -value 0.206 which implies acceptance of the null of no small-study effects or no significant publication bias.

Sensitivity Analysis

A sensitivity analysis is included to check the robustness of the results. Some outliers are detected. Four large r values are excluded from the study and the meta-regressions are re-run. No significant changes in the results are to be found. Similar observations are made after running the models without the unpublished articles. In addition, the meta-regressions are re-run with Fisher's Z_r transformation as dependent variable and once again little difference to our results is to be uncovered.

Testing for Heterogeneity

Figure 3 exhibits the forest plot shows the stratified mean Fisher's Z_r transformation figures. If the diamond touches the line of null effect, the presence of heterogeneity can be rejected. In general, there is high level of heterogeneity. The overall $I^2 = 96.5\%$ with p -value = 0.000, indicating a high degree of between-study heterogeneity. The fixed-effects assumption of similar true effect in each study is strongly rejected. Finally, a test of the null hypothesis of no effect of MLP (where effect size = 1) is conducted. There is strong evidence against the null hypothesis ($z = 3.45$, p -value = 0.001).

Meta-Regression Analysis and Order of Model Choice

With the presence of between-study heterogeneity, the random-effects meta-regression model with REML estimator is employed. The model can be written in general terms as:

$$r_{ij} = \beta_0 + \sum \beta_k X'_{ki} + \beta_1 SE_{ij} + \varepsilon_{ij} \quad (1)$$

where r_{ij} is partial correlation between MLP and academic performance of the i^{th} estimate and the j^{th} study, β_0 is the true value of the academic performance coefficient, X'_{ki} is the vector of moderator variables, β_k represents the meta-regression coefficients, SE_{ij} denotes the standard error of the coefficient of the j^{th} study and ε_{ij} is the error term. The constant β_0 quantifies the size of the effect as measured by the partial correlation, holding all the other variables constant. If $\beta_1 = 0$, then the literature is free of publication selection bias (Stanley, 2008). This is known as the Funnel Asymmetry-Precision Effect Test (FAT-PET).

A general-to-specific strategy is initially considered. We then proceeded to remove the variables which as an insignificant to produce a specific model. Consistent with Machts et al. (2016), we employ a more specific approach by checking for the effect of each variable individually. This has the potential to make the underlying associations clearer (Stanley & Doucouliagos, 2012). The results for each model are in Table 4.

Table 4. Meta Regression with Methods of Moments Estimates (MLP)

Parameter	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Standard Error	1.165 (2.842)															
Year	0.007 (0.005)		-0.006 (0.003) [‡]													
Income Level																
Developed	-0.218 (0.044)*	-0.201 (0.041)*		-0.078 (0.029)*												
Political System																
Democracy	0.150 (0.048)*	0.154 (0.043)*			0.042 (0.033)											
Motivation																
Intrinsic	0.098 (0.085)	0.083 (0.083)				0.346 (0.039)*										
Extrinsic	0.042 (0.081)	0.036 (0.079)				0.288 (0.038)*										
Self-efficacy	0.148 (0.080) [‡]	0.136 (0.079) [‡]				0.408 (0.037)*										
Achievement	0.164 (0.084)*	0.153 (0.082) [‡]				0.418 (0.049)*										
Learning																
Cognitive	0.055 (0.061)	0.055 (0.060)					0.324 (0.054)*									
Psychomotor	0.032 (0.061)	0.035 (0.061)					0.315 (0.060)*									
Affective	0.041 (0.055)	0.034 (0.054)					0.130 (0.056) [‡]									
Social	0.144 (0.073) [‡]	0.134 (0.072) [‡]					0.362 (0.058)*									
Personality Traits																
Openness	0.226 (0.090) [‡]	0.232 (0.089)*					0.334 (0.045)*									
Conscientiousness	0.216 (0.083) [‡]	0.219 (0.082)*					0.396 (0.036)*									
Extraversion	0.168 (0.078) [‡]	0.174 (0.076) [‡]					0.281 (0.049)*									
Agreeableness	0.175 (0.087) [‡]	0.178 (0.086) [‡]					0.319 (0.043)*									
Subject Type																
Literacy	-0.018 (0.037) [‡]	-0.041 (0.029)*						0.043 (0.034)								
Science	0.079 (0.034) [‡]	0.054 (0.031) [‡]						-0.034 (0.033)								
Cohort Gender																
Boys	-0.064 (0.155)	-0.021 (0.096)								0.219 (0.112) [‡]						
Girls	-0.243 (0.065)*	-0.225 (0.060)*								0.007 (0.058)						
Main Method																
Correlation	0.141 (0.033)*	0.163 (0.029)*									0.194 (0.032)*					
SEM	0.104 (0.033)*	0.113 (0.031)*									0.090 (0.034)*					
Study Level																
Primary	0.055 (0.043)	0.060 (0.046)										-0.013 (0.040)				
Secondary	0.031 (0.032)	0.070 (0.028)										0.045 (0.030)				
Sample Size																
Small	0.082 (0.065)	0.160 (0.046)											0.162 (0.046)*			
Medium	0.091 (0.033)*	0.070 (0.028)*											0.093 (0.028)*			
Study Type																
Published	-0.183 (0.054)													-0.134 (0.057) [‡]		
Impact Factor																
Citations	0.0001 (0.0001)															0.0001 (0.00009) [‡]
Intercept	-15.128 (10.334)	-0.171 (0.053)*	-12.002 (6.677) [‡]	0.274 (0.025)*	0.186 (0.030)*	-0.090 (0.031)*	-0.032 (0.050)	-0.095 (0.032)*	0.202 (0.018)*	0.216 (0.014)*	0.108 (0.026)*	0.197 (0.024)*	0.151 (0.022)*	0.345 (0.055)*	0.243 (0.021)*	0.203 (0.016)*
Observations	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344	344
τ^2	0.037	0.037	0.061	0.060	0.061	0.044	0.052	0.045	0.061	0.061	0.055	0.061	0.058	0.060	0.061	0.075
Adj-R ²	0.400	0.400	0.006	0.017	0.002	0.273	0.251	0.256	0.0002	0.005	0.092	0.045	0.041	0.013	0.0004	0.009
F-Statistics	8.88*	11.37*				33.13*	16.23*	30.38*	1.05	0.152	18.52*	1.81	8.41*			

Note: *, [‡] and [†] are 1%, 5% and 10% respectively. The standard error is in brackets. REML estimate of between-study variance% residual variation due to heterogeneity Proportion of between-study variance explained Joint test for all covariates With Knapp-Hartung modification.

In model 1, variables such as income level, political system, MLP, subject type, cohort gender, main methodology used and sample size are found to be statistically significant. The coefficient on standard error is not statistically significant. This confirms the absence of publication selection bias and is consistent with Begg and Mazumdar's test.

The specific model (model 2) reveals that all these variables have statistically significant impact. The Spearman correlation coefficient between extrinsic motivation and social learning is computed to be 0.655. The same correlation coefficient between conscientiousness and self-efficacy is equal to 0.502. The mean variance inflation factor statistics (VIF) for the general (model 1) and specific (model 2) regressions are equal to 5.37 and 5.61 correspondingly. A VIF ≥ 5 indicates severe multicollinearity (Garson, 2012) and this can affect the standard error of the estimates. Inferences will be based mainly on these specific regressions (from model 3 to model 16).

No significant effect of publication year is found for the model 1 but in model 3, it is found to have a statistically significant but negative impact on r . Model 4 assesses the impact of income level. The coefficient of developed countries is negative and statistically significant at 1%. Studies on developed countries result in larger negative (or smaller positive) partial correlations. In relation to studies on developing countries, those on developed countries have an effect size⁵ of 0.196. Statistically significant effect of democracy is found for the models 1 and 2 but not in model 5. This implies no impact of political system on r . Model 6 shows that relative to amotivation, studies on intrinsic, extrinsic, self-efficacy and achievement have larger significant positive (or smaller negative) impact at 1% level. Relative to studies relating to healthy learning in model 7, studies on cognitive, psychomotor, affective and social learning have a positive and statistically significant impact at conventional levels. These imply a larger positive effects (or smaller negative) on r . As per Model 8, all the personality dummy variables are also found to be significant at 1% level. Relative to studies on neuroticism, studies on openness, conscientiousness, extraversion and agreeableness have a larger positive (or smaller negative) effect on r . Model 9 analyzes the influence of subject type and no significant effect is found. Model 10 investigates the effect of gender cohort. Male single-sex institutions outperform mixed ones. No impact was found for female cohort.

As revealed in Model 11, relative to OLS regression coefficients, the ones of correlation and SEM are found to be positive and statistically significant both at 1% levels. Model 12 looks into the importance of educational level and no significant effect is worked out. Model 13 scrutinizes the impact of sample size. The coefficients of the Small and Medium dummies are positive and statistically significant at 1% level both. These results entail a larger positive (or smaller negative) effect for studies with small and medium size. Model 14 provides statistically significant difference between published and unpublished studies. Model 15 checks the effect of impact factor on the partial correlation between MLP and academic performance. No significant effect is revealed. In Model 16, the coefficient of the Citations variable is found to be statistically significant at 10%. Studies with higher citations tend to have a larger positive (or smaller negative) impact.

DISCUSSIONS

The focus is on the MLP variables while a brief discussion of the mediator variables is given.

The Predictor Variables

Motivation model

Regression 6 strongly supports the significant impact of motivation dummy variables relative to the amotivation. When students have low self-confidence and self-esteem, high anxiety and inhibition, their level of motivation is shattered. The relationship between amotivation and performance is negatively related (Chantal et al., 1996; Gillet et al. 2010). Amotivation is linked to conventional, dictatorial approaches and poorly trained teachers (Htoo, 2014). Monotony, poor focus in class, poor mental adjustment, stress owing to studying and drop out are all correlated with amotivation (Baker, 2004). On the other hand, good quality intrinsic or extrinsic (tangible and intangible) motivation such as direct competition (Tripathi, 1992) and rewards (Hilden & Jones, 2011) will bring positive impacts on performance. Homework and assignments develop self-confidence and a sense of responsibility in students thereby improving self-learning skills or self-regulated learning and academic performance (Bembenutty, 2011). It is important to influence factors like praise, personal satisfaction and the feeling of mastery and context (Wilkins & Kuperminc, 2010) in students in order to bring achievement motivation as it positively impacts performance.

Learning model

Model 7 shows the importance of learning domains in explaining r . Relative to health, devoting time in the other domains may bring enhanced academic performance. It is important to understand the relationship of cognitive abilities in academic performance which can be measured using cognitive tests like processing speed and working memory (Magnúsdóttir, 2013). Students are recommended to be open minded, collaborative, committing and value life-long learning as affective learning outcomes are pervasive in education (Gano-Phillips, 2009). Psychomotor learning is required from simplest writing to playing basket and students are therefore invited to embrace related activities as they contribute to performance. Acceptance and recognition among peers relate to social aspects of learning and these factors need consideration as they affect academic performance (Pečjak et al., 2009).

⁵ The effect size is computed as: $[0.274 + (-0.078)] = 0.196$.

Personality model

In model 8, the personality variables too are positive and highly significant at 1% with neuroticism as reference. Neuroticism is normally associated with a negative impact on performance supported by literature (Lievens et al., 2009). In contrast, openness to experience is related to academic performance and students should be given opportunities to develop qualities like imagination, creativity, curiosity and interest (Sahinidis et al., 2003). Students need to have responsibility, determination, constancy and focus in their studies as these traits are associated with conscientiousness and performance (Conrad & Patry, 2012). Extraversion encloses traits like sociability, audacity, engagement with the social environment making such students more likely to be help seeking and visible to students and teacher (Vedel & Porapat, 2017). Qualities like friendliness, being appreciated and accepted reflect agreeableness (Porapat, 2009) and they may help in positive performance as such students develop compliance, effort and stay focus on learning tasks.

Other moderator variables

In model 3, the impact of publication year on size effect is negative which could be explained by misuse of ICT by students over time in terms of wasting time, copying, depression, out-of-touch with family and teachers and so on (Billieux, 2012; Lee et al., 2014). Regression 4 supports a significant and negative impact of developed economies on r which may be due to poor quality education relative to countries wealth in terms of teacher salaries, course duration (Fuller, 1985) whereby expenditures are not translated into performance. As depicted in the fifth model, the political system has an insignificant impact on r .

In regression 9, the subject type literacy and both dummies are insignificant when the reference is science. There is no impact on r . In the same line, Hassan et al. (1995) find a mixed correlation outcome between results in English and sciences courses. About 28% of the selected papers relate to English speaking countries only. Non-natives English students can encounter learning difficulties in science due to their weaknesses in English language. Given that the English language is so ubiquitous and remains the main medium of instruction, there is a need for a change in teaching strategy of English teaching such as a continuing education program extending into all scholarly years.

Regression 10 shows that males perform significantly better than females in accordance with literature (Roger et al., 1998; Rashidi & Javanmardi, 2012). Boys tend to master learning goals with good understanding of what is learned in a better way with higher interest for challenge (Musa et al., 2016) than do girls. This is in contradiction with the traditionally held idea and intelligence from Western countries that females perform significantly better than males in English/language (Mars et al., 1983) and Dale (1969, 1974), which explains that mixed schools show a better correlation with academic performance. These differences may be due to social and gender climates as cross-gender interaction could interfere with academic development (Lee & Bryk, 1986). Early maturing in coeducational schools may promote more delinquency and problematic behaviours like drug use, fighting among others compared to single sex schools (Rutter et al., 1979).

Model 11 provides evidence that method type can yield significantly different in results especially among correlation, SEM and OLS regression. Creswell (2002) defined correlation as a statistical test to establish patterns for two variables while the SEM is a comprehensive statistical approach to testing hypotheses about relations among observed and latent variables (Hoyle, 1995). As per Nazim and Ahmad (2013), the SEM is superior to OLS as it can compute the effects of items under each variable individually while considering the structure of mean, variance and covariance. For confirmatory purposes, the use of more than one technique is usually required.

Model 12 indicates that there is no difference among study levels and their impact on academic performance. This is due to the implementation of learner-centered and learner-friendly curriculum as recommended by the United Nations Educational, Scientific and Cultural Organization (Stabback, 2016).

Model 13 shows the significant impact of sample size. A large sample size can produce results among variables that are significantly different (Patel et al., 2011). A large sample size expands the series of potential data and outlines a better picture for a study (DePaulo, 2011) relative to a small one.

Model 14 indicates a statistically significant difference between published and unpublished studies. Published studies are more robust as they are peer-reviewed and sensitive to criticism due to the use of guidelines for performing systematic literature reviews in software engineering (Kitchenham et al. 2007).

Model 15 reveals no significant effect of impact factor scores on performance. Impact factor is used to evaluate status of scientific journals or scientific output of scientists (Moed & Van Leeuwen, 1996). The impact factor is a simple ratio of citations and articles and may not wholly represent the quality of all articles in the journal (Walter et al., 2003). Although researchers tend to use studies from high impact factor publications (Dubben & Beck-Bornholdt, 2005), educational research should consider types of studies.

In model 16 the intervening variable citations is positively significant. A higher number citation leads to greater r values as researchers tend to associate with facts and articles with scientific touch⁶. Even if citation analysis may be simple to apply, it should be used with caution to avoid it coming under disrepute through uncritical use (Smith, 1981).

Limitations and Future Research

We acknowledge possible limitations of our research. Publication year and study type emerged as significant moderator variables. Despite the results from the FAT-PET and Begg and Mazumdar (1994) tests, we cannot fully exclude the risk of a

⁶ Online at: http://thomsonreuters.com/products_services/science/free/essays/history_of_citation_indexing/

publication bias (Machts et al., 2016). The tabulated keywords under MLP can be debatable although they have been meticulously categorized as per the underlying theories.

For future research on performance, we recommend the implementation of detailed picture of student characteristics. This study was also limited by the information on further student characteristic as it did not address the development of resiliency in at-risk students. The theory of resilience attempts to explain why some students academically and socially achieve even though they encounter many negative environmental or psychological situations (Reis et al., 2005). Many not only survive but also thrive academically and socially (Condly, 2006). The use of meta-analytic structural equation modeling (MASEM) to investigate the combined effects of MLP on academic performance could have shed more light in the research work. But, the constructs employed should be consistent across studies and this may be an avenue for future research.

Practical Implications

The results of this study are crucial and implementations are highly recommended to translate existing MLP related variables into academic output. Minimizing amotivation may boost students towards better performances as it is inversely related to both intrinsic and extrinsic motivation (Putwain, 2012). Therefore, engaging in school activities for the purpose of interest and enjoyment is beneficial to students and it should be promoted not only as options but integrated in core subjects to add value. It also combats dropouts and disengagements over time. Parents too require encouraging their adolescents to peruse studies that are interesting and exciting to them (Taylor, 2014) rather than dictating into unknown fields due to trends.

Health can impact academic performance and therefore it should be the concern of the academic system to guarantee it to its population. Consistent and stable lives are crucial for healthy psychological development. Family disrupts and court decisions to change geographical regions should be the last resort (Gindes, 1998). Moreover, ranging from physical fitness, eating habits to psychological development of the children, a close monitoring is required as too much time devoted to these activities may hinder academic performance (Jayanthi et al, 2013; Chircop et al, 2013). Children engaging in hard physical activities should be medically screened first and then channeled to specific tracks but not merely be selected on the basis of endurance and performance. Grants could also be provided to empower parents to assist their children to eat a healthy diet (Wang et al., 2011). Striking the right balance between academics and extra-curricular activities is thus recommended.

Students who are intellectually curious, closely controlled, planned and less neurotic are likely to have higher Academic Motivation (Komarraju & Karau, 2005; Komarraju et al., 2009). Students are advised to have less sleep debt and are encouraged to be morning chronotype as these two factors may account for enhanced neuroticism and improve academic performance (Onder et al., 2014). So, parents are advised to inculcate such learning behaviours in order to shape the personality of their children. Engaging in proper sport activities with less physical injuries risk and body shaping acts like Yoga and meditation accounts for endurance, lower levels of emotional reactivity and neuroticism (Su, 2016). On overall, motivation (adjusted-R²=27.1%) explains a slightly higher degree of academic performance compared to learning and personality traits.

This meta-analysis indicates boys performing better than girls with co-education as base category. Researchers have also long observed that fields in the areas of mathematics, science, and technology are typically viewed by students as being within a male domain (Eisenberg et al., 1996; Fennema & Sherman, 1978). The masculine orientation is associated with confidence and achievement due to the notion that success in these areas is a masculine imperative (Eccles, 1987a, 1987b; Hackett, 1985). In the choice of subject streams for future endeavors, parents and students are required to understand such innate nature so that better extraction and translation of their abilities occur. For instance, the writing domain tends to be female oriented (Pajares & Valiante, 2001) and a challenge for all educators, and for the broader culture, is to continue to strive towards equalizing these two extremes so that smooth learning and transition takes place.

Conclusion

This meta-analysis provides the first inspection of the literature of motivation, personality traits and learning to academic performance and it offers a firm ground for future endeavours in attempts to relate explanatory variables to performance in the educational sector. Technically, this work approved the significance of motivation, personality traits and learning both as associated variables and on individual basis and they can positively impact student's academic performances at large. Income level, gender, the main method used, sample size, study type and citations can individually contribute as moderator variables in explaining the relation between MLP and academic performance. Therefore, it's crucial to consider policy implications that can bring about optimum learning environment.

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