

# Relationships between Academic Achievements and Student Motivation, Relative Autonomy Index and Self-Perception of Competence before Streaming

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**Abstract**—Student motivation and self-perception of academic competence are crucial elements affecting every individual in the process of learning. This study, based on Self-Determination Theory, explores the strength of correlations between academic achievements in English and mathematics of students from three Singapore primary schools before they were streamed, with respect to their motivation to learn, relative autonomy index (RAI) and self-perceptions of academic competence. The strengths of the correlations of these aspects of learning were considered with respect to academic achievements in English and mathematics. Correlations were examined before the students were streamed into three groups according to their academic ability which was based on the examination results at the end of their primary four education. Students with high, middle and low academic achievements were placed into three courses, High Course (HC), Middle Course (MC) and Low Course (LC) respectively. Results show students who were least academically inclined had a higher dependency on external regulations and high achieving students had a greater self-perception of academic competence and were least motivated by external regulations.

**Index Terms**—external motivation, introjected motivation, identified motivation, intrinsic motivation, relative autonomy index, self-perception of competence

## I. INTRODUCTION

According to the Report on the Ministry of Education 1978 [1], Singapore educational streaming system was introduced to reduce high education wastage, raise low levels of literacy and eliminate ineffective bilingualism. Streaming was first implemented in primary schools beginning with the 1979 primary three cohort, at the age of nine, where students were streamed at the end of primary three, based on their examination results in primary two and three, into three different courses. The normal bilingual course ends with a Primary School Leaving Examination (PSLE) at primary six, students in the extended bilingual, or monolingual courses would take eight years to complete their primary education [2]. From 1991, the streaming system was modified, it was

delayed from Primary three to the end of Primary four to give students an additional year to build a stronger foundation in languages and mathematics.

Streaming has its merits in allowing student to learn and excel at their own capability with teaching materials tailored to their respective needs, nonetheless, it can be a form of labelling and stigma for students belonging to the lowest course. In 2008, Subject-Based Banding was implemented to provide greater flexibility for students by offering them the option of a combination of standard and foundation subjects, depending on their strengths [3]. This study attempts to examine the relationships between student achievement in English and mathematics and the types of motivation and their self-perception of academic competence before streaming. Data were collected before the primary four final examinations and analyzed after streaming when students were placed into three different courses according to their academic ability when they were in primary five. This paper does not seek to examine the effectiveness of the streaming system, instead, its focus is on the motivational and self-perception responses of the students who were streamed under the Singapore primary education in the aforementioned, where students were channeled into three distinct groups according to their academic achievements.

## II. LITERATURE REVIEW

### A. Conceptualization of Motivation

Student motivation has always been one of the main concerns in the arena of education. Terrell Bell, former US Secretary of Education (1912-1996), succinctly expressed it, “There are three things to remember about education. The first is motivation. The second is motivation. The third is motivation” [4]. Motivation is a pivotal concept in most learning theories [5], it is closely related to arousal, attention, anxiety, feedback and reinforcement. For example, a person needs to be motivated enough to pay attention while learning; anxiety can decrease the motivation to learn. Receiving a reward or feedback for an action usually increases the likelihood that the action will be repeated.

Motivational theories deal with the reasons behind why we behave as we do. Generally, they attempt to identify the conditions that instigate behavior and direct it. To put it simply, motivation is the force that energizes and directs a behavior toward a goal. Despite its intuitive importance, there is much to be known about motivation. Professionals disagree over what motivation is, what affects motivation, how motivational processes operate, what effect motivation has on learning and performance, and how motivation can be improved [6]. Undeniably, student motivation is a complex, multidimensional concept and there is a myriad of interdependent elements associated with student motivation. Motivation to accomplish goals, expressed interest in and effort toward schoolwork, self-confidence in one's own ability, and persistence in the face of difficulty, these are some aspects of motivation in the academic ground. Basically, student motivation has to do with the reasons students engage or in some cases choose not to engage in school related academic endeavors. It is related to what provides the impetus for students to participate in the learning process. It concerns also the reasons or goals that underlie their involvement or nonchalant attitude in academic activities. Although students may be equally motivated to perform a task, the sources of their motivation may differ [7]. Apathetic students may be less likely to achieve their full potential than those who manage to retain a sense of excitement and satisfaction about learning for its own sake. Hence, the proper question is not, "How can people motivate others?" but rather, "How can people create the conditions within which others will motivate themselves?" as Deci and Flaste put it [8].

#### *B. Intrinsic and Extrinsic Motivation and the Continuum*

Weiner [9] points out that behavioral theories tended to focus on extrinsic motivation, which deals with rewards, while cognitive theories deal with intrinsic motivation, which has to do with goals. The Self-Determination Theory (SDT) proposes that when any of the three psychological needs is unsupported to a certain degree, it will have a detrimental impact on one's motivation and overall wellness. The three psychological needs are autonomy, competence and relatedness. According to SDT, people need to feel in control of their own behaviors and goals (autonomy) and there is a need for them to gain a sense of capability through mastery of tasks as they learn different skills (competence). Lastly, people need to experience a sense of belonging and attachment to other people (relatedness). In self-determination theory, Ryan and Deci [10]-[11] also describe intrinsic regulation as the inherent tendency of seeking out novelty and challenges, by extending and exercising one's capacities to explore and to learn, and external regulation as behaviors that are performed in order to satisfy an external demand or reward. The continuum between intrinsic and extrinsic regulations includes introjected and identified regulations. The former involves taking in a regulation but not fully accepting it as one's own. It is a relatively controlled form of regulation in which behaviors are performed to

avoid guilt or anxiety or to attain ego enhancement such as pride. The latter reflects a conscious valuing of a behavioral goal or regulation, such that the action is accepted or owned with personal importance [12].

Motivation to learn is defined by Marshall [13] as "the meaningfulness, value, and benefits of academic tasks to the learner, regardless of whether or not they are intrinsically interesting." Ames [14] describes motivation to learn as characterized by long-term, quality involvement in learning and commitment to the process of learning. Much of the literature on student motivation refers to two basic learning orientations. Depending on why they pursue learning tasks, students are primarily intrinsically oriented or extrinsically oriented. Lepper [15] states that intrinsically motivated behavior is "undertaken for its own sake, for the enjoyment it provides, the learning it permits, or the feelings of accomplishment it evokes." In contrast, extrinsically motivated behavior consists of "actions undertaken in order to obtain some reward or avoid some punishment external to the activity itself." Student motivational orientation is important because it can affect both the on-task time and the quality of involvement in the task. In addition, motivational orientation can also have a bearing on the level of task difficulty students select. Students with an extrinsic orientation tend to prefer tasks that are low in degree of difficulty, whereas intrinsically oriented students gravitate naturally toward tasks that are comparatively challenging. The former will be most concerned with doing only what is obligatory so as to gain some form of reward that is peripheral to the task itself. Extrinsically oriented students are also less likely than internally oriented students to take risks in responding to academic tasks. Generally, individuals with an extrinsic orientation towards learning tend to expend less mental effort and employ less deliberate and less effective strategies when undertaking an activity than do intrinsically oriented individuals.

#### *C. Intrinsic Motivation and Learning*

White [16], Harter [17], and Deci and Ryan [18] are among those who have suggested that behavior primarily originates from the need to feel effective or competent, and the need to master the environment independently, which is often referred to as autonomy. Deci and Ryan [18] mentioned that intrinsic motivation is primarily influenced by the competence one feels in mastering a task and the perceived freedom in defining and selecting the task. In addition, environmental factors, such as the influence of parents and teachers, are considered crucial in the development and maintenance of intrinsic motivation. Their theory of intrinsic motivation also postulates that human being prefers to act in a competent manner to reach goals and fulfil needs. Students who are intrinsically motivated pursue a task for its inherent pleasure, they focus on the task rather than the self; consequently, learning becomes a generally pleasurable experience rather than merely a means to an end, such as grades and rewards. Furthermore, students who are encouraged to develop intrinsic motivation in their early years continue to be intrinsically motivated in subsequent

education, thus providing the basis for achievement motivation in later years [19]. In addition, intrinsically motivated students who complete a task have better conceptual understanding of that task relative to externally motivated peers [20].

#### *D. Self-Perceptions of Academic Competence*

Nobody enjoys dealing with tasks that engender feelings of incompetence, as a result, individuals employ all devices and means to avoid probable failure. Hence, the way students view their competence has strong implications for their motivation to learn. Whether they see themselves as able or helpless, as high or low in ability and competence, influences how they cope with learning situations [21]. Based on messages they gather from external sources, such as their parents, teachers, and peers, children eventually come to think of themselves as generally academically capable or incapable, competent or incompetent. This general sense of one's ability is often referred to as self-concept of ability, which was found to have significant consequences for student achievement behavior and the way students respond to challenges and tasks [22]. Especially after they enter the often competitive atmosphere of the school, students begin making judgments about their sense of competence. Internally, they appraise the learning situations and decide on the likelihood of succeeding at a given task. In addition to the nature of the given task itself, students' self-perceptions of ability influence their performance [23]. Those who possess a strong sense of competence are more apt in initiating and maintaining involvement in the activities, and consequently, such behavior further challenge and enhance their actual ability [24]. It is imperative to note that although a child's self-concept of ability may be distorted and based on erroneous input, this does not nullify its influence.

Raffini [25] cited an example of a student who had an SAT score (Scholastic Aptitude Test) in the 98<sup>th</sup> percentile mistakenly thought that to mean he had an IQ of 98. And because he got the notion that his IQ was 98, he anticipated that college-level work would be difficult for him. Sure enough, he did indeed struggle during his first year at college. He was ready to drop out, convinced he could not meet the expectation of college work. It was only later, after he received an accurate understanding of his SAT score and learned his IQ was actually about 140, that his college performance began to soar. In due course, he began to do very well in his work. His newfound knowledge of his ability helped him to achieve his actual, rather than his perceived, potential.

#### *E. Frame of Reference*

One of the major concerns about streaming or grouping practices is their effects on the self-perceptions of the students' abilities. Educators worry that students in the "low" group will acquire low perceptions of their academic competence and the accompanying feelings of shame and maladaptive behavior. Research suggests that the effect of grouping practices depends to a large extent on what the students compare themselves to, or their

frame of reference, when they assess their own abilities. If students use their immediate social context as their frame of reference, relatively high-achieving students should have lower self-perceptions of their academic competence in a high-achieving group than they would if they were in a heterogeneous group; conversely, low-achieving students should acquire higher self-perceptions of academic competence in a low group than a heterogeneous group [26]. This analysis predicts that ability grouping should have positive effects on relatively low-performing students than high-performing students on their perceptions of competence. However, Felson and Reed [27] suggested the opposite; they found that students placed in relatively high groups rated their academic ability higher than those placed in relatively low groups, regardless of their performance within the group, that is, students also base their ability on their group membership. In addition to comparing their performance to their classmates, students also use a personal frame of reference to judge their competence; that is, they make comparison between their own performances in different subject areas. Thus, a student who is particularly good at English may rate herself lower in mathematics than would be expected on the basis of her performance in mathematics relative to her classmates [28]-[29].

Other research indicates that student's self-perceptions are affected more by their group assignments when the ability groups are constituted within than they are constituted between classrooms. For instance, Reuman [30] found that high-achieving six-graders had relatively higher achievement expectancies and low-achieving students had relatively lower achievement expectancies when grouped within their classrooms than between-class grouping was used. Indeed, anyone who has given motivation any serious thought knows it is like a slippery eel, it is no simple task getting to the crux of the problem.

### III. METHODS

This study employed a correlational design utilizing written survey methodology and included English and mathematics test scores of participants as their academic achievement indicators. Quantitative data were obtained through the administration of questionnaires; English and mathematics tests results of the students from the participating schools were converted to base 100 and used to reflect the academic performance of the students. Data were then analyzed based on the three ability groups when students were streamed into high (HC), middle (MC) and low (LC) ability courses.

#### *A. Participants*

Participants were taken from three primary schools. There were 197 boys and 235 girls (N = 432) who attempted Self-Regulation Questionnaire (SRQ-E) for English. There are three main races in Singapore, out of the participants, 55.1% were Chinese, 30.8% were Malays, 11.3% were Indians and 2.8% of the students belonged to other races. Of all the participants, 15.7% were HC, 72.7% were MC and 11.6% were LC students.

For the Self-Regulation Questionnaire (SRQ-M) in mathematics, there were 192 boys and 227 girls (N = 419) who took part in it of whom 56.1% were Chinese, 30.5% were Malays, 10.5% were Indians and 2.9% were under other races. There were 16.5% of HC, 72.3% of MC and 11.2% of LC students.

One of the weaknesses of this study was the meagre number of HC and LC students; however, this situation could not be improved as majority of the students were from the middle course.

**B. Instrumentation**

The SRQ consisted of 32 items about motivation and self-perceptions of academic competence. There were 28 questions on self-regulations in part 1, and part 2 consisted of 4 questions on self-perceptions of academic competence.

**C. Motivation Measurement**

The Self-Regulation Questionnaire Academic (SRQ-A) format which was introduced by Ryan and Connell [31] was adapted with reference to Hayamizu's (1997) version of Stepping Motivation Scales [32]. The SRQ, which was developed for late-elementary students concerning schoolwork, asks why the respondent does a certain behavior and then provides several possible reasons that have been pre-selected to represent the four different styles of regulation. The original SRQ was not constructed to measure motivation related to a particular subject, however, for the purpose of this research, it was modified to measure the motivation of the students in English (SRQ-E) and mathematics (SRQ-M). The original 32 questions were reduced to 28 with 7 questions for each of the four sub-scales: external regulation, introjected regulation, identified regulation and intrinsic regulation. Instead of being questioned for a certain situation as in the SRQ, participants were asked to complete the sentences with reasons which they have to rate on a scale of 4. Scale 1 stands for never, scale 2 stands for rarely, scale 3 means often and scale 4 stands for always. The four situations are:

- I do my English/ math homework because...
- I study for my English/math test because...
- I try to answer difficult questions in my English/math class because...
- I try to do well in English/math because...

The students rated the reasons to the corresponding situations. A high score in the sub-scale will indicate a high level of endorsement of that regulatory style. Most of the SRQ items were unaltered except certain pre-selected reasons which were modified to fit the context in Singapore. The following is the list of 28 reasons with 7 for each situation. The phrasings of some reasons were different for each subject. The items for external reasons are:

- I'll get in trouble if I don't.
- That's the rule.
- That's what I'm supposed to do.
- I don't want the teacher to scold me.
- I want the teacher to say nice things about me.

- My parents/ guardians get angry if I don't do well in English/ math.
- I might get a reward if I do well.

To assess the introjected regulation, the items are:

- I'll feel bad about myself if I don't do it.
- I'll feel really proud of myself if I complete my homework.
- I want the teacher to think I'm a good student.
- I want the other students to think I'm smart.
- I feel ashamed of myself when I don't try.
- I don't want my parents/ guardians to feel sad when my English/ math results are poor.
- I may end up regretting if I don't do well in it.

The subscale of identified regulation comprises of the following items:

- I want to understand the subject.
- I want good English/ math results to be on my report book.
- I want to learn new things.
- I want to find out if I'm right or wrong.
- It's important to me that I try to do so.
- It's important to me that I try to get into the best class.
- Doing well in English/ math will be useful for me in the future.

Lastly, items to assess intrinsic regulation are as follows:

- It's fun.
- I enjoy doing my English/ math homework.
- It's fun for me to improve my language skill/ it's fun for me to improve my math problem-solving skill.
- I want to feel the joy of making sure that I've understood what I learned in class/ I want to feel the Joy of understanding math.
- I like thinking.
- It's interesting for me to answer difficult questions/ it's interesting for me to solve math questions.
- It's fun to be good at it.

Evidences attesting to the validity and reliability of these scales have been reported in some studies [33]-[35]. These modified versions of SRQ for English and mathematics have acceptable and very good reliability with alpha coefficients ranging from .66 to .88, except for SRQ-M introjected regulation sub-scale ( $r = .63$ ), which is undesirable. For the participants of a younger age, the reliability may not be as high as for adult respondents in certain cases. Table I gives the Cronbach's Alpha internal consistency reliability of the 7-item subscales for SRQ-E and SRQ-M.

TABLE I. CRONBACH'S ALPHA RELIABILITY FOR THE ADAPTED VERSION OF SRQ-E AND SRQ-M

Regulations	SRQ-E	SRQ-M
External	.71	.66
Introjected	.68	.63
Identified	.79	.79
Intrinsic	.80	.88

The SRQ-A has four subscales: external, introjected, identified, and intrinsic. The subscale scores on the SRQ-A were combined to form Relative Autonomy Index (RAI), which is a single score obtained by applying a weighting to each subscale and then summing the weighted scores. It gives an index of the degree to which participants feel self-determined. High positive scores indicate greater relative autonomy and low negative scores indicate more controlled regulation. For the SRQ-A, the weightings are as follows:

External regulation	-2
Introjected regulation	-1
Identified regulation	+1
Intrinsic regulation	+2

To form the RAI, the external subscale is weighted -2, the introjected subscale is weighted -1, the identified subscale is weighted +1, and the intrinsic subscale is weighted +2. In other words, the controlled subscales are weighted negatively, and the autonomous subscales are weighted positively [36].

#### D. Self-perceptions of Academic Competence Measurement

A 4-item self-perceptions of academic competence scales for English (SPACS-E) and mathematics (SPACS-M) were constructed to measure how students perceive their academic capability. It has a 5-point Likert scale, rating 1 is for near negative perception and rating 5 is for near positive perception [37]-[38]. The followings are the 4 items:

- How good are you at English/ mathematics?
- If you were to rank all the students in your English/ math class from the worst to the best, where would you put yourself?
- How confident are you in your ability to use English/ to solve math questions?
- Compared to most of your other school subjects, how good are you at English/ math?

The reliability alphas indicated very good internal consistency of .83 for English and mathematics.

#### IV. RESULTS AND DISCUSSION

The analyses of the results show that the correlations were weak. As shown in tables II and III, in both subjects, there were negative correlations between academic achievements and external regulation; this means that those who performed well academically were less motivated through external factors than those who were academically poor. With regards to English performance alone, the performance of LC students,  $r = .346$ ,  $p < .05$ , was positively related to external regulation, whereas, the performance of HC,  $r = -.252$ ,  $p < .05$ , and MC students,  $r = -.186$ ,  $p < .01$ , was negatively related to it. This implies that LC students who were academically good were more reliant on external regulation than HC and MC students. HC students showed the strongest negative relationship, meaning those who were better academically were the least to be motivated externally in their learning of English among the three groups and vice versa.

The LC students who did well in English were high in their introjected,  $r = .419$ ,  $p < .01$  and identified regulations,  $r = .323$ ,  $p < .05$ , and vice versa, as they were the only group who had a significant positive correlation between English performance and the two regulations. They wanted to do well in English for introjected reasons such as to please their parents, to look smart among their peers and to have their teachers think they are smart. Among the MC students, those who were more autonomous tend to perform better in both subjects as they were the only group that showed a positive correlation between the relative autonomy index (RAI) and achievements in English,  $r = .257$ ,  $p < .01$ , and mathematics,  $r = .213$ ,  $p < .01$ .

TABLE II. CORRELATIONS BETWEEN ENGLISH PERFORMANCE AND EXTERNAL, INTROJECTED, IDENTIFIED AND INTRINSIC MOTIVATION, RELATIVE AUTONOMY INDEX (RAI), SELF-PERCEPTIONS OF ACADEMIC PERFORMANCE

English	All N = 432	HC N = 68	MC N = 314	LC N = 50
External	-.154**	-.252*	-.186**	.346*
Introjected	-.012	-.030	-.041	.419**
Identified	.208**	-.185	.056	.323*
Intrinsic	.204**	.056	.098	.247
RAI	.294**	.164	.257**	-.163
Self-perceptions	.373**	.459**	.283**	-.004

\* $p < .05$ ; \*\* $p < .01$

Overall, there was a relatively stronger correlation between the students' performance and their self-perception of their academic competence in mathematics,  $r = .414$ ,  $p < .01$ , than in English,  $r = .373$ ,  $p < .01$ . This could be due to the fact that mathematical skills are more definable and explicit as compared to English language skills which involve speaking and listening skills which are seldom graded. In other words, it can be deduced that the self-evaluation of competence in overall English language skills is more difficult, hence there was a weaker correlation as compared to mathematics. There was a relatively stronger significant correlation between the self-perception of English competence and the achievement of HC students,  $r = .459$ ,  $p < .01$ , than MC students,  $r = .283$ ,  $p < .01$ . Both HC and MC students who did well in English and mathematics were able to have a high perception of their competence and vice versa, but LC students were not able to do so as the correlations between their academic achievements in both English,  $r = -.004$ , *ns*, and mathematics,  $r = -.027$ , *ns*, and their self-perception of competence were close to naught.

TABLE III. CORRELATIONS BETWEEN MATHEMATICS PERFORMANCE AND EXTERNAL, INTROJECTED, IDENTIFIED AND INTRINSIC MOTIVATION, RELATIVE AUTONOMY INDEX (RAI), SELF-PERCEPTIONS OF ACADEMIC PERFORMANCE

Mathematics	All N = 419	HC N = 69	MC N = 303	LC N = 47
External	-.139**	.050	-.122*	-.001
Introjected	-.042	.058	-.057	.045
Identified	.221*	-.205	.085	.119
Intrinsic	.175**	.030	.119*	.042
RAI	.276**	-.067	.213**	.111
Self-perceptions	.414**	.370**	.390**	-.027

\* $p < .05$ ; \*\* $p < .01$

## V. CONCLUSION

In terms of motivation, students who performed well academically in English and mathematics were less motivated through external factors than those who were academically poor. Examination by group shows that LC students who were good at English were more dependent on external motivation than HC and MC students. HC students who were better academically were the least to be motivated externally in their learning of English among the rest. The correlations were insignificant in other groups but among the LC students who did well in English, they were high in their introjected and identified regulations which were not evident in the other two groups. It was also clear that students who were better academically were more autonomous.

Students who were good academically were able to have a better judgement of their academic competence. A closer look at the individual groups shows that HC and MC students were very certain of their competence in handling both subjects in English and mathematics. However, LC students were not able to do so as the correlations between their achievements in both subjects and their self-perception of competence were close to nil. It is often assumed that being in an LC class would inevitably have a negative influence toward their self-perception of competence but in this case, it shows that even before they were streamed into lower academic course in primary five, they were already uncertain of their academic competence when compared to the students in the other two higher courses. The phenomenon found in this study is also evident on other studies [39]-[42].

A longitudinal investigation is necessary to further examine the possible changes among the three groups of students when they are streamed into various courses in primary five.

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