The Influence of Learning Styles and Motivation on Undergraduate Student Success in Mathematics

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Abstract: This study investigates the influence of motivation and learning styles on the achievement of tertiary education Mathematics' students. A randomly selected of 140 undergraduates students in an university have participated in this study. Students were asked to complete a questionnaire on the different aspects of the motivation (extrinsic motivation and intrinsic motivation) and learning styles (participation, collaboration, independence, and competition) towards their respective academic performance. Grasha's Model is applied in this research and there are six aspects of learning styles for this model. However, the learning style of avoidance and dependent are not suitable for university students. Therefore, only four aspects of learning styles are used. Correlation analysis is use to examine the relationship between the learning styles and motivation on students' achievement. The findings reveal that the extrinsic motivation of students exceeds intrinsic motivation. Also, learning styles, encompassing participation, collaboration, and independence significantly influence students' performance relative to the competition. The results also indicate that both motivation and learning styles are significantly different in the context of performance in Mathematics for the undergraduates.

Keywords: Motivation; learning style; academic achievement; Mathematics; undergraduates

1. Introduction

The Malaysian education system has undergone a lot of changes and developments throughout the years, mostly due to the challenges brought about by globalization, liberalization, and the rapid development of information and communications technology (ICT) (Phoong et al., 2018). Therefore, Education 4.0, STEM, and HOTS were introduced to provide students with the opportunity to apply the concepts and knowledge derived from various disciplines to solve real-world problems (Harkin, 2008; Baharin et al., 2018).

Education remains an important cornerstone for national development. The socio-economic gap between rural and urban students is evident in the disparity between rural and urban income, assets, and medical care, and also education. Disparities in education were measured by the inequity in educational attainment of rural and urban people in the context of education, especially in higher education, student-teacher ratio, and the allocation of educational resource.

Educational attainment is an absolute criterion for progress (Phoong et al., 2019). However, disparities in student achievement are caused by factors such as learning styles, motivation, attitude, interest, rural-urban influences, cultural influences, student’s personality, languages, learning environment, family, and teachers. These factors are not only student-dependent, they are also dictated by the teachers and educational process. Therefore, this study sets out to determine whether the learning styles and motivation affect students’ academic performance. Learning styles refers to the preferential way a student absorbs, processes, comprehends, and retains information. According to Meor Ibrahim and Assadah (2011), learning style is the main factor determining a student’s success and failure. Perger and Takacs (2016) also supported the supposition that learning style is important towards students’ academic achievement.

There are various forms of learning styles, such as the VAK Model (Visual, Auditory, Kinesthetic) (Cid et al., 2018), Model Felder & Silverman (1988), Dunn & Dunn Model (1978), Honey Mumford Model (1992) (1984), Model Grasha (1996), and others. The learning style used in this study is the Grasha Model (1996). There are six main aspects in Grasha's (1996) learning styles, which are competitive, collaborative, avoidant, participative, dependent, and independent. Competitive is the attitude of a student compelling them to compete with other students for better achievements. In terms of collaboration, students work in group and share information, ideas, and abilities. Avoiding is a learning style defined by students who are less interested in teaching materials and
often end up skipping classes, which means they miss their chance to learn. Participation is defined as a learning style that is well regarded by teachers due to its role in encouraging students to attend school due to the fact that the students are actively involved in the learning process. The learning style depend is characterized by students always seeking help and guidance from teachers/fellow students. The student only learns directly from the source, and usually eschew the extra effort needed to increase their level of knowledge. The independent learning style contradicts the dependent style, where the student rely on self-reliance, solitary learning, and tend to go only for the important points in the study materials (Cimermanová, 2018).

However, this study utilized only four learning styles, which are participation, collaborative, independent, and competition. The learning style of avoidance and dependent are not used due to the fact that the former is unsuitable for high school and university students, as their absence will be noted by the instructors and they will be barred from further attending school. The dependent learning style is also unsuitable in the context of this study as tertiary students are expected to be independent despite the input from the instructors being sufficient, which is in line with the national education goal of producing knowledgeable individuals. Moreover, academic excellence can also be realized by motivated students. Motivation plays an important role in increasing student productivity and efforts towards achieving one's goals. A motivated individual will also be actively involved and more effective than their unmotivated counterparts (Saeed and Zyngier, 2012). Azizi and Jaafar Sidek (2006) pointed out that motivation is regarded as a factor enabling students to actively participate in the teaching and learning process. It renders the learning process meaningful, beneficial, and fun. Teachers will need to reward or praise students when they exhibit positive responses, which will directly improve students’ motivation and performance. Also, Legault (2016) reported that intrinsic motivation is more important relative to extrinsic motivation because if a student is highly and intrinsically motivated, then indirectly, they will more than likely to strive for excellence (in academia).

This study details an investigation into students' academic performance by undertaking the self-motivation and learning styles as determinants. The academic performance in this study refers to the score obtained in Mathematics. The significance of this study is that the perception of undergraduates on their learning styles and motivation towards the success in Mathematics. Most of the previous studies discussed the students’ perception on their learning styles and motivation towards academic achievement. However, the target respondents mostly are the secondary school students. There are few of the studies discussed the perception of students from higher education. This is an essential aspect that influence student's attainment because students from different education level have different opinions towards their learning behaviour and type of motivation. This study intends to provide an overview to the students, lecturers, and universities so that they can improve on the teaching and learning experience and create programs and workshops that would enhance students’ motivation. Student attitudes can be formed via peer association, and parents are also responsible for being aware of the attitudes of their children’s peers.

2. Literature Review

Learning Styles

Learning style is a phenomenon that involves individual development and growth, racial progress and civilization. So, this phenomenon is important and causes many researcher to explore this phenomenon to benefit effectively in the field of education. With that, various theories have been developed for use in education (Kamarudin, 2010). Basically these learning theories are divided into four aspects namely behaviour, cognitive, social and humanist (Mok, 2012). Additionally, learning is a change of individual understanding and ability in implementing and practicing the learned knowledge rather than increasing the number of goals built (Hargreaves, 1996).

Style means behaviour, style or manner (Nor Zakiah, 2010). Then the learning style refers to how one uses the style or way of learning. Learning style in the context of educational psychology is the way students focus and act to process and obtain information, knowledge or experience. Kamarudin (2010) also states the same, where students focus on and showcase their way of processing information, mastering knowledge, building and formulating concepts or principles. Learning style is how to learn something according to individual tendencies. In addition, the learning style not only means the ability of a person to process information but also means individual differences in processing and organizing information (Kolb, 1984). According to Cassidy (2004), learning style means a style practiced in learning situations such as the way an individual approaches in solving problems, thinking, seeing and remembering.
King (2011) concluded that there is a significant difference between learning style and culture. This showed that cultural differences can play a role in learning style. If the teaching style of the teacher is not in line with the student learning style then the teaching and learning process becomes less effective (King, 2011). Honey and Mumford (1992) define a learning style as an explanation of the attitude and behaviour of the learning practiced by the individual. According to Dunn and Dunn (1978), learning styles are the way people begin to concentrate, process and remember a difficult or new information. The purpose of testing the learning style is to identify the most effective learning styles for an individual, intangible learning style, precise learning style through certain instruments and avoid misinterpretation of behaviours and identify certain behavioural signs. The students' learning styles might influence the teaching and learning processes and affect the effectiveness of learning process in a classroom. Therefore, educators should play an important role as key drivers in the development of student education. The learning styles practiced by each individual vary from each other. A student began to develop a learning style from the beginning and then they will applied that learning style in the process of teaching and learning.

**Motivation**

Education is a continuous effort towards further development comprehensive and integrated individual potential to create a human being balanced and harmonious in terms of intellectual, spiritual, emotional and physical based trust and obedience to God. This effort is to give birth to the people Malaysia with knowledge, skill, noble character, responsible and capable of achieving well-being, and giving contribution to harmony and prosperity of families, communities and countries (National Philosophy of Education, 1992). The above statement clearly states that the country needs human capital that can drive the country towards developed prosperity of families, communities and countries. By that, good attitude and motivation will ensure student enrolment in school and so that it can produce a diverse society in various fields and able to be competitive in the face of this era of globalization.

According to Nurul Ain and Azizi Yahaya (2012), students are incapable to be positive on difficult problems, they cannot adjust idea with current situation, hard to think of various methods for solve problems and set goals in learning, problematic in planning strategies in learning and lacking confidence in solving a problem. This is because students are familiar depending on the teacher when making decisions in teaching and learning activities at school. Through the study of Jerie and Zamri (2011), Chitra (2003) and Zarina (2001), various ethnic and race have high attitudes, motivations and achievement levels when applying the mastery of 21st century learning. According to Halim Tamuri and Nur Hussin (2017), learning the 21st century in Malaysia in a diversity of cultures is to create a unity between the various races and ethnic groups in Malaysia can eliminate racial prejudices and streams in an effort to inculcate a positive attitude and arise respect for ethnic, ethnic and cultural differences. In the study Ainun Iberahim et al. (2017), found that the attitude, motivation and achievement of the students towards the learning of the Malay language after applied 21st century skills to overall is at a high level. This means the skills of the 19th century, 21 is very effective in influencing student learning in subjects Bahasa Melayu in helping to improve the achievement of Bahasa Melayu in among students. Noor Erma Abu and Leong (2014), stated that there was a relationship which is significant between attitude and student achievement in Mathematics Additionally through correlation test showing that if the attitude of the student to Additional Mathematics is high, then their achievement will also be height.

In the study of Ainun Iberahim et al. (2017), students lack confidence in solving problems encountered as they are usually dependent on teacher when deciding on teaching and learning activities at school. This is because, lack of motivation that drives a person's seriousness and actions to do something, whether good or not. Hence, for helping students improve their 21st century skills, teachers need to be able to improve student motivation to actively engage in the teaching and learning activities (Rohani Arbaa et al., 2017). Motivation is considered as an element that enables students to actively participate in the teaching and learning process. Next, it makes the learning process happen in a meaningful, beneficial and fun situation. Therefore, teachers need to always reward or praise when they exhibit positive behaviour, indirectly improving the motivation and performance of the students. Agger and Meece (2015) found that motivational differences based on gender, found that there was a gender gap in motivation between male and female students. In addition, the findings showed that male students tent to have positive achievement to Mathematics, Science and sports subjects. Meanwhile, female students prefer in language, arts and reading.

Student motivation can also be enhanced when the teacher is successful interesting and challenging teaching materials for students. A capable teacher adjust the teaching material with the real life of the pupil will stimulates the involvement of the students for being able to give meaning to life they (Rohani Arbaa et al., 2017). This student's motivation and interest should be maintained by teachers using various approaches in teaching and learning methods learning in the classroom. Effective teacher teaching methods can improving the motivation
and interest of students in the learning process improving the ability of students to acquire skills and knowledge useful to them (Nurul Nashrah Salehuddin et al., 2015). In the study of Chen, Alias Masek and Mohd Hasril Amiruddin (2014), found no difference which is significant among the aspects of interest with grades of student achievement in the course Electrical Technology 1, but there is a significant difference in attitude. Attitude, motivation and achievement as much as capable of encouraging students to master 21st century skills are faster and easier and have long-term impacts are a result that should be anticipated by country in producing a versatile society in various fields and able to be competitive with developed countries (Ainun Iberahim et al., 2017). In the study Nurul Nashrah Salehuddin et al. (2015), found that students’ perceptions of levels four of Mathematics subjects are at a high level. Perception Mathematics students are important to improve their motivation for learning Mathematics can thus nurture their interest in Mathematics.

Teaching directly or indirectly desires to get results or changes that apply to pupils in a sense wide. To get the result, teachers need to measure the achievement of the students through the assessment methods (Noor Hisham Nawi, 2011). Intermediate achievement level relates to students' attitude and motivation. According to Noor Erma Abu and Leong (2014), found that attitude and interest have a clear relationship with student achievement in Additional Mathematics. This has been proven through research Chen et al. (2014), which found that the intrinsic motivation of the pupils was at a level height. Intrinsic motivation in the aspect of interest finds that the student becomes more encouraged to do something with the onset of interest internally what he did. With high interest will increase the achievers the pupil is in the field where he is. Chong et al. (2012) stated that besides the self-motivating factor that exists in the student, the external factor such as parent encouragement is also necessary in ensuring the academic interest in among students. Students studying with enthusiasm will be delighted and encouraged to work harder in achieving goals, namely to acquire grade A (Nur Maizatul Mukhtar et al., 2017).

Mei and Siti Liyana (2011) examined the relationship between the level of motivation and academic achievement of distance education students in a university. The findings showed that intrinsic motivation and extrinsic motivation of students were at high level. However, the relationship between the two motivations toward academic achievement shows no significant relationship. Moreover, Saemah and Phillips (2006) investigated the relationship between meta-cognition awareness, motivation and academic achievement of university students and found that motivation factor of self-esteem and learning goals had an indirect relationship with achievement. This can be supported by referring to Nurul and Azizi (2012) that the goal factor influences the intrinsic motivation of a student, meaning that when the student has a high level of motivation then indirectly they will strive to achieve excellent results in line with the goals they have set. Budiawan (2008) also found that motivation can affect the student's performance. It is thought that high motivation can help students make efforts to achieve their performance. Overall, an outstanding achievement in the academic field influenced by attitude and motivation. Motivation is said to be a driving force and drive to something to happen. The students' interest and attitudes towards the matter It can also improve their achievement.

3. Methodology

The sample size of this study was determined using the table outlined in Krejcie and Morgan (1970). According to the Krejcie and Morgan (1970), a total of 140 students were randomly selected from a total population of 220 students. The respondents are Mathematics students from the Faculty Science and Mathematics, Sultan Idris Education University (UPSI). After identifying the number of respondents, a questionnaire was developed to collect data on students' perception on motivation and learning styles that influence their respective academic performances.

The questionnaire is divided into two sections; sections A and B. Section A details the background of the respondents, encompassing the age, gender, race, academic achievement, and education level, while section B details the perception of students on the motivation and learning styles in relation to their respective academic achievements. A four-point Likert scale (strongly disagree, disagree, agree, and strongly agree) is utilized in this questionnaire. The data were then analyzed using Statistical Packages for the Social Sciences (SPSS) 22.0 to determine the relevancy of the descriptive statistics of the data. Also, the correlation analysis and mean score were adopted in this study to elucidate the relationships between the variables. Correlation analysis is a method used to study the strength of a relationship between two variables. To calculate the strength and direction of a relationship between two variables, the correlation coefficient was used, with Table 1 detailing the strength of the relationships.
Meanwhile, the mean score analysis was used to measure the average rate of satisfaction level in a survey, or users were asked to rate something on a scale, then convert the rate into useful mean values by analyzing the responses using a score.

### Table 2. Interpretation of Mean Score for 4-point Likert Scale

<table>
<thead>
<tr>
<th>Mean Score</th>
<th>Interpretation of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00 – 2.00</td>
<td>Low</td>
</tr>
<tr>
<td>2.01 – 3.00</td>
<td>Moderate</td>
</tr>
<tr>
<td>3.01 – 4.00</td>
<td>High</td>
</tr>
</tbody>
</table>

(Sumber: Taib, 1996)

Table 2 shows the interpretation of the mean score for a four-point Likert Scale (Taib, 1996). The mean score interpretation was then used to analyze each item in the questionnaire. The mean score of 3.01 - 4.00 are at a high level, while mean scores of 1.00 - 2.00 are at the low level.

### Figure 1. Conceptual Framework of Study

Figure 1 shows the conceptual framework of the study. The determinants motivation and learning styles were investigated based on its different aspects towards academic performance of the students.

### 4. Results and Discussion

#### Motivation

This study investigated the effect of motivation and learning styles towards the academic performance of students. As per Tables 3 and 4, the variable motivation is divided into two categories; intrinsic and extrinsic.
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The former is further divided into four aspects, which are attitude, effort, goals, and interests, while the latter is divided into five aspects, which are performance, encouragement, environment of the classroom, challenges, and rewards.

Table 3. Mean Score for Intrinsic Motivation

<table>
<thead>
<tr>
<th>Aspect from Intrinsic Motivation</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude</td>
<td>3.30</td>
</tr>
<tr>
<td>Effort</td>
<td>3.34</td>
</tr>
<tr>
<td>Goals</td>
<td>3.25</td>
</tr>
<tr>
<td>Interests</td>
<td>2.80</td>
</tr>
<tr>
<td><strong>Total Mean Score</strong></td>
<td><strong>3.17</strong></td>
</tr>
</tbody>
</table>

Table 3 shows that the average means for the attitude, effort, and goals of the intrinsic motivation are at the high level, while interest falls in the moderate level. The total mean score of intrinsic motivation is 3.17, which is at the high level, confirming that the students possess high intrinsic motivation.

Table 4. Mean Score for Extrinsic Motivation

<table>
<thead>
<tr>
<th>Aspect from Extrinsic Motivation</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>3.61</td>
</tr>
<tr>
<td>Encouragement</td>
<td>3.65</td>
</tr>
<tr>
<td>Environment of The Classroom</td>
<td>3.61</td>
</tr>
<tr>
<td>Challenges</td>
<td>3.42</td>
</tr>
<tr>
<td>Rewards</td>
<td>3.14</td>
</tr>
<tr>
<td><strong>Total Mean Score</strong></td>
<td><strong>3.49</strong></td>
</tr>
</tbody>
</table>

Table 4 shows that the overall mean of extrinsic motivation for all aspects are at high levels. The total mean score for extrinsic motivation is 3.49, which confirms a high level of extrinsic motivation. Overall, both intrinsic and extrinsic motivations confirmed that the level of motivation of students is high.

Learning Styles

This study also elucidated the learning styles of the students. The types of learning style practiced by the students include participation, collaborative, independent, and competitive. Table 5 shows that the participation, collaborative, and independent learning styles are at high levels due to the average mean value being greater than 3.01. The competitive learning style is at a moderate level, at 2.63. The total mean score for the learning styles practiced by the students are at high levels.

Table 5. Mean Score for Learning Styles

<table>
<thead>
<tr>
<th>Aspect from Learning Styles</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation</td>
<td>3.05</td>
</tr>
<tr>
<td>Collaborative</td>
<td>3.34</td>
</tr>
<tr>
<td>Independent</td>
<td>3.20</td>
</tr>
<tr>
<td>Competitive</td>
<td>2.63</td>
</tr>
<tr>
<td><strong>Total Mean Score</strong></td>
<td><strong>3.06</strong></td>
</tr>
</tbody>
</table>

Relationship between Students’ Academic Achievement and Motivation

This section elucidates the relationship between academic achievement and motivation. The hypothesis for this objective is:

$H_0$: There is no significance difference between students' academic achievement and motivation
Table 6. Correlation Analysis for Academic Achievement and Motivation

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Pearson Correlation, r</th>
<th>Sig. level, p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achievement</td>
<td>140</td>
<td>3.62</td>
<td>0.253</td>
<td>0.674</td>
<td>0.048</td>
</tr>
<tr>
<td>Motivation</td>
<td>140</td>
<td>3.33</td>
<td>0.364</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It can be seen in Table 6 that the Pearson coefficient value is 0.674, which confirms a strong positive correlation between academic achievement and motivation. The significant level obtained, $p = 0.048 (< 0.05)$ indicates that there is a significance difference between students' academic achievement and their motivation.

**Relationship between Students’ Academic Achievement and Learning Styles**

This study elucidated the relationship between students’ academic achievement and learning styles. The hypothesis is:

$H_0$: There is no significant difference between students' academic achievement and learning styles.

Table 7. Correlation Analysis for Academic Achievement and Learning Style

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Pearson Correlation, r</th>
<th>Sig. level, p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achievement</td>
<td>140</td>
<td>3.62</td>
<td>0.253</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning Style</td>
<td>140</td>
<td>3.06</td>
<td>0.361</td>
<td>0.752</td>
<td>0.034</td>
</tr>
</tbody>
</table>

The Pearson coefficient value is 0.752, which means that the relationship between academic achievements and learning style is strong and positively correlated. Based on the significant level ($p = 0.034$) obtained, the hypothesis is rejected, as it indicates that there is a significant difference between academic achievement and learning styles.

5. Conclusion

This study investigated the relationship between students' academic achievement, motivation, and their respective learning styles. It can be seen from the results that the level of extrinsic motivation exceeds that of intrinsic motivation. This shows that students are more influenced by external factors in striving for academic excellence, which is in line with Ainol Madziah and Isarji (2009) stating that extrinsic motivation provides a positive stimulus towards improving academic performances. This supposition is also supported by Azizi and Jaafar Sidek (2006), where they posited that extrinsic motivation encourage students' interest towards doing well in examinations.

In terms of the learning style practiced by the students, participation, collaboration, and independence are at high levels, while competition is moderate. This confirms that students practice various learning styles with the purpose of improving their academic performance. This supposition is supported by Ilcin et al. (2018), where it was posited that learning style is an important factor influencing students’ success. The findings also revealed that there is a significant difference between students' academic achievement and motivation. Other findings include the fact that there is a significant difference between academic achievement and learning styles in the case of students pursuing tertiary education.

6. Acknowledgement

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References

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