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Learning Styles and Academic Achievements of Stem Students

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Abstract

Learning styles are the patterns and ways in which a student processes, interprets and elaborates information obtained according to their personal preferences. Students' excellence, including those in the STEM fields, is often associated with several factors, such as learning styles, family socioeconomic status and gender, which are said to influence their success. This study was conducted to identify the learning styles and academic achievements of science students, as well as explore the relationship between learning styles and academic achievements. This study follows the quantitative research approach, and a questionnaire was used as the instrument to collect the data. 512 respondents were involved in this research. This study has shown that environmental and psychological are the two main factors influencing the learning styles of STEM students at public universities in Malaysia. This study also shows that environmental factors and psychological factors are the two main factors influencing the learning of STEM students in public universities in Malaysia. In addition, gender and socio-economic status do not have a direct effect on students' learning styles and academic achievement. Similarly, there is no significant relationship between learning styles and students' academic achievement.

Keywords: Learning Styles, Academic Achievement, Gender, Socio-Economic Status

Introduction

In today's era of globalisation, the success and progress of a country are closely linked to the knowledge, competencies, and skills possessed by its population. A quality higher education system, through the formulation of the Higher Education Strategic Plan 2013 – 2025 is expected to produce university graduates who can meet the demands of globalisation, which requires labour skilled in all critical fields such as economics, technology, and medicine. Furthermore, the education system is now facing the challenge of adapting teaching and learning so as not to fall behind in confronting the 4.0 industrial revolution. It turns out that the Industrial Revolution 4.0 has a significant impact on all educators in preparing students who can communicate well, collaborate, possess high creativity, think critically and solve problems, and have emotional well-being (Nor Haziah dan Atiqah, 2018).

Background of the Study

STEM is an acronym for Science, Technology, Engineering, and Mathematics, which is a branch of education that emphasises practicality and reality (Sneideman, 2013). Both elements of practicality and reality usually involve hands-on activities that are more enjoyable and provide direct experiences to stimulate students to think and solve problems (Noriah et al., 2016).

STEM is a field of learning offered at schools and the tertiary level. Examples of STEM subjects in schools include science, chemistry, mathematics, graphics communication and computer science, while STEM courses at the tertiary level include mechanical engineering, medicine, biochemistry and computing and information systems. Technical and Vocational Education and Training (TVET) is also a component of STEM that adds significant value in industrial sectors such as oil and gas, aerospace engineering, shipping and green technology. The development of STEM education is important to support national policies related to science, technology and innovation, such as the Science, Technology, and Innovation Policy (DSTIN) 2021-2030, the National Fourth Industrial Revolution (4IR) Policy, the National Energy Policy 2022-2040 and the National Nanotechnology Policy and Strategy 2021-2030. Based on such importance, STEM education will continue to be developed from schools to the tertiary level to prepare students for the workforce.

Higher education institutions play a crucial role in producing highly skilled human capital capable of creating, innovating, generating and pioneering new knowledge, as well as applying and developing technology. (Mohd Zaidi, 2016). The Ministry of Higher Education is constantly striving to enhance the employability of graduates by emphasising several strategies, such as intensifying programs like industrial training, apprenticeships, finishing schools and entrepreneurship training. In addition, the Ministry of Higher Education has also taken steps to incorporate employability elements into the curriculum through the renewal of the teaching and learning system, enhancing graduates' employability through extracurricular activities, and involving employers in curriculum improvements to address the issue of unemployment among graduates. Therefore, universities, as institutions of higher education, clearly play a very important role in preparing students with credibility and outstanding character to compete on a global level.

Problem Statement

It is widely known that academic achievement is a determinant of an individual's level of success in any official examination taken. In Malaysia, academic excellence is undeniably still a benchmark and a priority in any educational institution and it is indeed the expectation from both parents and educators (Nur Adzrina dan Norhayati, 2017). Students' excellence, including those in the STEM fields, is often associated with several factors, such as learning styles, family socioeconomic status and gender, which are said to influence their success.

University graduates are often labelled as incompetent and have low mental resilience (Norasmah, 2017). Discipline issues, attitude, family and environment are the problems affecting academic achievement among students (Mohd Erfy, 2019). However, other factors can influence students' academic achievement, such as learning environment, parenting style and learning styles (Muhamad Shafiq & Norani, 2018). According to Mohamad Rofian et al. (2020), two main factors influence students' academic excellence, namely external factors

and internal factors. External factors are the pressures and elements that encourage and assist students in achieving academic success, while internal factors refer to the attitudes and efforts of the students themselves to succeed academically. However, the excellence of students also depends on various factors such as the education system, teachers, school facilities, parents and family environment. In addition, various studies indicate the factors contributing to students' academic achievement are learning methods, teaching approaches and students' attitudes. (Muhamad Shafiq & Noraini, 2018).

In general, learning style entails how something is learned according to individual tendencies. An individual born into this world certainly has their personality and style, including in the learning process. Therefore, it can be concluded that learning styles are the patterns and ways in which a student processes, interprets and elaborates information obtained according to their personal preferences (Yusfazila dan Effandi, 2018). A study by Dhakal (2020) explores student, school and parental factors that influence students' academic performance. However, Atchia and Chinapah (2019) have analysed the socio-economic factors of families, school leadership, students and teachers are said to influence the academic achievement of secondary school students in Mauritius. They found that all these factors had a positive impact on students' academic achievement.

A study conducted in France by Gulhanim (2018) found that an educator, whether a teacher or a lecturer, needs to identify the learning styles of the students they teach. Educators need to constantly plan activities both inside and outside the classroom because the variety of activities allows students to identify the learning styles that are most dominant for them. Another study conducted by Evans and Smith (2016) states that educators also need to create a positive learning environment, including emphasising aspects of delivery and feedback. The application of technology in teaching is also highly encouraged to make the learning process more engaging. In addition, academic achievement is also influenced by family background and parents' commitment. The socio-economic background of a family consists of family income and finances, parents' occupations, parents' education levels and family support. (Zakari et al., 2022). Sociologist Max Weber (1864 - 1920) argued that a family's socio-economic status influences how children are raised in both physical and social environments.

Most parents realise how important it is to provide a better education for their children to ensure the continuity of their generation. However, at the same time, parents must also consider their finances for more essential basic needs, which are crucial for survival. (Kitha, 2021). The issue of financial hardship and poverty has caused parents to be unable to afford their children's school expenses. This statement is supported by Ganesen (2013) and Mahamod et al. (2021), who argue that weak family financial factors have led parents to be unable to provide necessities such as school supplies, learning materials, tuition classes and to be indifferent to their children's learning needs. Family aspects such as encouragement, discipline compliance, and warm relationships among family members can impact children's personality, motivation and academic achievement. (Mohamad, 2018) and Mohammad Fadzia et al. (2021).

In addition to learning styles and family socio-economic status, previous studies have also shown that students' academic achievement is influenced by gender. The gender factor

needs to be explored further because nearly half of the students in STEM fields are dominated by female students (Khuzaimah & Siti Salina, 2019). A study conducted by Makarem and Wang (2019) found that female students who choose STEM fields possess high competitiveness based on their confidence and leadership attitudes. Another study by He et al. (2020) states that female students in STEM fields have shown good achievements in recent decades, particularly at the higher education level. According to Kumar and Sarangi (2018), the increase in female student enrolment in STEM fields and other majors can have a positive impact on overall economic growth both now and in the future, especially when these students enter the workforce later on. A study by Zainuddin and Kutty (2021) involving female students from the STEM field found that, based on the overall mean score, the motivation of these students is at a high level. This finding shows that the level of motivation among female students towards STEM subjects is very positive.

Learning styles and academic achievement among STEM students in public universities are the main focus of this study. Academic achievement refers to the Cumulative Grade Point Average (CGPA) of the students, while learning styles refer to the elements in the Dunn and Dunn Learning Style Model (1978), which includes environmental, emotional, sociological, physical and psychological. In addition, this study will examine the impact of socioeconomic status and gender on students' academic achievement.

Purpose of The Study

This study was conducted to identify the learning styles and academic achievements of STEM students, as well as explore the relationship between learning styles and academic achievements.

Objectives of the Study

There are four specific study objectives as follows:

a) Identify the learning styles and academic achievement of STEM students in universities.
b) Identify the learning styles and academic achievements of STEM students in universities based on gender.
c) Identify the learning styles and academic achievement of STEM students in universities based on socio-economic status.
d) Identify the relationship between learning styles and the academic achievement of STEM students in universities.

Research Hypothesis

The hypotheses for this study are:

H01: There is no significant influence of gender on the learning styles of STEM students in universities.
H02: There is no significant influence of socio-economic status factors on the learning styles of STEM students in universities.
H03: There is no significant influence of gender on the academic achievement of STEM students in universities.
H04: There is no significant influence of socioeconomic status factors on academic achievement of STEM students in universities.
H05: There is no significant relationship between learning styles and academic achievement of STEM students in universities.

Framework of the Study

This study's conceptual framework is grounded on the Behaviourism Learning Theory (1974) and the Dunn and Dunn Learning Styles Model (1978), which emphasises five types of stimuli: environment, emotion, sociology, physical, and psychological, that influence an individual's learning style.

The development of behaviourism theory was pioneered by researchers like Skinner (1974). It asserts that learning is any change in behaviour, that is, the way a person acts in a situation. This perspective emphasises observable and tangible behavioural changes. The behaviourist theory states that learning occurs when a student consistently exhibits the same behaviour as desired and how they respond to the events that have been outlined.

The Dunn and Dunn Learning Style Model (1978) highlights the tendencies underlying different learning styles among students. The Dunn and Dunn Learning Style Model is applied in this study based on the principles that most individuals are capable of learning and have specific learning styles, and these learning styles consistently respond to the climate, resources and teaching methods to optimise the learning process. In this light, Dunn and Dunn (Dunn R and Dunn K, 1978) introduced five types of stimuli that influence an individual's learning, and each stimulus has several elements and important characteristics.
Table 1 shows the elements and characteristics of these five stimuli.

Table 1
Dunn and Dunn Learning Styles (1978)

Stimulus	Elements	Important Characteristics
Environmental	Sound	Prefer studying without or with background music
	Light	Prefer to study in a bright place or a dim place.
	Temperature	Prefer studying in a cold or a hot place.
	Seating	Prefer to study in a formal seating or lying/sitting on the floor.
Emotional	Motivation	Able to motivate oneself to study or needs to be motivated by someone else
	Task Persistence	Able to study over a long or short period
	Responsibility/Conformity	Responsible for learning or need guidance from a teacher
	Structure	Prefer to study according to a schedule or prefer to study if given more time for a subject or matter.
Sociological	Self	Likes to study alone
	Pair	Like to study in pairs
	Peers	Like studying with peers
	Team	Likes to study in groups
	Adult	Enjoys learning with adults (senior)
Physiological	Perceptual	Likes to learn with tangible objects or experiences or with abstract concepts

	Intake	Likes or dislikes eating and drinking while studying
	Time	Likes to study at a particular time or at any time
	Mobility	Like or dislike moving while studying.
Psychological	Global or Analytic	Global students learn more easily when they understand the concept first and then concentrate on the details, but analytic students learn most easily when information is presented step by step in a cumulative, sequential pattern that builds toward conceptual understanding.
	Left Brain or Right Brain	Left-brain students prefer to learn something part by part and are interested in language and performing calculations and analysis, while right-brain students prefer learning as a whole, making synthesis, making movements and creating something.
	Impulsive or Reflective	Impulsive students act spontaneously, while reflective students think before acting.

Notably, in this study, the students' socioeconomic status was measured based on the monthly income of their parents. **Table 2** shows four categories of parents' monthly income in this study.

Table 2
Monthly Income Categories of Students' Parents

Category	Parents' Monthly Income
1	> RM10,000 per month
2	RM6,000 – RM10,000 per month
3	RM2,000 – RM5,999 per month
4	< RM2,000 per month

Research Methodology

The quantitative approach was used in this study because it is more compatible with the design and objectives of the research. This study focused on four main variables which are gender, socio-economic status, learning styles and academic achievement. Learning styles consist of five stimuli, namely environmental, emotional, sociological, physical and psychological, while academic achievement was measured based on the students' CGPA. The population of this study consisted of students pursuing studies in the STEM field in Malaysia. Hence, the respondents were undergraduate students pursuing their studies in the STEM field in Malaysian public universities.

The instrument used in this study comprised a set of questionnaires divided into three domains: (i) demographics, (ii) academic achievement, and (iii) learning styles. This questionnaire uses a standard scale commonly used in social science research, namely the five-point Likert scale. The scales used to determine responses related to learning styles

among students are as follows: 5 Strongly Agree (SA); 4 Agree (A); 3 Disagree (D); 2 Strongly Disagree (SD); and 1 Strongly Disagree (STS).

The pilot study was conducted to test the reliability of the research instrument by using the Rasch measurement model through Winsteps 4.8.1.0. Five main analyses conducted were i) item fit, ii) item bias, iii) unidimensionality and iv) reliability index and item-person separation index. Overall analysis of the pilot study data shows a Cronbach's Alpha (KR-20) value of 0.85 which demonstrates that the instrument has very good and effective reliability with a high level of consistency. In addition to the reliability of the instruments, the findings from the pilot study were also analysed to obtain the reliability index of respondents and items, as well as the discrimination index of respondents and items, as shown in **Table 3**.

Table 3
Reliability Index and Discrimination Index of Respondents and Items for the Overall Instrument Construction

	Reliability Index	Discrimination Index
Respondent	0.85	2.34
Item	0.95	4.45

According to Linacre (2012), if the respondent reliability index exceeds 0.80 and the item reliability index exceeds 0.90, then these values are highly acceptable. Hence, for the reliability value of respondents, the tested items should be able to distinguish the abilities of one individual from another for a measured variable, while the reliability value of the items indicates that the items are equivalent even when the same items are given to another group of individuals with similar characteristics (Bond dan Fox, 2015). For the isolation index, a value exceeding 2.0 indicates a good and acceptable index (Bond dan Fox, 2015). The results indicate that these items are capable of differentiating individuals based on their abilities and categorising items according to the levels of difficulty.

Data collection was carried out using Google Forms distributed to the respondents via online applications such as WhatsApp, Telegram, Instagram and Facebook Messenger. Quantitative data processing was carried out using the Statistical Package for Social Science (SPSS) version 20.0 and Smart PLS 3.0 software. The analyses for this study involved descriptive statistics and inferential statistics.

Research Findings

Demographics

This study involved students in the STEM field at public universities in Malaysia. Table 4 shows the demographic distribution of the respondents involved in this study.

Table 4
Demographic Distribution of the Respondents

	n	%
Gender		
Male	164	32.0
Female	348	68.0
Parents' Monthly Income		
> RM10,000	48	9.4
RM6,000 – RM10,000	96	18.0
RM2,000 – RM5,999	208	40.6
< RM2,000	164	32.0
CGPA		
< 2.00	8	1.6
2.00 – 2.67	8	1.6
2.68 – 3.00	28	5.5
3.01 – 3.33	80	15.6
3.34 – 3.67	152	29.7
3.68 – 4.00	236	46.1

Learning Styles

This study examined the variable of learning styles using the Dunn & Dunn Learning Style Model (1978), which encompasses five dimensions: environmental, emotional, sociological, physical and psychological. The findings for each learning style variable are shown in **Table 5**.

Table 5
Learning Style Variables

Learning Styles	Mean	Standard Deviation	Interpretation
Environmental	3.69	.561	High
Emotional	3.23	.591	Moderate
Sociological	3.25	.599	Moderate
Physiological	3.40	.536	Moderate
Psychological	3.83	.488	High
	3.48	.400	Moderate

The findings indicate that subconstruct of environmental learning style (M = 3.69, S.D. = 0.561) and psychological learning style (M = 3.83, S.D. = 0.488) are at high level, while emotional learning style (M = 3.23, S.D. = 0.591), sociological learning style (M = 3.25, S.D. = 0.599), and physical learning style (M = 3.40, S.D. = 0.536) are at moderate level.

Table 6
Comparison of Student Learning Styles based on Gender

Learning Styles	Gender	Mean	Standard Deviation	Interpretation
Environmental	Male	3.58	0.526	Moderate
	Female	3.74	0.569	High
Emotional	Male	3.21	0.678	Moderate
	Female	3.24	0.547	Moderate
Sociological	Male	3.24	0.644	Moderate
	Female	3.25	0.577	Moderate
Physiological	Male	3.37	0.600	Moderate
	Female	3.42	0.502	Moderate
Psychological	Male	3.76	0.557	High
	Female	3.86	0.449	High

The findings indicate that emotional learning styles, sociological learning styles, physical learning styles and psychological learning styles show similarities for both male and female genders. However, the environmental learning style of male students (M = 3.58, S.D. = 0.526) is at a moderate level, but the environmental learning style of female students (M = 3.74, S.D. = 0.569) is at a high level.

Table 7
Comparison of Students' Learning Styles based on Socio-economic Status

Learning Styles	Parents' Monthly Income	Mean	Standard Deviation	Interpretation
Environmental	> RM10,000	3.49	0.448	Moderate
	RM6,000 – RM10,000	3.75	0.636	High
	RM2,000 – RM5,999	3.79	0.489	High
	< RM2,000	3.59	0.602	Moderate
Emotional	> RM10,000	3.18	0.492	Moderate
	RM6,000 – RM10,000	3.31	0.583	Moderate
	RM2,000 – RM5,999	3.32	0.589	Moderate
	< RM2,000	3.08	0.598	Moderate
Sociological	> RM10,000	3.39	0.493	Moderate
	RM6,000 – RM10,000	3.28	0.696	Moderate
	RM2,000 – RM5,999	3.22	0.575	Moderate
	< RM2,000	3.24	0.596	Moderate
Physiological	> RM10,000	3.36	0.445	Moderate
	RM6,000 – RM10,000	3.22	0.634	Moderate
	RM2,000 – RM5,999	3.48	0.526	Moderate
	< RM2,000	3.41	0.490	Moderate
Psychological	> RM10,000	3.85	0.351	High
	RM6,000 – RM10,000	3.77	0.518	High
	RM2,000 – RM5,999	3.48	0.510	Moderate
	< RM2,000	3.42	0.477	Moderate

The findings indicate that environment learning styles are high specifically for the income category of RM6,000 – RM10,000 (M = 3.75, S.D. = 0.636) and the income category of RM2,000 – RM5,999 (M = 3.79, S.D. Psychological learning styles are also high, specifically for

the income category of > RM10,000 (M = 3.85, S.D. = 0.351) and the monthly income category of RM6,000 – RM10,000 (M = 3.77, S.D.

Table 8
Students' Academic Achievement based on Gender

	Gender	N	Standard Deviation	Sig.
CGPA	Male	164	1.094	0.416
	Female	348	1.112	

**p<0.01; *p<0.05

Table 8 shows p=0.416; >0.05, which indicates that there is no significant relationship between gender and students' academic achievement.

Table 9
Students' Academic Achievement based on Socio-Economic Status

	Parents' Monthly Income	N	Standard Deviation	Sig.
CGPA	> 10,000	48	.30401	0.369
	6,000 – 10,000	92	.48358	
	2,000 – 5,999	208	.38034	
	< 2,000	164	.39291	

**p<0.01; *p<0.05

Table 9 shows p=0.369; >0.05, which indicates that there is no significant relationship between socioeconomic status and students' academic achievement.

Table 10
The Relationship between Learning Styles and Students' Academic Achievement

		Learning Styles	CGPA
Learning Styles	Pearson Correlation	1	.093*
	Sig. (2-tailed)		.036
	N	512	512
CGPA	Pearson Correlation	.093*	1
	Sig. (2-tailed)	.036	
	N	512	512

**p<0.01; *p<0.05

Table 10 shows that there is a less significant (r=0.093, p<0.05) relationship between learning styles and academic achievement of STEM students in public universities.

Hypothesis Testing

The study also examines the value of crossing coefficient β, t-statistic value and p-value to confirm whether the research hypotheses are rejected or not. Hypothesis testing is viewed from the significant regression load path. Significant values are determined from the critical ratio values, namely t>1.96 and p<0.05. **Table 11** shows path coefficient values β, t-statistic values and p-values obtained through the Structural Equation Modeling.

Table 11
Path Coefficient β, t-Statistic, p-Values and Hypothesis Testing

Construct	*β*	*t*-Statistic	*p*	Hypothesis Testing
Gender → Learning Styles	0.065	1.212	0.226	Accepted
Socio-Economic Status → Learning Styles	-0.057	1.255	0.210	Accepted
Gender → CGPA	-0.032	0.813	0.416	Accepted
Socio-Economic Status → CGPA	-0.041	0.899	0.369	Accepted
Learning Styles → CGPA	-0.048	0.779	0.436	Accepted

Discussion

Learning Styles

Learning styles consist of environmental, emotional, sociological, physical and psychological. Data analysis shows that STEM students in public universities generally have learning styles according to the Dunn and Dunn Model at a moderate level (M = 3.48, S.D. = 0.400). This study has shown that environmental and psychological are the two main factors influencing the learning styles of STEM students at public universities in Malaysia. According to Walberg's (1981) theory of educational productivity, psychological characteristics and environment contribute to students' educational outcomes and the ecosystem functions as 'academic enablers' and also predictors of students' academic achievement (DiPerna, Volpe & Elliott, 2002). The findings of this study are supported by research conducted by Kanammah, Melissa and Shahizan (2014), which states that students' psychological readiness and conducive learning environment can influence students' self-regulated learning.

Environmental factors that include sound, light, temperature and learning patterns have been found to significantly influence students' learning styles. The findings are supported by previous research by Che Nidzam, Saidatul Ainoor and Asmayati (2016), which states that the learning environment, lighting, furniture arrangement and equipment, as well as safety aspects provided in the learning space contribute to the effectiveness of learning. A comfortable learning environment will encourage students to actively engage in learning and help them understand better.

Psychological factor encompasses global or analytical, left or right brain and impulsive or reflective tendencies. A study conducted by Kanammah, Melissa Ng and Shahizan (2014) found that psychological factors enable students to organise their learning process. Students who have the skills to organise their learning activities are actually motivated by psychological factors. These students have a high level of self-efficacy and a clear goal, which is to optimise their learning outcomes.

The Influence of Gender on Students' Learning Styles

The Structural Equation Model for path coefficient β, t-statistic and p-value indicate that there is no significant relationship between gender and learning styles ($\beta = 0.065$, $t = 1.212$, $p > 0.05$). Therefore, the hypothesis is accepted. This is supported by previous research by Gauri, Husaini Aza and Siti Farah (2016), which found that the mean scores between the learning styles of male and female diploma engineering students were not different. Similarly, the study by M. Kaviza (2019) found that gender does not influence students' learning styles, but subject stream and school location do affect students' learning styles.

This finding is completely contrary to the previous research by Mohd Azmi (2017), which indicates that there are significant differences in learning styles between male and female students. Similarly, a study conducted by Sharifah Azizah and Haslinawati (2018) also found that there are differences in learning approaches based on the gender of students in higher education institutions.

The Influence of Socio-economic Status Factors on Student Learning Styles

The Structural Equation Model for path coefficient β, t-statistic and p-value indicate that there is no significant relationship between socio-economic status and learning styles (β = -0.057, t = 1.255, p>0.05). Therefore, the hypothesis is accepted. The finding contradicts the previous research by Roni Priyo (2017), which found that the socio-economic status of both parents influences children's learning styles. Children from families with high socio-economic status have access to more educational resources, receive greater parental support and therefore exhibit stronger learning willingness and motivation.

The Influence of Gender on Students' Academic Achievement

The Structural Equation Model for path coefficient β, t-statistic and p-value indicate that there is no significant relationship between gender and academic achievement (β = -0.032, t = 0.813, p>0.05). Therefore, the hypothesis is accepted. The findings are supported by research conducted by Awang et al. (2014) and Mohd Noor (2015), which found that gender is not the main factor contributing to student achievement. The finding is contradicted by the previous research conducted by Nyanamani (2017), which found that the academic achievement levels of female students were higher than those of male students. A study by Hanita and Norzaini (2018) shows that the level of student engagement and academic achievement is better for female students compared to male students. Research by Seeni (2017) also shows that the academic achievement of female students is higher compared to male students.

According to Amirah et al. (2019), female students show a high level of self-efficacy in science subjects, while male students prefer engineering subjects. Similarly, male graduates show more interest in careers related to engineering, computer science and mathematics. Meanwhile, female students are more interested in careers as educators. Therefore, students' attitudes and interests towards STEM need to be nurtured earlier and continuously to reduce the gender gap at higher education levels and also in the workforce.

The Influence of Socio-Economic Status Factors on Students' Academic Achievement

The Structural Equation Model for path coefficient β, t-statistic and p-value indicate that there is no significant relationship between socio-economic status and academic achievement (β = -0.041, t = 0.899, p>0.05). Therefore, the hypothesis is accepted. The finding is supported by research by Zuraidah et al. (2019), which found that parents' income and socio-economic status have less influence on students' academic achievement. Previous research by Nur Maizatul Azra et al. (2017) states that socioeconomic factors will influence students' academic achievement, but the correlation between these factors and students' academic performance appears to diminish at higher levels of education.

Socio-economic factors, particularly the level of parents' education and parents' income, are closely related to students' attitudes, such as motivation, self-esteem and

participation in extracurricular activities at school (Zahir, 2015). Anuar Ahmad (2019) states that graduates from low-income families are most likely to be unemployed or employed with monthly incomes lower than their academic qualifications. Zuraidah et al. (2019) state that a study conducted in the United States using data from the National Assessment for Educational Progress (NAEP) shows that students from low socio-economic backgrounds have achievement issues in core subjects such as Mathematics and Science.

The Relationship between Learning Styles and Students' Academic Achievement

The Structural Equation Modeling decision for the path coefficient value β, the t-statistic value, and the p-value indicate that there is no significant relationship between learning styles and academic achievement ($\beta = -0.048$, $t = 0.779$, $p>0.05$). Therefore, the hypothesis is accepted. The finding is supported by research by Gauri, Husaini Aza and Siti Farah (2016), which showed that students' academic achievement is not influenced by their learning styles. On the other hand, a previous study by Roni Priyo Jatmiko (2017) found that learning styles have a significant influence on academic performance because students who understand the learning styles that suit them will find it easier to apply those styles to comprehend a topic being taught. Another study by Che Ghani et al. (2016) states that students' learning style practices are not the main factor determining academic achievement. Instead, the students can identify their strengths and improve their weaknesses in each dimension of the learning style that determines their academic performance.

Conclusion

Overall, this study has identified the factors of learning style, gender and socio-economic status on the academic achievement of STEM students at the university. Academic achievement is very important in measuring student's level of mastery over the knowledge they have learned. This study also shows that environmental factors and psychological factors are the two main factors influencing the learning of STEM students in public universities in Malaysia. In addition, gender and socio-economic status do not have a direct effect on students' learning styles and academic achievement. Similarly, there is no significant relationship between learning styles and students' academic achievement.

STEM education is universal and focuses on literacy skills such as creative thinking, critical thinking, problem-solving, and collaborative work that individuals must acquire. Research on STEM academic success needs to be continuously done to provide a clear understanding of the importance of STEM education and indirectly raise awareness and commitment to improve students' academic achievements.

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