# Self-Regulated Learning and Academic Achievement among University Students in Online Learning Environments

Shiau Wei Chan[1,*], Chee-Kit Looi[2], Nur Hafizah Kharudin[1], Md Fauzi Ahmad[1], Fadillah Ismail[1]

[1] Department of Production and Operation Management, Faculty of Technology Management and Business, Universiti Tun Hussein Onn Malaysia, Parit Raja, 86400 Batu Pahat, Johor, Malaysia
[2] Department of Curriculum and Instruction, The Education University of Hong Kong (EdUHK), Ting Kok, Hong Kong, China

**ABSTRACT**

In developing countries, the underutilization of online education creates challenges for higher education, highlighting the need to enhance student engagement and self-regulation for better academic outcomes. Hence, this research aims to investigate the association between self-regulated learning (SRL) and the academic achievement of Universiti Tun Hussein Onn Malaysia (UTHM) students in online learning environments. Seven factors of SRL, including goal setting, self-evaluation, seeking assistance, environmental structuring, learning responsibility, and organizing, were considered in this research. Additionally, this study seeks to identify the differences in SRL strategies used by male and female students. For this study, 173 undergraduate students were selected from five programs under the Faculty of Technology Management and Business, UTHM, using proportionate stratified random sampling. The results revealed a positive but significant association between SRL and academic achievement. Furthermore, learning responsibility was found to have a negative correlation with students' higher performance. However, the difference in SRL strategies used between males and females was not significant. This study is important as it provides evidence, in the Malaysian context, that will encourage a better understanding of the role of SRL in boosting the efficiency of the learning process from the perspectives of both learners and educators. Future research should delve deeper into how and to what extent students' characteristics affect the application of SRL.

*Keywords:*
Self-regulated learning; Academic achievement; University students; Online learning environments

## 1. Introduction

The landscape of education has undergone significant transformation as a result of the widespread adoption of online learning experiences. This shift has introduced a range of benefits, including enhanced flexibility, broader access, and increased responsiveness to diverse learning needs, benefiting both learners and educational institutions alike. Effective teaching in this context demands the utilization of distinct pedagogical strategies compared to traditional teaching methods [1]. Numerous challenges and obstacles emerge with online learning [2,3]. For instance, one notable

* Corresponding author.
*E-mail address: swchan@uthm.edu.my*

challenge in online learning is the limited interaction among students and with instructors, as students are not physically present in a traditional classroom setting. The effectiveness of online teaching is contingent on teachers' abilities and experience [4], and a positive relationship exists between the instructor's attitude and student satisfaction with online learning [5]. Consequently, there is a pressing need to devise innovative teaching approaches that facilitate active student engagement in various online learning activities [6]. In the realm of online learning, educational materials are typically made readily available to learners [7], aligning with their individual needs and preferences. The manner in which students access and engage with this material is left to their discretion and plays a pivotal role in fostering self-regulation—a critical factor in achieving successful learning outcomes. Self-regulation is an essential skill set for students in higher education, as the cultivation of these self-regulatory skills is a cornerstone of effective teaching and learning, contributing significantly to academic success [8].

Self-regulated learning (SRL) refers to a process of self-directing and self-beliefs that assist learners in converting their mental capability into academic performance skills [9]. It focuses on how individual students manage, modify, and regulate their learning practice [10]. Self-regulation is important to support the purpose of education, which is to improve lifetime learning skills [11]. SRL is a repeated process in which learners plan for a task, monitor their performance, and then reflect on the output [7]. This cycle will keep on repeating as students alter the process after reflecting on the output and when students plot for their next task [12]. This shows that SRL is one of the best learning strategies that aim to improve the students to become independent [13].

Several studies have already highlighted the relationship between SRL and academic achievement. For example, prior research found a significant positive correlation between students' SRL and their academic performance [10,14-16]. However, Dai *et al.,* [17] and Elfakki *et al.,* [18] suggested an opposite finding, whereby SRL did not significantly influence higher academic performance amongst learners. Other than that, the different effects of SRL on the student's GPA between experienced and inexperienced online learners were also recommended by Dai *et al.,* [17].

While prior research has shown much evidence that SRL holds an important role in predicting students' academic performance, little to no studies have been done in the Malaysian higher education setting. For example, a study by Dai *et al.,* [17] revealed the effect of SRL and academic entitlement on students' academic performance during online learning in China. Park and Kim [19] measured the effect of self-regulation, co-regulation, and interactive engagement on students' achievement in South Korean higher education. Meanwhile, a study by Santos and Mayoral [16] investigated the role of motivation and self-regulation on the academic achievement of university students in Spain. Therefore, this study aimed to identify the relationship between SRL and academic achievements among Malaysian university students.

Other than that, previous research showed significant evidence that self-regulation level was affected by students' gender differences. For example, studies by Elfakki *et al.,* [18], Susilowati *et al.,* [20] and Rohman *et al.,* [21] showed that females' SRL strategy is significantly higher than males. However, while some academic researchers have reported the connection between these two variables, few studies have been found to analyse the types of SRL strategies used by different genders. On top of that, the level and usage of SRL strategies vary amongst students based on several factors, including [22]. Therefore, studying the differences could facilitate educators in tackling the problems faced by students through SRL strategies. This study intended to compare the types of SRL strategies used by male and female students.

Therefore, this study is guided by the following research questions:

i. What is the relationship between SRL and academic achievements amongst UTHM students in online learning environments?

ii. Is there a significant difference in the types of SRL strategies used by male and female students?

## 2. Literature Review
### 2.1 Self-Regulated Learning

The word self-regulation accentuates students' SRL and denotes the talent known as "learning to learn", a plain talent that all-time learning is based on. SRL is professed as activities executed by learners at various segments of their learning procedure. Self-regulated students are keen to actively engage in their learning processes [23]. Self-regulated experts plan, set goals, and are involved in approaches to achieve those goals. Via evaluation and assessment, these strategies are observed and adjusted to boost one's development in the direction of goal achievement. SRL is neither an intellectual skill nor an academic ability but a method of self-direction utilised by students in revolving their mental capabilities into academic skills [21]. Previous research has suggested that SRL skills or strategies can be learned through training and the repetitive exercise of skills in academic situations [24].

As per Zimmerman [23], SRL generally comprises three important elements, which are metacognition, motivation, and active behaviour in the learning process. The metacognition element of SRL describes the process, which includes planning, goal-setting, organising, controlling, and assessing themselves during different phases in the goal-attainment journey. These practices enable them to be self-alert, well-informed, and confident in their progress in learning. The SRL motivation feature refers to conditions in which students obtain increased self-efficacy and self-attribution and are attracted to intrinsic assignments. From the perspective of motivation, an autonomous learner is aware of his or her ability and focuses on high internal confidence. Highly motivated individuals begin learning by displaying extraordinary effort and perseverance while studying [21]. Komarraju, Karau, and Schmeck [25] suggested that intrinsic motivation positively influenced the GPA of undergraduate students. SRL behaviour refers to students' attempts to select, arrange, and build an environment that elevates learning. It includes the students' effort to ask for guidance or pursue information associated with learning. Behavioural control is proposed as one of the significant factors in university students' achievement [26].

### 2.2 Academic Achievement

Academic achievement is a demonstration of learning outcomes that denotes the level to which the student has accomplished particular learning goals and illustrates the student's proficiency in curriculum activities [27]. It generally refers to the communiqué, statistical, science, social science, and intellectual skills and capabilities that allow students to excel in academics and society [28]. In the present study, exam and assignment scores were used to evaluate students' academic performance. Students' academic achievement concerns the scores obtained by students in the courses of study. At higher education institutes, students' academic achievement for each semester is portrayed by grade point average (GPA), which comprises cumulative scores for tasks and examinations. Throughout study years, the total GPA from the first to the last semester will be cumulated into a cumulative GPA [29]. The score for each course varies from the highest "A" to the lowest "F" with an equivalent attainment index ranging from the lowest "0.00" to the highest "4.00".

## 2.3 Research Framework

The dependent variable for this research is academic achievement, while the independent variable is SRL. There are seven determinants of SRL being studied in this research, namely memory strategy, goal setting, self-evaluation, seeking assistance, environmental structuring, learning responsibility, and organising. Based on Figure 1, the conceptual framework is portrayed.

Previous studies have shown evidence that SRL is a significant factor in predicting students' academic achievement [15,16,30]. The more students practice SRL, the more likely they are to be involved in co-regulation and the more likely they are to have better academic achievements [19]. In their study, Al-Abdullatif *et al.,* [14] showed a significant association between SRL and academic achievements in both traditional and flipped classroom models. According to the above relationships, hypothesis H1 is:

### 2.3.1 H1: There is a significant relationship between SRL and academic achievement

Regarding the memory strategy of SRL, several studies have shown an inconsistent direction in association with academic achievements. For example, a study by Zheng *et al.,* [31] proved that memorising plays an important and positive role in forecasting learners' online self-regulation which significantly affects academic performance. Meanwhile, a study by Xu *et al.,* [32] found that memorisation and elaboration strategy and instrumental motivation negatively influenced the effect of perseverance on the academic achievement of students. Although, it has a greater impact on determining Western students' achievement as compared to East Asian students [32]. Therefore, hypothesis H1A is:

i. <u>H1A: There is a significant relationship between memory strategy and academic achievement</u>
Regarding to the goal-setting strategy, Perez *et al.,* [33] proved that goal orientation approaching goals and self-regulation determined the GPA of university students. Other than that, a goal-setting strategy has negatively influenced academic procrastination and subsequently resulted in higher academic achievements [34]. Moreover, the internal goal orientation and the positive motivation trend are correlated with a higher level of SRL and result in successful students [10]. The stated relationships conclude that H1B is.

ii. <u>H1B: There is a significant relationship between goal setting and academic achievement.</u>
On the self-evaluation of SRL, a study by Ohrstedt [35] showed a positive relationship between self-regulation and expected learning outcomes and a negative relationship with actual learning outcomes. This indicated that students who estimate higher outcomes had more significant self-evaluation than students who estimate lower outcomes. Meanwhile, students who attained higher results had lower self-evaluation skills than those who obtained lower results [35]. In his study, Bloom [36] found that students who conducted self-evaluation performed better in each course examination than those who did not. Therefore, the above relationships deduce that H1C is.

iii. <u>H1C: There is a significant relationship between self-evaluation and academic achievement.</u>
A study by Algharaibeh *et al.,* [37] suggested a significant role of student help-seeking as a mediator between academic motivation and students' GPA. It is important to encourage students to seek help for more successful opportunities in life, particularly in the academic context [37]. Al-Jabri *et al.,* [38] also found that seeking assistance practice is the strongest

determiner of academic accomplishment. Furthermore, Hinnant-Crawford *et al.,* [39] suggested a significant correlation between academic help-seeking and students' Mathematics achievements. Therefore, based on the stated relationships, H1D is.

iv.  H1D: There is a significant relationship between seeking assistance and academic achievement.

On the subject of environmental structuring, a study by Ejubovic & Puska [30] found that environment structuring, computer self-efficacy, social dimension, and metacognitive strategies have positively and significantly influenced students' academic performance and satisfaction. It is also proven by Bakir [40] that successful open and distance learning (ODL) is carried out in an environment that supports active learning. Based on the above statements, H1E is.

v.  H1E: There is a significant relationship between environmental structuring and academic achievement.

As stated by Garba *et al.,* [41], there is an association between learning responsibility and academic achievement of higher education students, especially in tasks, examinations, and tests, if they were appropriately done before handing in. Students must be responsible for utilising metacognitive strategies to achieve better academic performance [30]. Similarly, Magno [42] also found a significant influence on college students' learning responsibility and academic achievement. Based on the above relationships, H1F is.

vi.  H1F: There is a significant relationship between learning responsibility and academic achievement.

Concerning the organising strategy, a study by Garba *et al.,* [41] showed that planning and organising is a major factor that has affected students' academic achievement, specifically CGPA. Moreover, Mutua [43] discovered that a positive organising strategy had determined better academic achievement than the rest of the SRL strategies. Students that usually organise their learning activities, such as highlighting the important keywords during reading, preserving older notes, and making time to study, are more likely to achieve higher academic performance [43]. Then, H1G is.

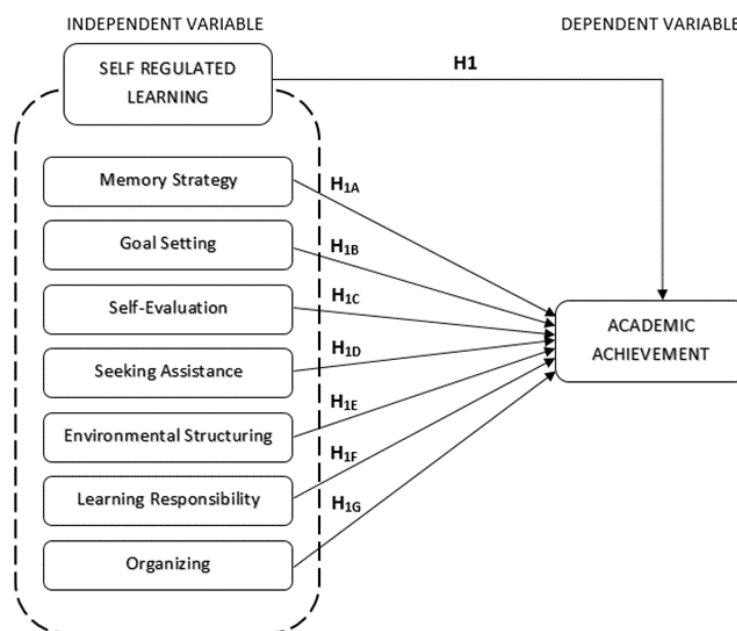vii.  H1G: There is a significant relationship between organising and academic achievement.



**Fig. 1.** Conceptual framework of the research

*2.4 Gender Difference in SRL Strategies*

On the subject of SRL, past researchers have shown evidence of the inconsistent influence of gender differences on students' SRL levels. In Saudi Arabia, Elfakki *et al.,* [44] conducted a study to measure the trend of SRL amongst medical students in the learning context. The sample consisted of 262 undergraduate medical students from both genders of all class levels at the University of Tabuk. The results revealed that there was a gender difference in SRL in which female students outdo male students in practising four domains of SRL strategies, namely:

i.    environmental structuring
ii.   time management
iii.  help-seeking
iv.   self-evaluation.

Surprisingly, a post hoc test of SRL amongst males found that male students regularly use two factors of SRL, namely environment structuring and time management.

In another study in Indonesia, Rohman *et al.,* [45] investigated the gender difference in SRL of junior high school students in Mathematics subject. A total of seventy-three 8th grade students with thirty-five males and thirty-eight females from SMPN 1 Pecangaan were involved in this study. This study considered three aspects of SRL: metacognition, motivation, and behaviour. The difference in SRL between genders was observed by using a t-test, and then scores for each aspect of SRL were analysed by their average value. The results suggested that there was a difference in SRL between genders, whereby female students surpassed male students in all three aspects of SRL.

Besides, research by Pérez *et al.,* [33] in Spain addressed three objectives, one of which focused on identifying the SRL scores and time trend reports on students of different genders. Data obtained from a sample of 192 university students were analysed by using the Mann-Whitney-Wilcoxon U test. Findings from this research showed that there was no difference existed between the two groups of gender. Students' profiles on SRL for both genders were relatively similar, with no significant difference. Further analysis found that SRL positively affected the academic performance of both genders.

## 3. Methodology
*3.1 Research Design*

Research design is a conceptual arrangement within which a study would be performed. A quantitative approach was utilised in this study to present a comprehensive understanding of the SRL of students and its relation to academic achievement. The quantitative method is designed to present the evidence in the form of numbers [46]. However, the underlying motives and reasons behind the answers cannot be obtained. The information related to this study was gained from primary and secondary sources. The questionnaire type of survey is used as a primary source of data. It provides immediate information that is closely related to the objects being studied. Meanwhile, secondary sources, such as journals, articles, and e-books serve as supporting data. It is commonly readily available, primarily through internet searches.

## 3.2 Population and Sampling

The targeted population of this study was all undergraduate students at the Faculty of Business and Technology Management (FPTP), UTHM. The individual students of FPTP were chosen as the population element because they have been involved in ODL for at least one semester. For the sampling, this study considered two types of techniques which were probability and non-probability sampling. Probability sampling gives an equal chance to each population item to be involved in the study sample [47], while the non-probability technique does not offer the same possibility for each population element [50]. However, the researcher opts for probability random sampling to prevent the risk of selection bias and flow of study based on assumption.

This study used a stratified random sampling technique in which it divided the huge population into several subcategories of population. This type of probability random sampling was utilised as it provided more consistent and accurate information about the sample [50]. The researcher classified the population into 5 strata as undergraduate students in this faculty enrolled in five different programmes: BPA, BPB, BPC, BPD, and BPP. After that, the sample size was determined by using Krejcie and Morgan's [44] Table, which was 320, as the population size of undergraduate FPTP students was 1982. Then, by using a stratified sample formula, the proportion of students for each programme or department was determined. The proportional allocation was utilised to keep the sample size of each stratum proportionate to its recommended size to ensure a fair representation [48].

The population of undergraduate students for each programme was obtained from the Office of academic management (PPA) and the sample size is shown in Table 1. This study obtained a total of 173 valid respondents which is equal to 54% of the response rate. The dispersion of respondents based on five programmes is shown in Table 1. Overall, it can be concluded that the obtainment of respondents for each stratum is proportionate to its sample size, with response rates of 43.06% and above.

**Table 1**
Population, Sample Size and Response Rate of Students for Each Program

| Program | Population size | Sample size | Response Rate |
|---------|-----------------|-------------|---------------|
| BPA | 490 | 320/1982 x 490 = 79 | 49.37% |
| BPB | 500 | 320/1982 x 500 = 81 | 67.90% |
| BPC | 443 | 320/1982 x 443 = 72 | 51.39% |
| BPD | 446 | 320/1982 x 446 = 72 | 43.06% |
| BPP | 103 | 320/1982 x 103 = 16 | 68.75% |

## 3.3 Research Instruments

The questionnaire in this study was developed to suit the research hypothesis. It consists of two main sections; Section 1 aimed to collect information on the demographic of students, including their gender, race, age, year of study, and grade point average (GPA). Regarding the measurement of academic achievement, GPA, the researcher categorised it into five levels of achievement, ranging from the lowest (Below 1.50) to the highest (3.51 - 4.00). Then, the students' GPAs were collected based on their Semester II 2020/2021 results. Meanwhile, the second section of the questionnaire has been constructed to measure the students' SRL based on the academic self-regulated learning scale (A-SRL-S). According to Magno [42], A-SRL-S consists of 54 items which are categorised under seven factors of self-regulation, namely memory strategy (14 items), goal setting (5 items), self-

evaluation (12 items), seeking assistance (8 items), environmental structuring (5 items), learning responsibility (5 items) and organising (5 items). The highest score amongst these subfactors determined the higher usage of that strategy. All items in this scale were based on a Likert scale ranging from 1 'strongly disagree' to 5 'strongly agree'.

The content validity was also conducted to determine how well the developed instrument assessed the particular construct it aimed to measure [47]. To ensure that the A-SRL-S tool could be used to measure the students' SRL level, the questionnaire was sent to be validated by two experts. The instrument was sent via e-mail to two local lecturers who have published substantially prominent works in the field of education. Expert A is a lecturer from UTHM, Malaysia, with years of teaching experience in the online learning environment. Expert B is also a lecturer from the same institute and has been involved in academic administration. Both experts contributed invaluable views and recommendations to the structured questionnaires other than aiding in verifying the educational terms used. As this instrument was constructed in English, two experts who are excellent in English helped to confirm the language's accuracy.

A pilot test was conducted to reduce the unnecessary errors related to the questionnaire. 30 undergraduate students were chosen to test the suitability and appropriateness of the questions in the survey. Table 2 summarises the Cronbach's alpha value for each variable item. The variable of memory strategy (MS) had a Cronbach's alpha value of 0.925 which was considered excellent [50]. Similarly, the variable of self-evaluation (SE) also had an excellent internal consistency with an alpha value equal to 0.923. Meanwhile, five items of goal setting (GS) resulted in good internal consistency with an alpha value of 0.835. Three other variables, namely seeking assistance (SA), environmental structuring (ES), and learning responsibility (LR) have good internal consistency with Cronbach's alpha value of 0.849, 0.860, and 0.847, respectively. Lastly, five organising (O) items showed an acceptable internal consistency with a value of Cronbach's alpha higher than 0.755 [51]. Overall, all items in this instrument were sufficiently reliable and consistent, with Cronbach's alpha values ranging from 0.755 to 0.925. As there was no amendment to the original questionnaires, a similar one was handed out to targeted respondents.

**Table 2**
Pilot Test Result

| Pilot Test | | | |
|---|---|---|---|
| Variables | No. of items | Cronbach's Alpha | Internal Consistency |
| Memory Strategy (MS) | 14 | 0.925 | Excellent |
| Goal Setting (GS) | 5 | 0.835 | Good |
| Self-Evaluation (SE) | 12 | 0.923 | Excellent |
| Seeking Assistance (SA) | 8 | 0.849 | Good |
| Environmental Structuring (ES) | 5 | 0.860 | Good |
| Learning Responsibility (LR) | 5 | 0.847 | Good |
| Organizing (O) | 5 | 0.755 | Acceptable |

*3.4 Data Collection*

The data were collected through the distribution of digital questionnaires by using the Google Form link. The channel of distribution used by the researcher includes WhatsApp group and e-mail. Concerning ethical considerations, the respondents were assured that the information obtained was not abused and used solely for this research. Consent of individuals was also acquired before answering the questionnaires. The number of questionnaires distributed was more than the determined sample size to compensate for the non-response of possible respondents. This was because the return rate for postal and e-mailed questionnaires was rarely achieved 100% [52].

Furthermore, Bartlett *et al.,* [53] suggested that researchers should increase the sample size by 50% during the distribution of questionnaires to ensure the lowest possible samples are met.

*3.5 Data Analysis*

The data collected were analysed by using a statistical package for social science (SPSS) software version 22.0. The descriptive statistics were first computed on every item of demographic and A-SRL-S. The descriptive analysis included means, standard deviations, skewness, and kurtosis were suggested as the best approaches to be used ahead of conducting further statistical analyses, such as correlation, T-test, and ANOVA. To determine the type of correlation analysis used by this study, a normality test was conducted using ($p > 0.05$) [54,55]. Normally distributed data would show the skewness & kurtosis Z values between -1.96 and +1.96. Other than that, a graphic inspection of the histogram, normal Q-Q plots, and box plots could also be done to determine whether the study population is approximately normally distributed or otherwise [56]. Given the non-normal distribution of the data in this study, non-parametric tests were applied, namely Spearman's rank correlation analysis and the Mann-Whitney U test. The association between SRL and students' academic achievements was assessed by using Spearman's rho correlation analysis. Two-tailed correlations were used in this study as the researcher did not predict the direction of the correlation. The variable is significantly related if the significance value is below 0.05. For the second research question of this study, the researcher used a Mann-Whitney U test to measure the statistical difference between the two groups of gender.

## 4. Findings and Discussion
*4.1 Relationship between SRL and Academic Achievements*

The first objective of this research is to investigate the association between SRL and students' academic achievement in online learning environments. One main hypothesis and seven supporting hypotheses were developed to assist in the achievement of this objective. As indicated in Table 3, the first finding showed no significant and weak positive influence of SRL on academic achievement, ($p>0.05$). This emphasised that undergraduate students were likely to gain higher academic achievements whether or not they practiced self-regulation. It was coherent with Elfakki *et al.,* [18], who found no significant difference in SRL strategy amongst different GPA achievers' groups. Moreover, this finding is in line with Dai *et al.,* [17], who indicated that SRL is slightly related to greater academic performance amongst higher education students with no experience in online learning. This is because this research obtained 81.5% of respondents who were in their 3rd and 4th years and had previous online learning experiences. However, this finding contradicted the prior research by Al-Abdullatif *et al.,* [14], who supposed that SRL is a key influencer in students' performance, especially in the flipped classroom environment. A potential explanation for this contradicted finding is that all students were forced to change to online learning despite having a lower computer self-efficacy.

The insignificant correlation between SRL and academic performance led to the rejection of the supporting hypotheses (H1A, H1B, H1C, H1D, H1E, H1F, and H1G). Firstly, the correlation between goal setting and academic achievement was very low and insignificant, ($p>0.005$). It is supported by Bruhn *et al.,* [57], who supposed that goal setting is important but not significant to help students achieve higher results. The reason is that students are likely to set idealistic goals and when not fulfilled, it will make them fail to achieve better academic performance [30]. Other than that, the relationship between self-evaluation and environment structuring on academic achievement was

also insignificant. This result is in line with Elfakki *et al.,* [18], who also found insignificant association between these constructs. It could be clarified by the instructor's capabilities to control the classroom activities that influenced the students' performance [19]. Despite that, this finding contradicted Ejubovic and Puska [30], who argued that environment structuring had a positive and significant effect on academic achievement. This is because the online learning environment has an important influence on students' enthusiasm to join online education [58].

Moreover, this study also found an insignificant relationship between seeking assistance and academic results. This could be inferred by students who seek help not for academic improvements but only for convenience and express solutions [37]. Furthermore, results on the association between learning responsibility and academic performance conflicted with a finding by Garba *et al.,* [41] who found a significant relationship. This is because, even though students are aware of the need to complete tasks on time, having weak time-management skills could still be a hindrance. Student equipped with better time management skills is found to be capable of finishing the task on time [59]. In conclusion, this study discovered a positive influence of memory strategy and organising on students' academic achievement. These findings were in agreement with Garba *et al.,* [41] that suggested a significant relationship between planning and organising and academic achievement. Gifted students are reported to apply organising strategy more than regular students [60]. However, this strategy has a weak correlation with academic achievement [41,60].

**Table 3**
Summarized result of hypotheses testing

| Hypothesis | Alternative Hypothesis | Correlation Coefficient | Results |
|---|---|---|---|
| H1 | There is a significant relationship between SRL and academic achievement. | 0.027 | Rejected since p-value=0.745 is above 0.05 |
| $H_{1A}$ | There is a significant relationship between memory strategy and academic achievement. | 0.026 | Rejected since p-value=0.738 is above 0.05 |
| $H_{1B}$ | There is a significant relationship between goal setting and academic achievement | 0.009 | Rejected since p-value=0.902 is above 0.05 |
| $H_{1C}$ | There is a significant relationship between self-evaluation and academic achievement. | 0.040 | Rejected since p-value=0.604 is above 0.05 |
| $H_{1D}$ | There is a significant relationship between seeking assistance and academic achievement. | 0.009 | Rejected since p-value=0.910 is above 0.05 |
| $H_{1E}$ | There is a significant relationship between environmental structuring and academic achievement. | 0.007 | Rejected since p-value=0.932 is above 0.05 |
| $H_{1F}$ | There is a significant relationship between learning responsibility and academic achievement. | -0.047 | Rejected since p-value=0.537 is above 0.05 |
| $H_{1G}$ | There is a significant relationship between organizing and academic achievement. | 0.004 | Rejected since p-value=0.958 is above 0.05 |

## *4.2 Differences in the Types of SRL Strategies used by Male and Female Students*

The second objective of this study was to compare the differences in SRL strategies used by male and female students. Results in Table 4 showed that no significant difference was present for all seven SRL strategies amongst the two gender groups, (P>0.05). The result corroborated the work of Susilowati *et al.,* [19], who also found no significant difference in the SRL strategy used between males and females. This demonstrated that there was no gender-based variations in SRL. Ruminta *et al.,* [61] believed that students of both genders exhibited the same self-learning traits across all four dimensions: behaviour, motivation/affect, context, and cognition. The gender difference may be due

to the stereotypical belief that women are more thorough, systematic, and competent in handling their learning environment. However, this stereotype did not exist when gender role stereotypes were under control [62].

Moreover, this finding was coherent with a previous study that suggested a significant effect of environmental structuring on higher academic performance among male students [63]. Another significant finding of this study was that female students have outdone male students in the "organising" strategy. This explained the finding by Abdi Zarrin *et al.,* [34], who found that males have higher academic procrastination than female students. However, the finding confirmed that male students surpassed female students in practicing six out of seven dimensions of SRL strategies, namely 'memory strategy, goal setting, self-evaluation, seeking assistance, environmental structuring, and learning responsibility'. Therefore, this study agreed with the presence of big differences in SRL in favour of males, which is consistent with previous studies that suggested a bigger effect of males over their SRL strategies than females.

**Table 4**
Mann-Whitney U test result

| | Gender | Mean Rank | Mann-Whitney U | |
| --- | --- | --- | --- | --- |
| | | | Stat. | Sig. (2-tailed) |
| Memory Strategy (MS) | Male | 93.11 | 3043.500 | 0.236 |
| | Female | 83.67 | | |
| Goal Setting (GS) | Male | 88.39 | 3331.500 | 0.787 |
| | Female | 86.25 | | |
| Self-Evaluation (SE) | Male | 96.07 | 2862.500 | 0.078 |
| | Female | 82.06 | | |
| Seeking Assistance (SA) | Male | 92.24 | 3096.500 | 0.308 |
| | Female | 84.15 | | |
| Environmental Structuring (ES) | Male | 88.27 | 3338.500 | 0.804 |
| | Female | 86.31 | | |
| Learning Responsibility (LR) | Male | 88.09 | 3349.500 | 0.832 |
| | Female | 86.41 | | |
| Organizing (O) | Male | 84.78 | 3280.500 | 0.664 |
| | Female | 88.21 | | |

## 5. Conclusions

In a nutshell, both research objectives and hypotheses have been successfully achieved and addressed. The first research objective study explored the relationship between SRL and students' learning outcomes at UTHM in the context of online learning. The results indicated that six dimensions have a positive but insignificant correlation with academic performance. The study also found that learning responsibility has a negative but insignificant influence on the higher academic achievement of students. Another noteworthy finding of this research is that the difference in SRL strategies used between male and female students is not significant. Besides, educators could use the awareness gained from this research to strengthen students' SRL and utilise the benefits offered by this research as a teaching source. This study also combined extremely remarkable elements which are student self-regulation and the academic achievement of higher education institution students, which have not been explored broadly to date. Investigating SRL amongst undergraduate UTHM students not only benefits the students' lifelong learning skills but also helps educators redesign, update, and plan the learning methods of curricula courses.

Several limitations were acknowledged in this study. Firstly, regarding the issues on the sample size. The incorporation of a relatively small sample of UTHM undergraduate students confined the

potential widespread of this result. In other words, findings from this research cannot be generalised to other higher education students in Malaysia. Therefore, it is necessary to involve more respondents in future research. Additionally, as the current study exploited a quantitative approach, similar research may apply a mixed-method approach to obtain a better in-depth understanding of how effectively the SRL influences students' academic achievement. Furthermore, other statistical analyses needed to be applied further to investigate the relationship between variables in this study and validate the given results. Furthermore, this study investigated the relationship of SRL towards students' achievement without controlling other variables that may influence the said relationship. Therefore, the following studies need to consider various factors that influence students' achievement, such as cultural differences and academic motivation. Last but not least, this study explored the effect of gender on SRL. Further studies need to investigate deeper into what and to what degree the physiognomies of students would affect the application of SRL.

Based on the discussed results, there are a few potential recommendations for teaching staff and administrations of higher education institutions. Firstly, institutions need to predominantly adopt the platform they use in online learning to allow the students to better grasp the functions and benefits of the tools in order to increase their academic achievement. Other than that, training of SRL for online learning needed to be conducted by higher education institutions to ensure all students of any background use SRL strategies to enhance their academic performance. Educational decision-makers and curriculum organisers need to design academic policies and courses that enable students' interpersonal interaction and active participation in the learning process. With all these proposals being applied in practice, students could gain better learning experiences that will eventually encourage them to use online tools to acquire diverse knowledge. At the same time, higher education institutions could successfully conduct online learning that would be convenient for all students.

## Acknowledgement

## References

[1] Wuensch, Karl L., Shahnaz Aziz, Erol Ozan, Masao Kishore, and M. Tabrizi. "Pedagogical characteristics of online and face-to-face classes." In *E-Learn: World conference on e-learning in corporate, government, healthcare, and higher education*, pp. 2422-2429. Association for the Advancement of Computing in Education (AACE), 2006.
[2] Nor, Siti Rohani Mohd, Adina Najwa Kamarudin, and Nurul Aini Jaafar. "Comparison on the Student's Performances during Physical and Online Learning in Financial Mathematics Course." *International Journal of Advanced Research in Future Ready Learning and Education* 28, no. 1 (2022): 1-8.
[3] Omar, Habsah, Nor Suhaila Abdul Ghani, Mohamad Sukeri Ismail, and Mohd Hazwan Hassim. "Readiness to Continue Online Learning Post Covid-19 Among Students of Politeknik Jeli Kelantan." *International Journal of Advanced Research in Future Ready Learning and Education* 35, no. 1 (2024): 42-51.
[4] Looi, Chee-Kit, Shiau-Wei Chan, and Longkai Wu. "Crisis and opportunity: Transforming teachers from curriculum deliverers to designers of learning." *Radical Solutions for Education in a Crisis Context: COVID-19 as an Opportunity for Global Learning* (2021): 131-145. https://doi.org/10.1007/978-981-15-7869-4_9
[5] Chan, Shiau Wei, Nur Amirah Fatini Abd Latif, Md Fauzi Ahmad, and Fadillah Ismail. "Critical Factors that Influence the Satisfaction of E-learning of Laboratory Subjects among University Students." In *Proceedings of the 7th International Conference on Distance Education and Learning*, pp. 164-169. 2022. https://doi.org/10.1145/3543321.3543348
[6] Wang, Chih-Hsuan, David M. Shannon, and Margaret E. Ross. "Students' characteristics, self-regulated learning, technology self-efficacy, and course outcomes in online learning." *Distance education* 34, no. 3 (2013): 302-323. https://doi.org/10.1080/01587919.2013.835779
[7] Looi, Chee-Kit, Shiau Wei Chan, and Longkai Wu. "Diversity and collaboration: A synthesis of differentiated development of ICT education." *ICT in Education and Implications for the Belt and Road Initiative* (2020): 231-243. https://doi.org/10.1007/978-981-15-6157-3_13

[8] Nicol, David J., and Debra Macfarlane-Dick. "Formative assessment and self-regulated learning: A model and seven principles of good feedback practice." *Studies in higher education* 31, no. 2 (2006): 199-218. https://doi.org/10.1080/03075070600572090

[9] Zimmerman, Barry J. "Investigating self-regulation and motivation: Historical background, methodological developments, and future prospects." *American educational research journal* 45, no. 1 (2008): 166-183. https://doi.org/10.3102/0002831207312909

[10] Nodeh, Helia. "The relationship between self-regulated learning strategies and students' academic performance in English course." *Pakistan Journal of Medical & Health Sciences* 15, no. 7 (2021): 2261-2263. https://doi.org/10.53350/pjmhs211572261

[11] Cetin, Baris. "Academic motivation and self-regulated learning in predicting academic achievement in college." *Journal of International Education Research* 11, no. 2 (2015): 95-106. https://doi.org/10.19030/jier.v11i2.9190

[12] Zimmerman, Barry J. "Becoming a self-regulated learner: An overview." *Theory into practice* 41, no. 2 (2002): 64-70. https://doi.org/10.1207/s15430421tip4102_2

[13] Wong, Jacqueline, Mohammad Khalil, Martine Baars, Björn B. de Koning, and Fred Paas. "Exploring sequences of learner activities in relation to self-regulated learning in a massive open online course." *Computers & Education* 140 (2019): 103595. https://doi.org/10.1016/j.compedu.2019.103595

[14] Al-Abdullatif, Ahlam Mohammed. "Investigating self-regulated learning and academic achievement in an eLearning environment: The case of K-12 flipped classroom." *Cogent Education* 7, no. 1 (2020): 1835145. https://doi.org/10.1080/2331186X.2020.1835145

[15] Hasanah, Uswatun, Sri Maria, and Dewi Lutfianawati. "Hubungan regulasi diri dalam belajar dengan prestasi belajar pada mahasiswa angkatan 2016 fakultas kedokteran universitas malahayati." *PSYCHE: Jurnal Psikologi* 1, no. 1 (2019).

[16] Santos, M. Valle, and Rosa M. Mayoral. "Training autonomous managers for a dynamic environment." *International Journal of Educational Management* 32, no. 4 (2018): 719-731. https://doi.org/10.1108/IJEM-06-2017-0156

[17] Daı, Yan, Xi Lın, Shu Su, and Li Lı. "The online learning academic achievement of Chinese students during the COVID-19 pandemic: The role of self-regulated learning and academic entitlement." *International Journal of Psychology and Educational Studies* 8, no. 3 (2021): 116-127. https://doi.org/10.52380/ijpes.2021.8.3.384

[18] Elfakki, Fakhralddin Abbas Mohammed, Marai Mohammed Alamri, Islam Ashraful, Mustafa Elnimeiri, and Ehab Frah. "Self-regulated learning in the University of Tabuk: gender differences in strategy and outcomes." *Rwanda Journal of Medicine and Health Sciences* 4, no. 1 (2021): 151-165. https://doi.org/10.4314/rjmhs.v4i1.11

[19] Park, Sunyoung, and Nam Hui Kim. "University students' self-regulation, engagement and performance in flipped learning." *European Journal of Training and Development* 46, no. 1/2 (2022): 22-40. https://doi.org/10.1108/EJTD-08-2020-0129

[20] Susilowati, Nurdian, Sari Lestari, Dela Yuniarsih, and Deviana Hardining Maharani. "Investigating self-regulated learning differences based on gender, scholarship, and student's housing." *Jurnal Pendidikan Ekonomi Dan Bisnis (JPEB)* 8, no. 1 (2020): 25-33. https://doi.org/10.21009/JPEB.008.1.3

[21] Rohman, F. M. A., and D. Indriati. "Gender differences on students' self-regulated learning in mathematics." In *Journal of Physics: Conference Series*, vol. 1613, no. 1, p. 012053. IOP Publishing, 2020. https://doi.org/10.1088/1742-6596/1613/1/012053

[22] Kurukkan, Abidha. "Self-Regulated Learning: A Motivational Approach for Learning Mathematics." *Online Submission* 5, no. 3 (2016): 60-65.

[23] Zimmerman, Barry J. "A social cognitive view of self-regulated academic learning." *Journal of educational psychology* 81, no. 3 (1989): 329. https://doi.org/10.1037//0022-0663.81.3.329

[24] Zimmerman, Barry J. "Investigating self-regulation and motivation: Historical background, methodological developments, and future prospects." *American educational research journal* 45, no. 1 (2008): 166-183. https://doi.org/10.3102/0002831207312909

[25] Komarraju, Meera, Steven J. Karau, and Ronald R. Schmeck. "Role of the Big Five personality traits in predicting college students' academic motivation and achievement." *Learning and individual differences* 19, no. 1 (2009): 47-52. https://doi.org/10.1016/j.lindif.2008.07.001

[26] Torenbeek, Marjolein, Ellen Jansen, and Cor Suhre. "Predicting undergraduates' academic achievement: the role of the curriculum, time investment and self-regulated learning." *Studies in Higher Education* 38, no. 9 (2013): 1393-1406. https://doi.org/10.1080/03075079.2011.640996

[27] Bloom, Marc. "Self-regulated learning: Goal setting and self-monitoring." *The Language Teacher* 37, no. 4 (2013): 46-51. https://doi.org/10.37546/JALTTLT37.4-6

[28] Lindholm-Leary, Kathryn, and Graciela Borsato. "Academic achievement." *Educating English language learners: A synthesis of research evidence* (2006): 176-222. https://doi.org/10.1017/CBO9780511499913.006

[29] Herizal, Herizal. "The Relationship among learning styles, classroom environment, and academic achievement of English education study program students in state Islamic university of Raden Fatah Palembang." *Ta'dib: Jurnal Pendidikan Islam* 23, no. 1 (2018): 34-43. https://doi.org/10.19109/td.v23i1.1967

[30] Ejubovic, Adisa, and Adis Puška. "Impact of self-regulated learning on academic performance and satisfaction of students in the online environment." *Knowledge Management & E-Learning* 11, no. 3 (2019): 345-363. https://doi.org/10.34105/j.kmel.2019.11.018

[31] Zheng, Chunping, Jyh-Chong Liang, Yu-Fang Yang, and Chin-Chung Tsai. "The relationship between Chinese university students' conceptions of language learning and their online self-regulation." *System* 57 (2016): 66-78. https://doi.org/10.1016/j.system.2016.01.005

[32] Xu, Kate M., Anna Rita Cunha-Harvey, Ronnel B. King, Bjorn B. de Koning, Fred Paas, Martine Baars, Jingjing Zhang, and Renate de Groot. "A cross-cultural investigation on perseverance, self-regulated learning, motivation, and achievement." *Compare: A Journal of Comparative and International Education* 53, no. 3 (2023): 361-379. https://doi.org/10.1080/03057925.2021.1922270

[33] Pérez, Honorio Salmerón, Calixto Gutiérrez Braojos, and Sonia Rodríguez Fernández. "The relationship of gender, time orientation, and achieving self-regulated learning." *Revista de Investigación Educativa* 35, no. 2 (2017): 353-369. https://doi.org/10.6018/rie.35.2.273141

[34] Abdi Zarrin, Sohrab, and Esther Gracia. "Prediction of academic procrastination by fear of failure and self-regulation." *Educational Sciences: Theory and Practice* 20, no. 3 (2020): 34-43.

[35] Öhrstedt, Maria, and Petra Lindfors. "Linkages between approaches to learning, perceived stress and expected and actual academic outcomes among first-semester psychology students." *Journal of Further and Higher Education* 42, no. 1 (2018): 116-129. https://doi.org/10.1080/0309877X.2016.1206856

[36] Bloom, Marc. "Self-regulated learning: Goal setting and self-monitoring." *The Language Teacher* 37, no. 4 (2013): 46-51. https://doi.org/10.37546/JALTTLT37.4-6

[37] Algharaibeh, Salem Ali Salem. "Should I ask for help? The role of motivation and help-seeking in students' academic achievement: A path analysis model." *Kıbrıslı Eğitim Bilimleri Dergisi* 15, no. 5 (2020): 1128-1145. https://doi.org/10.18844/cjes.v15i5.5193

[38] Al-Jabri, Y. "Disclosure of patterns of academic aid request and its relationship to academic achievement among secondary school students in the Jazan region." *Arab Educators Association*, (92), (2017): 305–327.

[39] Hinnant-Crawford, Brandi Nicole, Morgan Z. Faison, and Mei-Lin Chang. "Culture as mediator: Co-regulation, self-regulation, and middle school mathematics achievement." *Journal for Multicultural Education* 10, no. 3 (2016): 274-293. https://doi.org/10.1108/JME-05-2016-0032

[40] Bakir, Selda. "5th grade students' opinions about active learning environment." *Procedia-Social and Behavioral Sciences* 116 (2014): 3553-3558. https://doi.org/10.1016/j.sbspro.2014.01.801

[41] Garba, R., Musa, H, & Abubakar, R. M. "Planning, Organization and Learning Responsibility as Correlate of Academic Achievement among NCE Students in Zamfara." *KaJEP*, 1(1), (2019): 31-40.

[42] Magno, Carlo. "Assessing academic self-regulated learning among Filipino college students: The factor structure and item fit." *The international Journal of Educational and psychological assessment* 5 (2010).

[43] Mutweleli, Samuel Mutua. "Academic motivation and self-regulated learning as predictors of academic achievement of students in public secondary schools in Nairobi County, Kenya." PhD diss., Kenyatta University, 2014.

[44] Elfakki, Fakhralddin Abbas Mohammed, Marai Mohammed Alamri, Islam Ashraful, Mustafa Elnimeiri, and Ehab Frah. "Self-regulated learning in the University of Tabuk: gender differences in strategy and outcomes." *Rwanda Journal of Medicine and Health Sciences* 4, no. 1 (2021): 151-165. https://doi.org/10.4314/rjmhs.v4i1.11

[45] Rohman, F. M. A., and D. Indriati. "Gender differences on students' self-regulated learning in mathematics." In *Journal of Physics: Conference Series*, vol. 1613, no. 1, p. 012053. IOP Publishing, 2020. https://doi.org/10.1088/1742-6596/1613/1/012053

[46] Creswell, John W., and J. David Creswell. *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications, 2017.

[47] Ahmad, Md Fauzi. "Basic statistical analysis: Step by step using SPSS." (2016).

[48] Etikan, Ilker, and Kabiru Bala. "Sampling and sampling methods." *Biometrics & Biostatistics International Journal* 5, no. 6 (2017): 00149. https://doi.org/10.15406/bbij.2017.05.00149

[49] Krejcie, Robert V., and Daryle W. Morgan. "Determining sample size for research activities." *Educational and psychological measurement* 30, no. 3 (1970): 607-610. https://doi.org/10.1177/001316447003000308

[50] Bhatnagar, Ruchi, Jihye Kim, and Joyce E. Many. "Candidate surveys on program evaluation: Examining Instrument reliability, validity and program effectiveness." *American Journal of Educational Research* 2, no. 8 (2014): 683-690. https://doi.org/10.12691/education-2-8-18

[51] Nunnally, J., and I. Bernstein. "Psychometric Theory 3rd edition (MacGraw-Hill, New York)." (1994).

[52] Taherdoost, Hamed. "How to design and create an effective survey/questionnaire; A step by step guide." *International Journal of Academic Research in Management (IJARM)* 5, no. 4 (2016): 37-41.

[53] Kotrlik, J. W. K. J. W., and C. C. H. C. C. Higgins. "Organizational research: Determining appropriate sample size in survey research appropriate sample size in survey research." *Information technology, learning, and performance journal* 19, no. 1 (2001): 43.

[54] Shapiro, Samuel Sanford, and Martin B. Wilk. "An analysis of variance test for normality (complete samples)." *Biometrika* 52, no. 3-4 (1965): 591-611. https://doi.org/10.1093/biomet/52.3-4.591

[55] Razali, Nornadiah Mohd, and Yap Bee Wah. "Power comparisons of shapiro-wilk, kolmogorov-smirnov, lilliefors and anderson-darling tests." *Journal of statistical modeling and analytics* 2, no. 1 (2011): 21-33.

[56] Sulaiman, Luqman Adedamola. "Effects of Merger on Corporate Performance." *M.Sc. Dissertation*. (2005).

[57] Bruhn, Allison Leigh, Josephine Fernando, Sara McDaniel, and Leonard Troughton. "Putting behavioral goal-setting research into practice." *Beyond Behavior* 26, no. 2 (2017): 66-73. https://doi.org/10.1177/1074295617711208

[58] Korlat, Selma, Marlene Kollmayer, Julia Holzer, Marko Lüftenegger, Elisabeth Rosa Pelikan, Barbara Schober, and Christiane Spiel. "Gender differences in digital learning during COVID-19: Competence beliefs, intrinsic value, learning engagement, and perceived teacher support." *Frontiers in psychology* 12 (2021): 637776. https://doi.org/10.3389/fpsyg.2021.637776

[59] Broadbent, Jaclyn. "Comparing online and blended learner's self-regulated learning strategies and academic performance." *The Internet and Higher Education* 33 (2017): 24-32. https://doi.org/10.1016/j.iheduc.2017.01.004

[60] Purdie, Nola, and John Hattie. "Cultural differences in the use of strategies for self-regulated learning." *American educational research journal* 33, no. 4 (1996): 845-871. https://doi.org/10.3102/00028312033004845

[61] Ruminta, Ruminta, Sri Tiatri, and Heni Mularsih. "Perbedaan regulasi diri belajar pada siswa Sekolah Dasar kelas VI ditinjau dari jenis kelamin." *Jurnal Muara Ilmu Sosial, Humaniora, Dan Seni* 1, no. 2 (2017): 286-294. https://doi.org/10.24912/jmishumsen.v1i2.1463

[62] Pajares, Frank, and Giovanni Valiante. "Students'self-Efficacy In Their Self-Regulated Learning Strategies: A Developmental Perspective." *Psychologia* 45, no. 4 (2002): 211-221. https://doi.org/10.2117/psysoc.2002.211

[63] Altun, Sertel, and Münire Erden. "Self-regulation based learning strategies and self-efficacy perceptions as predictors of male and female students' mathematics achievement." *Procedia-Social and Behavioral Sciences* 106 (2013): 2354-2364. https://doi.org/10.1016/j.sbspro.2013.12.270