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Exploring multiple intelligences and language learning strategies among science and technology students in a Malaysian university

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Abstract

Student profiling and learning strategies have gained the interest of many researchers. In language learning in particular, understanding students' learning strategies as well as their multiple intelligence profiles is significant because it allows the teachers to develop and design lessons and materials that are customised to their diverse learning needs. Hence, this study investigates the Multiple Intelligences (MI) and Language Learning Strategy (LLS) profiles of students from various science and technology faculties of Universiti Teknologi MARA (UiTM) Terengganu, with a focus on gender differences. The study's objectives were to determine the dominant students' MI profiles, their preferred LLS, and gender variations in these variables. Two instruments were adopted in this study, namely McKenzie's Multiple Intelligences Inventory and the Strategy Inventory for Language Learning (SILL). The findings indicated that the students mostly acquire introspective intelligence, and the majority of male respondents use metacognitive learning strategies. However, the findings revealed a significant positive relationship between MI and LLS. Based on these findings, the study emphasises the importance of incorporating MI and LLS in language teaching and learning and provides recommendations for language teachers to create lesson plans and teaching materials that suit the students' needs.

Keywords: multiple intelligences; language learning strategies; science and technology

Introduction

Language learning and teaching have seen prominent changes over the years, with huge emphasis placed on students and learning rather than on educators and classroom instructions. Educationalists at all levels adapt and adopt countless instructional methods to improve their lesson quality. Identifying the correct ways to go about successfully imparting a lesson in a class is an expensive skill for a teacher to have. Changes in the lesson instructions have been debatable since some think that it is the students' responsibility to adjust their learning styles according to how the teacher teaches. Some others believe that it is the responsibility of the instructors to make considerations and adjustments to the different students' diverse learning styles and needs. One of the most significant changes has been the shift from teacher-centred learning to student-centred learning. Students are becoming more responsible for their own learning process, especially for what they want to learn (Boştină-Bratu, Negoescu & Morar, 2022). Thus, it is essential for students to actively engage during classroom sessions, and additional opportunities should be provided for them to practise the skills that they have been taught (Adnan et al., 2022). Consequently, by integrating activities and exercises that appeal to multiple intelligences, the level of engagement in classroom learning can be enhanced. Since acknowledging an individual's diversities can lead to different achievements, for example, in language learning, it is therefore important to understand the implications of

profiling the students according to their Multiple Intelligences (MI) and Language Learning strategies (LLS).

The MI theory, as proposed by Gardner (1983, 1999), asserts the existence of nine distinct human intelligences. Based on the different human intelligences, Gardner believes that humans at least possess one intelligence that affects the way knowledge, understanding, and learning take place. Since its emergence, the theory of MI has deeply influenced teachers to design appropriate approaches when dealing with students in accordance with their intellectual profiles. Lazear (2004) states that MI presents a new interpretation of human uniqueness in learning, and this is crucial in highlighting or bringing out the true potential of students based on the belief that humans do not possess static intelligence. This is because intelligence can be developed, learned, and enhanced.

Meanwhile, LLS is also seen as a paradigm shift from focusing on teachers and teaching to students and learning. LLS encompasses the range of behaviours that students engage in to enrich their language learning experiences and make them more efficient, self-directed, and enjoyable (Oxford, 1990). It is critical for students to develop their own LLS as it teaches them how diverse activities in the provided domains can lead to student autonomy (Boştină-Bratu, Negoescu, & Morar, 2022, 2022). LLS also helps students store and retrieve knowledge, as well as assist and even accelerate their learning. Thus, it is apparent that LLS plays critical roles in facilitating the understanding of language learning and determining academic achievement, especially in enhancing language proficiency.

On the contrary, the influence of gender on MI presents an intriguing perspective. According to the study by Szymanowicz and Furnham (2013), males typically exhibit higher levels of logical-mathematical intelligence, while females score higher in verbal and intrapersonal intelligence. As for LLS, some studies, like Goh & Foong (1997) and Yilmaz (2010), have suggested that female language students tend to excel in strategy utilisation. The same result was found in the study by Tercanlioglu (2004), but from the males' perspective. However, the significance of gender in language strategy use has been challenged by some studies like Aliakbari & Hayatzadeh (2008) and Khamkhien (2010).

Although numerous studies on MI and LLS have been conducted worldwide, studies on MI and LLS, which both deal with students from science and technology faculties, have not been carried out. It is hoped that the results of this study will provide some insights into identifying the MI and LLS profiles as well as determining whether gender plays a role in this area. When profiling is done to identify the students' intelligence and LLS dominance, students can learn better knowing their learning characteristics, and teachers can accommodate students with various learning preferences (Emmiyati, 2014).

Given the growing interest in MI and LLS, the purpose of this study is to explore the relationship between MI and LLS among Science and Technology students. Accordingly, this study addresses the following research questions:

1. What are the dominant MI and LLS profiles of science and technology students?
2. How does gender affect the MI and LLS profiles of science and technology students?
3. What is the nature of the relationship between MI and LLS among science and technology students?

Multiple intelligence

The Multiple Intelligences (MI) theory was introduced by Gardner (1983) in his book, *Frames of Mind.* According to the theory, humans possess each intelligence to varying degrees, with at least one intelligence being dominant (Marefat, 2007). Therefore, it is crucial to understand their differences to identify the appropriate tools to be used in the class when imparting the lesson in a classroom. The definition of multiple intelligences

from the point of view of Gardner (1983) lies under three basic components, which are: human competence, which involves problem-solving skills and the ability to overcome obstacles; the ability to create quality products or services appreciated by the culture of his or her society; and the ability to come up with ideas that help build the groundwork for learning new things.

From the aspect of education, this theory signals to educators an important message: each student has the right to gain the necessary learning experiences, which are enhanced with the knowledge of their individual intelligence(s).

According to Gardner (1999), there are nine intelligences, which include verbal-linguistic, musical/rhythmic, logical/mathematical, visual/spatial, bodily/kinaesthetic, interpersonal, intrapersonal, and naturalist intelligences. McKenzie (2002) later categorises the nine intelligences under three domains: analytical, interactive, and introspective domains, which serve as a guideline in understanding the relationship between MI and LLS (see Table 1).

Domains (McKenzie, 2002)	**Type of Intelligence (Gardner, 1999)**	**Think**	**Love**	**Need**
Analytical	Logical-Mathematical	Through reasoning/ deducting	Experimenting, inquiring, solving logical challenges, and calculating	Experimenting, inquiring, solving logical puzzles, estimating resources for scientific experiments and manipulatives
	Musical/ Rhythmic	Through rhythms and melodies	Singing, whistling, humming, listening	sing-alongs, attending musicals
	Naturalist	Through nature	Playing with pets, gardening, exploring nature, caring for animals, and preserving nature	access to nature, chances to interact with animals, and tools for learning about nature
Interactive	Verbal-Linguistic	Through words	Reading, writing, storytelling, and word games.	books, tapes, writing tools, dialogues, discussion
	Interpersonal	Through gaining feedbacks from others	Leadership, organisation, relationship building, manipulation, mediation, and socialising	Friends, group activities, social events, community gatherings, organisations, apprenticeships.
	Bodily-Kinesthetic	Through somatic/ bodily sensation	Dancing, running, hopping, building, making gestures	Role-playing, physical activity, construction, sports, tactile experiences, and learning by doing
Introspective	Intrapersonal	Through their wants, emotions, and goals	Goal-setting, thinking, dreaming, and making plans.	hideaways, individualism, autonomy, and free will

Domains (McKenzie, 2002)	**Type of Intelligence (Gardner, 1999)**	**Think**	**Love**	**Need**
	Visual-spatial	Through illustrations and images	Doodling, sketching, visualising, and designing.	Crafts, videos, slideshows, slides, games of the mind, mazes and riddles
	Existential	Through summative and intuitive iteration in collective awareness and values	Seeking meaningful learning, connecting, synthesising, having good relationships, and exhibiting a sense of global community	Creating their own stories about larger-than-life topics, motivated by learning concepts

Table 1: The nature of MIs based on their domains and learning preferences (adapted from Armstrong, 2018).

There have been many previous studies conducted to identify the relationship between MI and the English language (Razmjoo, 2008; Norizan and Nuramirah, 2013; Magda and Mohamed, 2016).

Magda and Mohamed (2016), for example, carried out research on how MI profiles affect students' motivation and their language proficiency. The study included 108 Saudi university students, and the participants were divided into two groups: the first group studied English as usual, while the other group studied English after MI profiling was done. The result shows that when students identified their MI profiles, they were able to increase their motivation, which allowed them to improve their language abilities.

Meanwhile, Norizan and Nuramirah (2013) investigated the relationship between Multiple Intelligence (MI) profiles and the reading competency of science stream students in the Malaysian University English Test (MUET). This study discovered a correlation between an overall score in the MUET reading component as well as in the linear text section and different types of intelligence profiles like Musical/Rhythmic, Bodily-Kinesthetic, and Interpersonal Intelligences.

Razmjoo (2008) conducted a study mainly investigating the relationship between MI and language proficiency and how gender plays a role in these two factors. The study involved 278 PhD students taking the Entrance exam. It was found that there was no correlation between language skills and MI, and there were no significant differences between the ways genders used MI when learning a language. This study's findings differ from the two previously addressed. As a result, this research is necessary since it will provide new insights in the field of MI profiling among science and technology students.

Language learning strategy in language classroom

The learning strategies that language students use in any setting—for instance, in a traditional classroom, at home, or online—can also have an impact on their success. Teng (2023) believes that language educators must first acknowledge how language learning strategies can help their teaching instructions. In the context of learning, this strategy refers to the intentional and conscious actions taken by a student to overcome obstacles and difficulties they encounter while engaging in the learning process (Oxford, 1990). The

LLS taxonomy is divided into two major classes of strategies, namely direct and indirect (see Table 2 below):

Class of strategy		Learning activities
Direct strategy	Cognitive	Practising/ receiving and delivering information/ reasoning and analysis/ creating the input-output structure
	Memory	Developing mental connections/ using visuals and audi/ reviewing effectively/ taking actions
	Compensation	Guessing intelligently/ overcoming limitations in oral and written communication
Indirect strategy	Metacognitive	Bringing focus to your learning/ arranging and arranging your learning/ assessing how well you've learned
	Affective	Reducing stress level/ motivating yourself/ being aware of your current emotions
	Social	Addressing queries/ collaborating with others/ being empathetic

Table 2: Classes of strategies and learning activities (adapted from Hismanoglu, 2000).

The Strategy Inventory for Language Learning (SILL) was developed to assist instructors in determining whether students understand the significance of LLS. The 50-item questionnaire includes language learning strategy declarations. As students grasp the concept underlying the language process, the language learning strategy can be utilised to its maximum capacity. For instructors, the goal is not only to equip them with the right strategies but also to give them the right tools to execute them. It is not only about achieving the desired goals but also providing them with an appropriate learning experience that matches their potential.

Multiple intelligences and language learning strategies

Previous studies on Multiple intelligences (MI) and Language Learning Strategies (LLS) showed the benefits of accepting students' varied intelligences and modifying language learning methodologies. Akbari and Hosseini (2007) evaluated any potential relationship between the use of LLS and the MI score of EFL students. The analysis revealed that there were strong relationships between the use of LLS and student IQ scores. The study, however, found that musical-rhythmic intelligence did not correspond with any part of the method used, while kinaesthetic intelligence only correlated with memory learning strategies. Bas and Beyhan (2010) carried out another study to examine the effects of multiple intelligences on students' achievement levels and attitudes towards English classroom learning. The study found that the MI-approach activities were more effective in developing students' positive attitudes towards the lessons. It was also revealed that the students who were exposed to MI-supported project-based learning methods were more motivated than those in the control group who were taught using traditional methods. These studies demonstrated that by recognising students' multiple intelligences and incorporating appropriate language learning strategies, educators can enhance students' attitudes, motivation, and language learning outcomes. However, it's important to note that further research is required to explore the relationships between individual intelligences and language learning strategies as well as the effectiveness of these approaches in different educational settings.

There was also research that suggested the importance of understanding students' strengths and weaknesses through MI characteristics. Shahrekord and Shahrekord (2012) examined MI characteristics and LLS use among 30 Iranian female students at a language institute. The MI profiles of students and LLS types were found to be positively

correlated. Verbal-linguistic intelligence, intrapersonal intelligence, and visual intelligence also positively correlate with memory and cognitive learning processes. This study identified L2 students' dominant intelligences and LLS preferences to inform L2 education. This research therefore suggests that educators can highlight students' strengths and minimise their faults.

There were also more recent studies on MI and learning styles that tried to understand gender differences in learning styles and multiple intelligences for better pedagogical practices and to promote equal learning outcomes for all students. Maxilom (2016), for one, conducted a study on the learning styles and multiple intelligences of students at the University of San Carlos. Contrary to the researcher's initial perception of the students as being restless and unable to concentrate in class, it was discovered that the students were self-aware and actively engaged in the learning process, as participants in the study had a variety of intelligence profiles. In a similar vein, Sener and Okçalşkan (2018) conducted a similar study on secondary school students' multiple intelligences and learning styles, where they looked at how gender affects students' learning methods and multiple intelligences. The result also revealed varied intelligence profiles and a significant difference between males and females. Similar result was also found in Dawahdeh & Mai (2021) study on the mediating effect of creative thinking on multiple-intelligence and thinking patterns among 10th-grade students in Abu Dhabi private schools. The results showed a strong correlation between multiple intelligences and thinking styles, and that creative thinking has an impact on the link between multiple intelligences and thinking styles. Both studies demonstrated the importance of acknowledging students' learning styles and varied intelligences. By understanding these qualities, educators can design more effective and engaging learning environments that cater to the students' individual talents and preferences.

Even though past studies looked into the impact of MI and LLS among L2, it can be seen that there is still no research conducted that focuses solely on students in science and technology. Therefore, it is apparent that research needs to be conducted to generate new insights on this matter.

Methodology

Participants

The participants for this study were 163 UiTM Cawangan Terengganu students from various science and technology faculties, ranging in age from 18 to 23 years old, with 93 males and 70 females. The selection of the participants for this research is deemed appropriate because UiTM is the biggest university in Malaysia, and samples from UiTM Cawangan Terengganu represent a significant portion of the university population. The sample size is also suitable for conducting statistical analysis and making generalisations. Furthermore, a sample size of 100–200 participants is appropriate for quantitative research (Creswell & Creswell, 1994). Hence, the participant selection for the study is justifiable as it is representative of the population.

Instruments

The present study employed two instruments: McKenzie's MI inventory (2002) and Oxford's Strategy Inventory for Language Learning (SILL) (1990). The MI inventory was used to determine the students' intelligence profiles. The MI inventory was designed to assess an individual's strengths as determined by each intelligence. It contains ninety closed-ended statements for each of Gardner's nine intelligences (1999a, 1999b).

Findings

Research question 1: What are the dominant MI and LLS profiles of science and technology students?

Multiple intelligences profiles

MI domains	analytical		interactive		introspective		total	
	N	%	N	%	N	%	N	
Total respondents	17	10.42	19	11.66	127	77.91	163	100
SD	0.11		0.14		0.10			

Table 3: Multiple intelligences profiles

From Table 3, it can be clearly seen that the majority (77.91%) of the students carry an introspective profile. This result is followed by interactive (11.66%) and analytical (10.42%) domains.

Language learning profiles

LLS categories	minimum	maximum	mean	SD
Memory	1.89	5.00	3.64	0.63
Cognitive	1.86	5.00	3.68	0.58
Compensation	1.83	5.00	3.61	0.64
Metacognitive	2.00	5.00	3.87	0.63
Affective	1.17	5.00	3.40	0.75
Social	1.50	5.00	3.64	0.80
Total			3.64	

Table 4: Language Learning Strategy profiles

According to Table 4, the mean scores of various strategies range from 3.40 to 3.87, with the total mean score being 3.64. The minimum score ranged from 1.17 to 2.00, while the maximum score recorded for all the categories is 5.00. The highest mean score is 3.87, and the lowest is affective strategy with 3.40.

Research question 2: How does gender affect the MI and LLS profiles of science and technology students?

The second research question seeks to determine whether there is any difference between Multiple Intelligence profiles across genders. To answer this question, descriptive analysis was carried out and the data were analysed in terms of percentage.

Differences between MI profiles across genders

MI domains	analytical		interactive		introspective	
	N	%	N	%	N	%
Male	7	41.18	7	36.84	74	58.27
Female	10	58.82	12	63.16	53	41.73
Total respondents	17		19		127	

Table 5: Male and female respondents' multiple intelligences profiles according to domains

Referring to Table 5, both genders (127 out of 163 students) mostly employ introspective domains (male-74, female-53), where more males use this strategy. This is

different from the Analytical and Interactive domains, where both of these domains are dominated by females. A similar number of male students claim to use Analytical and Interactive domains, which is 7.

Differences between LLS profiles across genders

To identify the differences between LLS profiles across genders, three tests were carried out: mean average test was carried out. The findings are illustrated in Figure 1:

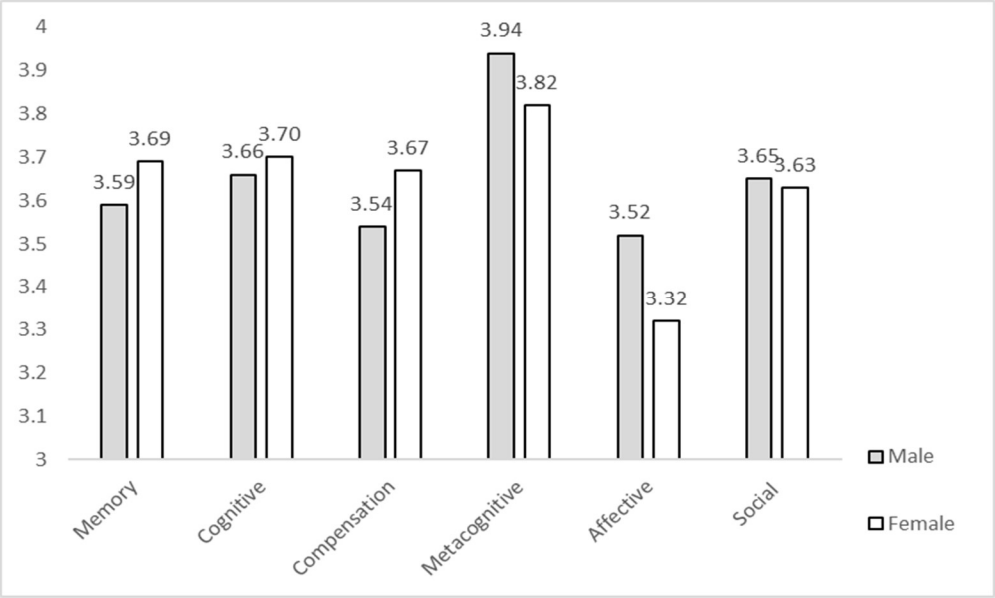

Figure 1: Means for language learning strategy profiles

According to Figure 1, the mean scores of varied strategies range from 3.32 to 3.94 and male students were reported to have a higher total mean score (3.65) compared to the females' (3.638). The lowest mean scores for male and female are 3.52 and 3.32 respectively and both are for Social Strategy. On the other hand, the highest mean scores for male and female are 3.94 and 3.82, both coming from metacognitive strategy. For the record, the standard deviations for males and females are 0.168 and 0.153 respectively.

Research question 3: What is the nature of the relationship between MI and LLS among science and technology students?

The last research question seeks to identify the nature of the relationship between MI and LLS among science and technology students. To answer this question, Pearson Correlation was carried out and the data were analysed to identify the correlation between the two.

		LLS
MI	Pearson correlation	.510**
	Sig. (2-tailed)	.000
	N	163

** Correlation is significant at the 0.01 level (2-tailed)

Table 6: Pearson Correlation between multiple intelligences and language learning strategies

In Table 4, Pearson product moment correlation was used to determine the relationship between respondents' scores on a measure of multiple intelligences and their use of language learning strategies. The analysis revealed a moderately weak but statistically significant relationship between the two variables of the study. A significant correlation of 0.510 ($p < 0.01$) was observed between the two variables.

Discussion

In this research, most students (77.91%) have an introspective profile. According to McKenzie (2002), the introspective domain consists of three intelligence classifications, which are intrapersonal, visual, and existential. What can be interpreted from Table 1 is that these students fundamentally look inward to seek their source of motivation or direction to help their learning. They constantly analyse themselves and are connected to their emotions to seek understanding. One of the characteristics of a person in this domain would be their ability to appreciate what they learn and take responsibility for it. This result is followed by the interactive (11.66%) and Analytical (10.42%) domains. The traits of Analytical domains were least possessed by the students, indicating they are not fond of the process of analysing data into existing schemas, even though they may have other components (Fauziati, 2014). This result differs from the findings from Roohani and Rabiei (2013), where kinesthetic intelligence (Interactive domain) was recorded at its lowest in their studies. The highest was recorded for naturalist intelligence (Analytical domain). Their research also saw both mathematical/logical and intrapersonal intelligences (from the analytical and Introspective domains, respectively) showing high scores, indicating many students fall under these two domains.

Another variable in this research is LLS. The mean scores of varied strategies ranged from 3.40 to 3.87, and the total mean score was 3.64, indicating that the respondents' language learning strategy types differed significantly. The minimum score ranged from 1.17 to 2.00, while the maximum score recorded for all the categories is 5.00. The highest minimum score (2.00) is a metacognitive strategy, indicating that most respondents adapt this strategy when it comes to language learning. This result is similar to the study by Roohani and Rabiei (2013) and Zare (2010), which indicated metacognitive strategies as the most frequently used strategy. Another study by Hajhashemi et al. (2013) also reports that Malaysian tertiary students mostly use metacognitive strategies, followed by social strategies. However, the findings of this study differ from Yilmaz (2010), where 79.4% of 140 students mostly used this strategy in dealing with language learning. Metacognitive strategy refers to methods by which students need to 'think' about their 'thinking. From the analysis as well, this strategy has the lowest standard deviation (0.63), the same as the memory strategy, suggesting that memory and compensation strategies are more frequently and confidently used by the students. The highest standard deviation value was recorded for the social strategy, which indicates a high variance of score for this strategy. Social strategy mostly involves interaction with another person, for example, asking for clarification, practising with another person, and asking for help from a native speaker. Varisoglu (2016) believes that social strategy is important since having strong communication skills can ensure a person is proficient in a language. Besides that, affective strategy was recorded to have the lowest minimum score (1.17) with a standard deviation of 0.75. This is similar to the findings in Gerami and Baighlou (2011), which also reported that affective strategies were the least preferred strategies used.

From the data presented in this study as well, both genders (127 out of 163 students) mostly employ the introspective domain (male 74, female 53), where more males use this strategy. This is different from the analytical and Interactive domains, where both of these

domains are dominated by females. It can be seen that a similar number of male students claim to use Analytical and Interactive domains, which is 7. A study carried out by Loori (2005) revealed that there were significant differences between males' and females' preferences for intelligence. The research reported that male respondents prefer logical-mathematical intelligence (Analytical domain), while females were seen to have the category of intrapersonal intelligence (Introspective domain). Furnham (1999), on the other hand, found that both genders share only one intelligence, which is logical. Other studies have shown that logical-mathematical and visual-spatial intelligences are prominent in the masculine group, whereas interpersonal and existential intelligences are more often regarded as prominent in the feminine group (Beloff, 1992; Bennett, 2000; Rammstedt & Rammsayer, 2000).

In the matter of LLS, male students were reported to have a higher total mean score (3.65) compared to females' (3.64). Looking at the varied strategies, the mean scores range from 3.32 to 3.94. The lowest mean scores for males and females are 3.52 and 3.32, respectively, and both are for Social Strategy. On the other hand, the highest mean scores for males and females are 3.94 and 3.82, both coming from metacognitive strategies. This result is the same as that of Ho and Ng (2016), in which their study identified metacognitive strategies as the most employed strategy by both genders and social strategies as the least employed. Other research found substantial gender differences in the use of language learning strategies. For example, Hakan, Aydin & Bulent (2015) discovered a significant difference in compensation where most males adopted this strategy when learning languages.

The last objective of this study is to see whether there is a significant relationship between MI and LLS. From the result, a Pearson correlation of 0.501 indicates that there is a moderate relationship between these two variables. Some factors leading to this result may be because some aspects of MI correspond to certain language uses, such as verbal-linguistic as well as intrapersonal skills. This agrees with previous findings that indicated MI is related to LLS due to the nature of the verbal-linguistic domain (Akbari & Hoseini, 2008; Richards & Rodgers, 2001). In Oteiza's (2013) findings, it is revealed that there is a moderate correlation between Intrapersonal Intelligence and metacognitive strategy, which may be due to respondents applying self-reflections to their own learning.

Conclusion

Attention to MI and LLS comes from the fact that knowing these two and implementing them in the classroom would have a great impact in teaching and learning. It is understood that when the students identify their MI and LLS profiles, they can take charge of their learning by focusing on their strengths and looking at ways to overcome their weaknesses. Armstrong (2009) mentions that the implementation of MI in class can be significant as it has the possibility to impact students' performance in the classroom through a conducive environment that recognises different individual needs. On the other hand, by identifying students' learning styles, specifically from a language teaching perspective, it will generate two big impacts to the language instructors. Not only it will help the instructors to identify the differences of students' learning preferences, it also allows instructors to always reflect their own teaching approaches (Razawi, Muslim, Razali, Husin &, Abdul Samad, 2011).

Therefore, it is imperative for teachers to identify the students' MI and LLS profiles so that classroom instruction can look into their strengths and limitations. Although the ideas of implementing MI and LLS have received a great deal of interest globally, it may not seem like an easy task since transforming the present instructional classroom practice

by incorporating these two into the existing lessons seems like a great deal of effort and time, especially from the educators.

This study investigates the science and technology students' MI and LLS dominant profiles as well as how profiles differ across genders. It was found that most of the students are categorised under the introspective domain, which is a combination of intrapersonal, visual, and existential intelligences. Looking at the LLS profiles, most students employ a metacognitive strategy in language learning. The least effective strategy employed by the students was the affective strategy. Another finding is that there is no difference in the profiles of MI and LLS according to gender. The last finding of this research is that there is a significant relationship between MI and LLS scores. In general, the findings of this study have shed some light on profiling the students' MI and LLS. Bearing in mind the role of the students' individual differences in language learning, teachers can devise lessons that are advantageous to all L2 students, even those with different profiles. One of the limitations of this study is the sample size. As mentioned earlier, the sample for this study is the social science students from UiTM Terengganu. Thus, the findings may not give insight to students from social science faculties. Pallant (2007) states that when the sample size is small, the findings may not be generalised to other samples. With this limitation, it is suggested that other studies be done by taking into consideration students from other faculties. Another suggestion that can be considered is to compare the MI and LLS profiles of social science and science and technology students.

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