An Analysis of Learning Preferences of Mechanical Engineering Undergraduate Students at Universiti Teknologi Mara (UiTM) Pulau Pinang to improve Teaching Approach

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ABSTRACT

Students learn effectively in a preferable learning environment with suitable teaching approach that matches their learning preferences. Teaching and learning activities which suit students' learning preferences have an impact on their motivational level to learn. As for the lecturers, it will help lecturers to organize and improve their teaching aids, learning and teaching assessment and learning environment. This work aims to analyze the learning preferences among the Diploma students in the Faculty of Mechanical Engineering which can be used to improve teaching approaches. The Dunn and Dunn Learning Styles model consists of five elements namely; environmental, sociological, emotional, physiological and psychological is applied in the survey involving of 131 students. The results show that, the diploma students of Mechanical Engineering posses various learning preferences. For the learning environmental element, majorities are more convenient in cool environment with informal seating design. Whereas for sound background and lighting elements, the students are nearly well balance distributed. Equilibrium distribution of learning preferences is also seen in the emotional element. For the sociological aspect, most of the students chose variations which indicate that, they are able to adapt their learning styles either self, pair, peers or team. Physiological aspect reflects that most of the students are visual learners, morning alert and requires of having snack during classes. They are also hardly to remain seated for a certain period of time. Finally, from the psychological aspect, most of them are analytical learners, left-brain dominants with reflective learning styles. The research outcomes will help lecturers to develop a variety approach in improving teaching and learning activities in order to align with students learning preferences. Consequently, it will improve the teaching approach and enhance the transfer of learning.

Key Words: Learning Preferences, Dunn an Dunn learning Style, Teaching Approach

INTRODUCTION

Learning preferences are about the ways that people want to interchange information, and it includes auditory (learning by hearing), visual (learning by seeing) and kinesthetic (learning by doing). In most of the higher learning institutions, the students are from diverse backgrounds with different age groups, and usually bring with them their different styles of learning experiences and preferences. Student population is diverse in age, experiences, level of preparedness, as well as learning styles. At higher institution, diversity in students' cohorts for each semester intake increases the demands on academicians or academic boards or learning providers to fulfill students' needs and preferences in terms of motivational aspects, encouragement and supports to enhance the students' understanding level in the learning process and the development of the comprehensive academic curriculums that improve learning.

One of the most well-known method that helps in acquiring information about students' learning styles is learning preferences questionnaire, that is called "Dunn and Dunn Learning Style Model". The Dunn and Dunn Learning Styles model illustrates a range of significant variables that may affect a person's ability and concentration in the learning process. Some variables are believed to be biologically influence and incline towards change as person grows and becoming more matured along the progress.

The elements of the Dunn and Dunn model are grouped according to five key stimuli (Hawk and Shah, 2007 and Dunn, 2001) comprising of environmental (where we learn best), sociological (with whom we concentrate best), emotional (what motivates us to learn and influences our feelings about learning), physiological (when and how we physically engage most in learning) and psychological (how we process and respond to information and ideas).

In terms of the environment stimuli, the Dunns noted that students are differed in terms of their definitions of an ideal place to learn. Some wanted a warm, brightly light place with desks, many people around, and involve much verbal interaction, while others are preferred cooler, more subdued lighting with a quieter and more informal environment. Though many teachers believe that they have little control over these elements, Dunn and Dunn describe how the standard square box of a classroom can be partitioned into separate areas with different environmental climates. Thus by knowing the learning styles of students, teachers or lecturers can organize the classroom setting in responding to their learners' needs either for a quiet place, bright or soft illumination, warm or cool room temperatures, different types of seating arrangement, mobility or group preference (Montemayor et. al, 2009).

The emotional stimuli centers on the extent to which students are self-directed learners. At one end of the continuum are self-starters who can be given a long term project and who monitor and pace themselves until finishing the job. At the other end are students who need considerable support and prefer to have their assignments in small chunks with periodic due dates. Semester-long projects

without periodic checks would be disastrous for these students. Understanding students' apparent needs for learning support allows the teachers or lecturers to design learning experiences that help students succeed and learn more effectively. Students are also differed in how they react to peer interactions. Some dislike group projects, preferring instead to learn by themselves; others thrive on the companionship and support provided by group work. Still others prefer the more traditional approach of learning from an adult. These preferences can be satisfied by varying teaching techniques based on different learning configurations.

Another important stimuli identified by the Dunns is related to individual differences in terms of physiological preferences. Probably the most important element here is learning modality; some of us are visual while others prefer auditory channels. For instance, it has been reported that, 80% of the engineering students prefers kinesthetic learning (Zywno and Waalen, 2002). Mobility, or the ability to periodically move around, is also an important element here. Another important element in this dimension is time. Some of us are morning people, while others do not function fully until later in the day. Teachers or lectures are able to accommodate these stimuli by setting up learning centers that allow students' movement during the learning process. These stimuli may be one of the challenges for teachers or lecturers to accommodate.

The fifth and final learning style stimulus is psychological. This stimulus refers to the general strategies used by students when dealing or resolving learning problems. Some dealt with the issues globally, looking at the big picture, while others prefer to address individual elements of a problem separately. In a similar way, some students jump into problems, figure things out as they go along, while others are more reflective and have a proper planning before beginning to analyze the issues.

LITERTURE REVIEW

Many studies of learning preferences had been conducted in the field of higher learning education. Variety of conclusions has been drawn. Uzun et. al. (2012) conducted a survey to determine learning styles of students in the Faculty of Education at Uludag University which involved ten different of departments. The result showed that, most of the students in all departments were more visual than auditory. Similarly, Penger et. al, 2008, carried out a survey to validate the learning styles of students enrolled in the course of Economics. In other works, French et. al. (2007) investigated the learning styles or preferences of a group of occupational therapy students at an Australian university. The remarkable findings revealed that, majority of the occupational therapy students prefer either experimenting with new ideas through case studies and practical classes ('converging'), or brainstorming through learning activities and receiving personal feedback ('diverging'). The converger prefers to be guided through an experimentation rather than receiving oral instruction, abstract conceptualization and active experimentation. Whereas diverger is more towards concrete experimentation and reflective observation.

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They normally prefer their teachers to be a motivator by providing them a feedback on timely basis.

Wang et. al. (2013) investigated the learning style preferences amongst undergraduate and graduate of therapy students in Taiwan. It is an examination on the associations between learning styles and academic performance. The findings showed no significant difference in the academic performance among the four different styles of learners. In contrast, Tulbure (2012) has made a comparison study between two groups of pre-service teachers in the Educational Sciences and Economic Sciences fields in order to identify their learning style preferences and academic performance. It is noted that, the Educational Sciences students with predominant converger learning style seem to achieve higher results than the students in the Economic Sciences where the diverger strategy been applied. Tabatabaei and Mashayekhi (2013) conducted the Productivity Environmental Preference Survey (PEPS) by Dunn and Dunn Learning-Style Model to examine the significant differences in learning styles of Iranian pre-university EFL learners across different levels of proficiency, majors and genders. The results showed that participants preferred visual style the most, followed by auditory, tactile and the least preferred learning style was kinesthetic. Though the tendencies were different but the success of these students showed no significant differences. It has also observed that field of studies and gender have no affect on the learning style preferences. Similar findings were concluded by Ismail et.al. (2010).

In other study, Prajapati et. al. (2011) applied the Index of Learning Style tool that was developed by Felder and Silverman. It was concluded that, majority of optometry students have balance learning styles. Based on the factors studied, an academic performance was the only factor that has an influence on student's intake or enrolment status. The differences in learning styles and gender have no significant effect on academic performance. Similar findings were demonstrated by Bidabadi and Yamat (2010), Baycan and Nacar (2007) and Slater et.al. (2007) in their studies, which concluded that male and female students are similar in their learning styles. The findings of this study also demonstrated that, there was no statistically significant difference between them with regards to their learning style preferences. However, Wehrwein et. al. (2007) concluded contra result which found that male and female students have significantly different in their learning styles.

Previous studies based on VARK questionnaires proved that most of students prefer multimodal learning preferences as reported by Lujan and DiCarlo (2006), Wehrwein et. al. (2006), Baykan and Nacar (2007) and Breckler et.al. (2009).

Based on variety findings and conclusions from previous research works, it is hard to finalize the learning preferences of the students. As noted by Penger et. al. (2008), individual's learning styles are influenced by the individuals' learning process, experience and culture. Thus, it can be concluded that teachers or lecturers will face different learning styles in every cohorts of students' intake. Hence, it will be important for the lecturers or teachers to examine the variations of the students learning styles before the class started. The information about

student's preferences can help lecturers or teachers become more sensitive to the differences and make a necessary adjustment to accommodate the students' different needs in learning.
The purpose of this work is to offer better insight into the different learning preferences among undergraduate students from the Faculty of Mechanical Engineering at UiTM Pulau Pinang in order to improve the educational practices. Information about learning styles and preferences can help instructors or lecturers become more sensitive to the differences between students, which in turn might help in designing learning experiences that match students' learning styles. Thus, most students may benefit from active learning strategies over the traditional lecture format which assumes that all students are auditory learners. More specifically, considering learning preferences can help individuals begin to understand their needs, and rationalize their choice of learning strategies suitable for themselves. It can help in designing academic curriculum, learning and teaching activities that address the aspect of the diverse backgrounds of students, which in turn might improve the transfer of learning, enhance their knowledge, skills and abilities and develop their competencies. This teaching and learning process would produce competent, confident and highly skillful graduates with an appropriate knowledge according to their disciplines.

OBJECTIVE

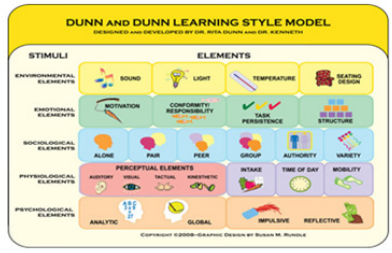
This study aims to determine the learning preferences of the Mechanical Engineering students at Universiti Teknologi Mara (UiTM) Pulau Pinang.

METHODOLOGY

Dunn and Dunn Learning Style model is used in this study. The sample of this study was derived from the UiTM Pulau Pinang undergraduate students. The survey based on data collected from 131 diploma students from the Faculty of Mechanical Engineering, Universiti Teknologi Mara(UiTM) Pulau Pinang. The researchers used simple random sampling technique to select the sample from different groups of students in their third to the fifth semester of studies. The present study employs Dunn and Dunn Learning Style Model" survey approach to collect data for testing the research objectives. The variables used in this study were taken from Dunn and Dunn published and validated instruments. The Dunn model is a comprehensive model that considers learner's strengths and preferences across the five categories i.e. environmental, emotional, sociological, physiological and psychological. Each stimuli consists of a few elements. For the noise level element, learners either prefer to learn with sounds present or in silence. Some people prefer bright and subdued lighting in a warm or cool environment. Some learners would prefer formal learning environment while others are towards informal arrangement. On the emotional predispositions, they involve learner's self-motivational level, the desire to achieve better performance academically

whereas those who are unmotivated, they need motivators, feedback, frequent monitored and peer encouragement to succeed in learning process. The element of persistent involves a person's inclination either to complete a task immediately or need periodic breaks. It involves learners' desires to do what they think they ought to do and highly related to the level of conformance or responsibility in learning and, structures or specific directions or explanations prior to undertaking or completing tasks. Some might learn alone or prefer peers present and feel better or more comfortable when someone with authority or recognized special knowledge is present which falls under the sociological preferences. Physiological characteristics cover learners' perceptual strengths (auditory, visual, tactual or kinesthetic modality), time-of-day preferences to learn better either morning, afternoon or evening, intake requirements (snacking or sipping during the process of learning) or mobility versus passivity needs (stay put or moving around) while engaged in learning. Last but not least is the processing style that refers how learners take in and internalize information. Learners process the information either sequentially (analytically) or holistically (globally through stories, drama, humor, illustrations or games).

The questionnaire used in this study is shown in Figure 1.



Stimuli	Elements					
	S	L	T	D		
Envi	❑ Quiet ❑ Music/Sound	❑ Bright ❑ Softer/Focused	❑ Warmth ❑ Cooler	❑ Formal ❑ Informal		
	M	R	P	S		
Emo	❑ Self ❑ Assisted	❑ Conformists ❑ Non-Conformists	❑ Focused ❑ Reminded	❑ Self ❑ Assisted		
	S	P	Pe	T	A	V
Soc	❑ Self	❑ Pair	❑ Peers	❑ Team	❑ Adult	❑ Variation
	P	I	T	M		
Physio	❑ Auditory ❑ Visual ❑ Tactile ❑ Kinesthetic	❑ Required ❑ Not-Required	❑ Morning ❑ Afternoon ❑ Evening	❑ Passive ❑ Active		
	G	H	I			
Psycho	❑ Global ❑ Analytical	❑ Right-Brain ❑ Left-Brain	❑ Impulsive ❑ Reflective			

Figure 1: Learning Preferences Questionnaire

RESULTS AND DISCUSSION

The study examines the learning styles or preferences of the Mechanical Engineering students. Our results indicate that;-

Environmental Elements
For the environmental elements, the results are shown in Figure 2. In general,

sound and light preferences among the respondents are equally balance where 50.38% of students prefer a quiet environment and bright light environment as a learning background. As for the temperature and seating design, huge difference can be seen between warm and cooler temperature and formal and informal seating design. The preferred learning environments are cooler and informal setting with a score of 83.97% and 80.92% respectively.

The findings also revealed that current teaching style needs to be improved especially on the aspect of sound background. Introducing a music background in the learning and teaching activities such as classroom exercise works, lab works and video demonstration could probably creating the learning environment in matching up the students learning preferences. Another aspect that is also required to be improved is seating design. Since majority of the students prefer informal seating, reconstruction of the classroom seating arrangement is strongly encouraged.

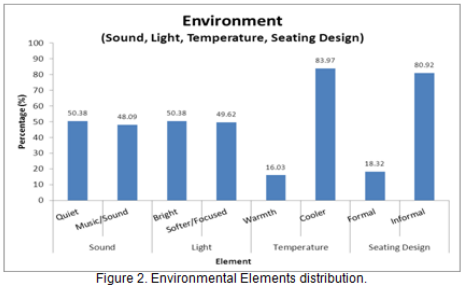


Figure 2. Environmental Elements distribution.

Figure 2. Environmental Elements distribution.

Emotional Elements

For the emotional elements, the results are shown in Figure 3. It is highlighted that, 51.91% of respondents chose self-motivation while 48.09% required assistance to boost up their motivational level to learn. For the responsibility element, 71.76% of the students are conformists while 25.19% are non-conformists. As for persistent and structure elements, more than half of the students need to be reminded and unable to determine their own structure for completing a task with a score of 51.91%.

This finding indicated that only half of the diploma students in the Faculty of Mechanical Engineering are self directed learners' and responsible for their own educational process whereas the remaining requires guidance and continuous motivational driven. In other to achieve excellent academic performance, students must possess a high self directed and motivation level to learn. With such outcomes, beside deliver information and knowledge, lecturers have to include motivation and self directed elements in their lectures. One of the way to improve the students' motivation is through the effective learning preferences. Daouk (2013) has reported that, the students' motivational/attitudinal levels increased significantly when the teaching and learning instructions applied match with the students preferred learning styles.

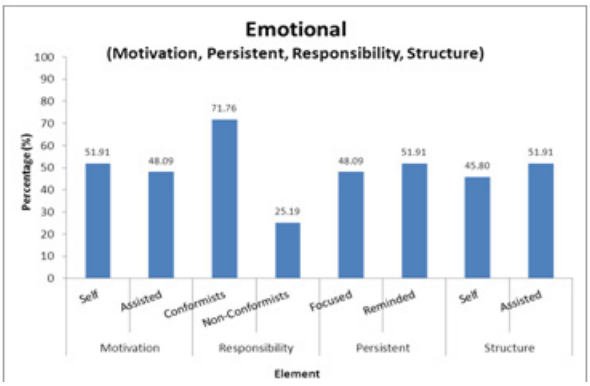


Figure 3. Emotional Elements distribution

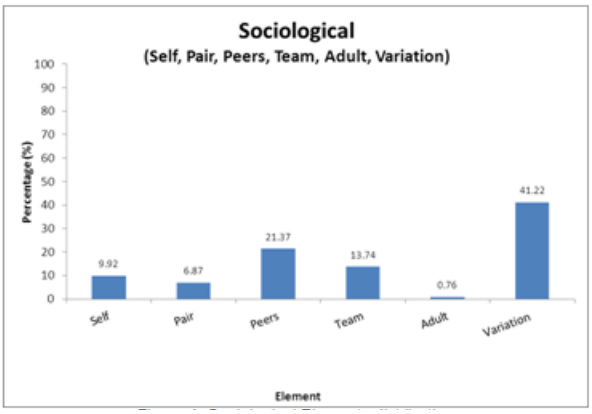


Figure 4. Sociological Elements distribution

Sociological Elements

For sociological elements, it is noted that majority of the mechanical engineering students varies in their ways of learning. They sometimes prefer to study alone or in another time in pair. In certain situation, they may have to work in a team and collaborate with peers. The findings are consistent with current teaching practices where students are exposing to variety of tasks during the process of learning in UiTM. For an example, during lab activities, students usually work in a team and peers. They may require working in a pair for their design class and sometimes they have to work alone in completing the assignment. In other point of views, this variety of learning arrangements has created a big challenge for the lecturers to help the students with difference interaction styles to suit with their teaching methods especially those who like to work alone and hardly cooperate with other students.

Physiological Elements

For the physiological elements, the output from the survey shows that 61.07% of the mechanical engineering students learn better with visual aids, followed by tactile and kinesthetic with a score of 22.14% and 19.85 % respectively as shown in Figure 5. Only minority of the students learn better with auditory mode. Similar findings reported by Breckler et. al. (2009) which highlighted various learning preferences for physiology students. However, contradict findings were reported by Zywno and Waalen (2002) which indicated that most of engineering students prefer kinesthetic learning.

Based on the above findings, as recommended by Broelryk (2003), ways of getting engaged with visual learners are by providing opportunities for students to represent ideas and concepts using visual organizers(i.e. mind maps, diagrams, graphs), using visuals to reinforce concepts (pictures, diagrams, flow charts, concept maps, schematics, timelines, videos, props, wall charts & posters), applying color coding to show connections whenever appropriate, creating charts or tables that students can use as graphic organizers, providing written as well as oral instructions for assignments and learning tasks, utilizing metaphors or descriptive passages to reinforce a concept and distributing lecture guides to help students focus on important information.

Other supporting studies by Ismail et. al. (2010) suggested that, for visual learners, the lecturers must consider highlighting the different kinds of information by contrasting the colors; tries to write out sentences and phrases that summarize key information at the end of each paragraph or topic and makes flashcards of vocabulary words and concepts that need to be memorized. While for audio learners, lecturers must think seriously about students' oral language format and how to get them involve in group discussions. As for kinesthetic learners, lecturers should think about activities which involve those students to use 'hands' while learning. Allowing them to walk back and forth while reading or answering the test could also increase their learning motivational level.

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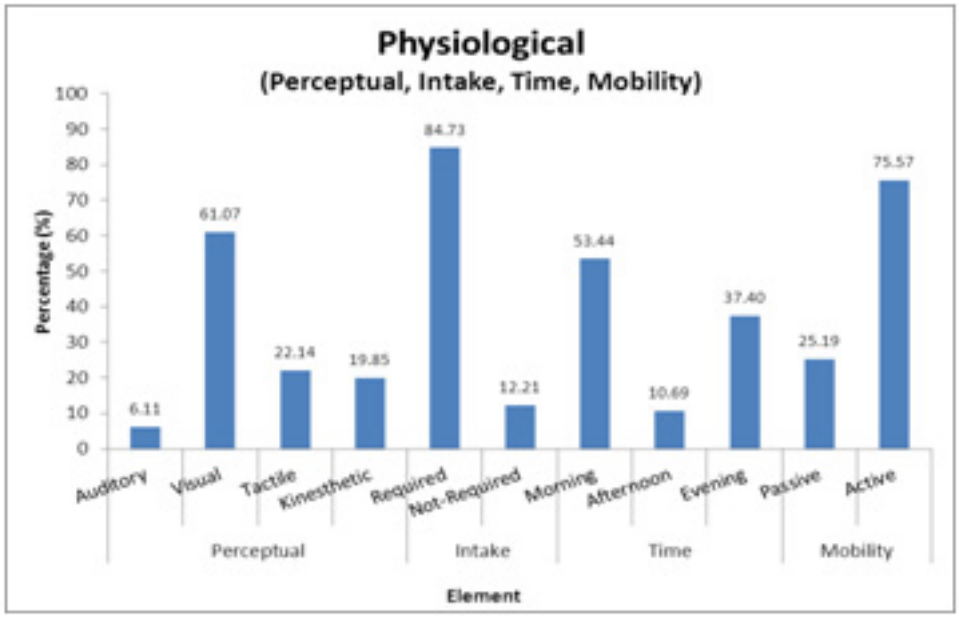

Figure 5. Physiological Elements distribution

For the intake elements, it is obviously proven that, the students prefer to be in a relaxing and enjoying mode with some light of refreshments. Thus, by allowing the consumption of light snacks especially in early morning slot should be considered. On the time aspect, morning and evening periods are seen to be more favorable even though it is not sound friendly with the UiTM current practices where classes are conducted in the afternoon due to limited facilities, limited issued. More preferable solutions should be considered. These findings provide a clue to the lecturers on suitable time for introducing or discussing heavy topics or conducting any test or quiz.

Psychological Elements

For the psychological elements, 59.54% of the students are analytical learners or processors whereas 35.88% of them is global learners or processors. On the aspect of hemisphere element, 62.60% claims that they are left brain individual learners while 37.40% claims that they right brain personal. 27.48% declares that they are impulsive learners and 70.23% declares that they are reflective learners. The summary of psychological elements distribution results is shown in Figure 6.

From the global-analytical aspect, it is noted that majority of the students are analytical processors or learners. Thus, not much improvement is required to the present UiTM traditional lecturing style since this type of students often learn best at a traditional desk in a brightly illuminated and quiet room. They are also more focused. Once they get started on an assignment, they want to finish it immediately (Dunn, 2001). It is also noted that, the Mechanical Engineering students are left-brain dominant. Boelryk (2003) suggested that, the best teaching strategies for

left-brain dominant are by giving students “To Do” lists so that they have a clear idea of everything they need to do, providing step by step procedures initially when solving problems, connecting learning to real world applications by using case studies and simultaneously always provide examples for each concepts and procedures introduce during lectures and linking it to previous chapters/topics.

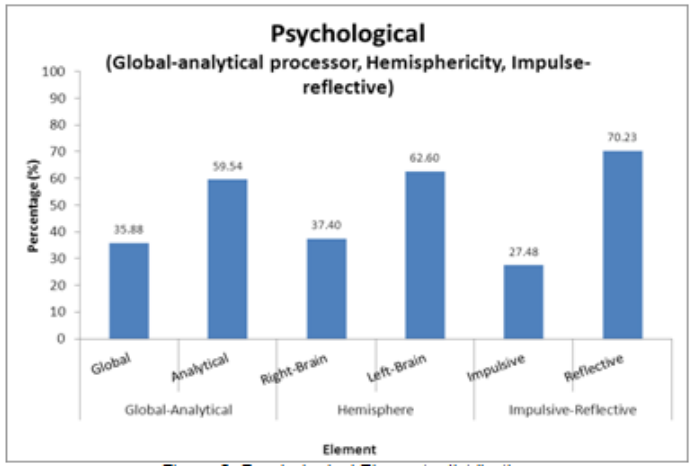

Figure 6. Psychological Elements distribution

CONCLUSION

The results from this study describe learning preferences of diploma students from the Mechanical Engineering of UiTM Pulau Pinang. Based on the findings, five conclusions (based on Dunn and Dunn five key stimuli) of students’ learning preferences can be drawn. The researchers finally disclosed the preferred learning styles or preferences amongst the “technical’ students. The results revealed that the most preferred learning environments are cool temperature environment with sound background during classes, informal learning styles, a balance result between self-motivated and required a consistent assistance, guidance and motivational driven in the learning process, most of the respondents are conformists, preferred variation ways of learning styles ; visual learners followed by tactile and kinesthetic learner, require relaxing and enjoying mode of learning with some light of refreshments, favored for morning classes with active mobility during the learning process. Majority of the students are able to adapt their learning interactions with others, work in pair or with peers, in a team or need adults assistance or either alone. Most of the students are analytical processors or learners with left brain dominant.

Addressing the student’s learning preferences can help to enrich the learning and teaching activities. In order to balance the variety of learning preferences and styles, teachers or lecturers have to be deeply grounded in pedagogy and andragogy as to address the student’s different learning styles. Hence, the university academics should be equipped with teaching skills or techniques

adequately prepared for the teaching of the disciplines which is aligned with appropriate philosophies and methodologies of teaching. Such abilities and exercise can only be developed through deliberate training programs where their teaching competencies should be tested and certified to be deemed professionals. This would ensure the effectiveness of the teaching and learning activities. It is also benefited and helped teachers or lecturers to plan and create a friendly and conducive teaching and learning environments that will enhance student's learning interests, concentration and motivational level during the learning process. Thus, the transfer of learning would be improved.

This study has practical implications for the academic curriculum developer and lecturers in the UiTM Pulau Pinang specifically. The findings highlighted some important aspects of effective learning and teaching activities where the university needs to improve the students learning by defining course/syllabus activities, classroom learning and teaching systems design, teaching methods or techniques, classroom exercises, create a conducive classroom environment for effective learning and improve the teaching materials which suit the students learning styles. The differences in their learning styles or preferences are due to the cultural aspect; diverse background, the uniqueness of the students, different learning experiences and motivational level as well as their self-efficiencies. Thus, the university needs to frame the teaching and learning policy and procedures which can both intrinsically and extrinsically contribute to the learners' satisfaction in learning. However, other factors can also influence the teaching and learning process that need to be re-explored. These findings also useful for the policy makers of higher learning education and government institutions to develop the educational curriculum the technical students or learners. Future research is needed to explore these findings in different environments and cultures as to validate the authenticity of the findings.

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