Pertanika J. Soc. Sci. & Hum. 25 (S): 251 - 258 (2017)

PERTANIKA JOURNALS

SOCIAL SCIENCES & HUMANITIES

Journal homepage: http://www.pertanika.upm.edu.my/

Identifying Learning Styles among Engineering Students

Jamali, A. R* and Mohamad, M. M.

Faculty of Technical and Vocational Education, Universiti Tun Hussein Onn Malaysia, 86400 Parit Raja, Batu Pahat, Johor, Malaysia

ABSTRACT

Every student learns with different learning preferences in a classroom. In order to know dominant learning preferences, learning styles play a significant role. Studying learning styles is important as contemporary studies have revealed that to increase the value of students' learning process, there should be a match between students' learning styles and teachers' teaching style. Mismatches in teaching style and students' preferred learning style often lead to poor academic performance among students. Therefore, the main purpose of this research was to explore learning styles of engineering students in the Faculty of Technical and Vocational Education, Universiti Tun Hussein Onn Malaysia. Forty-six students from the Electrical, Civil and Mechanical Engineering disciplines participated in this study. The instrument used is the survey questionnaire based on the Index of Learning Styles (ILS) by Felder and Silverman that consists of 44 items. The ILS consists of four dimensions, each with two sub-scales: process (active-reflective), perceive (sensing-intuitive), input (visual-verbal) and understanding (sequential-global). Each main dimension has 11 items. Data were analysed using SPSS 20.0. The analysis showed that in the process dimension, 57.11% of the participants were active learners, while 42.86% were reflective learners; in the perceive dimension, 54.54% were sensing learners and 45.45%, reflective learners; in the input dimension, 76.87% were visual learners and 23.12%, verbal learners; and in the understanding dimension, 52.96% were sequential learners and 47.03%, global learners. This study highlights that knowing the preferred learning style of students will help teachers to create a classroom environment that suits students' needs so that their academic achievement can be easily enhanced.

Keywords: Index of Learning Style (ILS), learning style, survey

ARTICLE INFO

Article history:
Received: 01 November 2016
Accepted: 15 April 2017

E-mail addresses:
alirazabinismail@gmail.com (Jamali, A. R.),
mimi@uthm.edu.my (Mohamad, M. M.)
* Corresponding author

ISSN: 0128-7702 © Universiti Putra Malaysia Press

INTRODUCTION

Learning style plays a vital role in engineering education that portrays the ways in which students normally obtain, retain and retrieve information. It facilitates students to improve their mental capacity and to cope with learning difficulties, which in turn, improves their academic performance (Mohamad, Mei, & Tze, 2014). Students have different learning styles depending on their preferences, such as auditory, listening, observing or practicing (Graf & Kinshuk, 2008). Students make use of certain environmental stimuli namely, seeing, hearing, reflecting and acting to acquire learning. These environmental stimuli help students to engage in the learning process, which includes reflection, acting, logical reasoning, intuition, memorisation and visualisation (Yee et al., 2015).

Learners acquire knowledge when teaching and learning materials provided cater for their preferred learning style (Mohamad, Sulaiman, Sern, & Salleh, 2015). In addition, learning styles determine how the individual receives and processes information. Students and teachers may prefer one learning style for one subject and another generally prefer to use for most subjects that they learn or teach (Letele, Alexander, & Swanepoel, 2013). Indeed, every classroom is diverse in terms of educational background, cognitive ability, preferred learning style and cultural influence of the learners and teachers.

Mismatches in teaching style and students' preferred learning style often lead to poor academic performance among students (Graf, Viola, & Leo, 2007). Therefore, to understand a particular learning style which meets the needs of a student, teachers need to determine the best possible learning style that can flourish in the classroom. In higher education, tertiary students are assumed to be mature enough to deal with lessons and assignments on their own (Romanelli, Bird, & Ryan, 2009). Nevertheless, the majority of those among them who fail exams usually attribute their failure to external stimuli such as lack of academic standards or inadequate teaching methods (Mohamad, Yusof, Muhammad, Yee, & Tee, 2013).

Definition of learning styles is also the trend in adopting a particular learning method. The teacher is a leading facilitator and guide to learning in the classroom. Teachers should have the capacity to understand how students learn (Eva & Kristýna, 2016). Therefore, it is required that teachers should adapt their teaching approach to help students learn and improve their learning styles. Discrepancy between teaching style and learning style results in poor academic performance among students (Felder, 1996). Thus, there is a need to provide effective teaching that combines elements of teaching style and preferred learning style in teaching activities, with a particular view to taking cognitive and intellectual demands into consideration (Alias & Zainuddin, 2005).

Due to lack of understanding of learning preferences, students fail to achieve satisfying academic results. Continuous use of effective learning styles may lead

students to better performance (Felder, Brent, & Prince, 2011). Felder is of the opinion that strong preference of any student for a particular learning style may be troubling if the teaching style does not match the student's learning style (Graf, Viola, & Kinshuk, 2006). Every student is different and has a different learning style, speed of pickup of information, passion and motivations to learn. However, teaching methods and academic activities are different. So, learning styles are intended to seek out individual thinking skills, motivation and preferred ways of acquiring knowledge to enhance a student's performance. Thus, educators must understand students' learning styles and learning needs to enhance their learning ability to help them meet the expected educational goals (Eishani, Saad, & Nami, 2014).

Learning Style

Learning style is the method by which students think, process and retain information. It varies from student to student as every student has a different preferred learning style. Learning style in general is assumed to be behaviour, belief and preferences used by individuals to help acquire learning (Koh & Chua, 2012). Every learner has his/her own attributes, preferences and strengths that are used to collect information and learn in class; for this reason, learning preferences are associated with teaching methods (Mansor & Ismail, 2012).

Learning styles have achieved significant attention in recent decades, and is now studied from many angles such as academic achievement, learning attitudes and culture, among others. Many researchers and theorists believe that learning styles have a significant role in the learning process and they agree that integration of learning styles in education will bring a prominent change in education institutions as well as among learners, helping them to learn easily (Felder & Spurlin, 2005). Moreover, Felder, for example, argued that learners with a strong preference for a specific learning style might have difficulty learning if the teaching style does not match their learning style (Felder & Silverman, 1988; Felder & Soloman, 1997).

Thus, from a theoretical point of view, it can be said that integrating learning styles should make learning easier and increase learning efficiency. On the other hand, learners who are not supported by the preferred learning environment may experience problems in the learning process (Felder, 1993). Learning styles can be considered in different ways in education. The first step is to make learners aware of their learning styles and show them their individual strengths and weaknesses (García et al., 2007). Knowing their learning styles helps students to understand why learning is sometimes difficult for them and is the basis for developing areas they are weak in (Alias & Zainuddin, 2005).

Furthermore, students can be supported by matching the teaching style with their learning style. Due to the nature of learning styles, providing students with learning

materials and activities that fit their preferred ways of learning seems to have high potential of making learning easier for them (García, Amandi, Schiaffino, & Campo, 2005). As students think and learn in their own different ways, teaching methods should be varied (Felder & Silverman, 1988). Indeed, preferred learning style is reflected by many students to be one aspect of success in education.

Felder-Silverman Learning Style Model (FSLSM)

This model was initially designed for engineering students to capture the essential differences in learning styles among students to provide engineering teachers with a good base for framing a teaching approach that meets the learning needs of all learners (Felder & Silverman, 1988). According to the Felder-Silverman Learning Style Model (FSLSM), students are characterised into four major dimensions of learner preference for dealing with information: to process information, to perceive information, to receive information and to understand information (see in Table 1). Every dimension consists of two sub-dimensions: to process information (active vs. reflective); to perceive information (sensing vs. intuitive); to receive information (verbal vs. visual); and to understand information (sequential vs. global). In these sub-dimensions, students prefer one or the other learning style: either active or reflective, sensing or intuitive, verbal or visual and sequential or global. Only one dimension is selected from the two options.

Table 1
Dimensions of Felder-Silverman index of learning style (Felder & Spurlin, 2005)

Major Dimensions	Sub-dimensions	
To process information	Active	Reflective
To perceive information	Sensing	Intuitive
To receive information	Verbal	Visual
To understand information	Sequential	Global

These dimensions were the foundation for the development of the Index of Learning Styles (ILS), which was created in 1991 and later on available as a pencil-and-paper version on the Internet (Felder & Spurlin, 2005). With respect to the instrument's psychometric qualities, numerous studies have shown that the ILS is a valid, reliable instrument that deals with predictive value and yields more consistency than other generally used instruments of learning style (Felder et al., 2011).

Identifying Learning Styles

The learning procedure is a communication between learners, educators and teaching

resources. The student learning process should always be given importance (Eishani et al., 2014). Preferably, educators' teaching style should match students' preferred learning style. Mismatches in teaching style and students' preferred learning style often lead to poor academic performance among students (Graf, Liu, Chen, & Yeng, 2009). As learning styles play a significant role in education, educators should not neglect learners' preferred ways of learning to enhance students' academic achievements. Achievement is greater when emphasis is placed on students' preferred learning style as this also develops critical thinking skills such as problem solving, analytical ability and decision making.

METHODOLOGY

This study adopted the survey research because this approach provides greater accuracy and reliability of research findings (Creswell, 2008). A survey is an empirical method that explores and provides potential information regarding the targeted population and enables the collection of data from individuals about their knowledge, feelings, ideas, health, social, financial and educational background (Creswell, 2008). In addition, a survey is an attempt to obtain data from participants to determine the current status of a population with respect to one or more variables (Krosnick & Presser, 2010).

The main purpose of this study was to explore learning styles of third-year Mechanical, Electrical and Civil Engineering students from a technical and vocational education institution, University Tun Hussein Onn Malaysia. The sample consisted of 46 students from the above courses. The measurement method was the questionnaire Index of Learning Styles (ILS) by Felder and Silverman (1988) that consists of 44 items. There are four dimensions in the ILS namely, to process, to perceive, to input and to understand. Each dimension contains two further sub-dimensions: active-reflective, sensing-intuitive, visual-verbal and sequential-global. Each of these dimensions contains 11 items with two options "a" and "b," where "a" represents the dimensions active, sensing, visual and sequential, and "b" represents the dimensions reflective, intuitive, verbal and global. Data were analysed using the Statistical Package for the Social Sciences (SPSS) version 20.0.

RESULTS

The results showed that overall, the third-year students of technical and vocational education who were pursuing Mechanical, Electrical and Civil Engineering in University Tun Hussein Onn Malaysia preferred visual learning (76.87%) to verbal learning (23.12%) for the input dimension. For the process dimension, there were more active learners (57.11%) than reflective learners (42.86%) among the students, while for the perceive dimension, 54.54% preferred sensing and the other 45.45% preferred intuitive. For the understanding dimension, sequential learning was

preferred (52.96%) to global learning (47.03%) among the students. Based on the overall findings, the research suggested that teaching material should align with the students' dominant learning preferences so that they can develop their skills and get good academic achievements. The summary of results in percentage is shown in Figure 1.

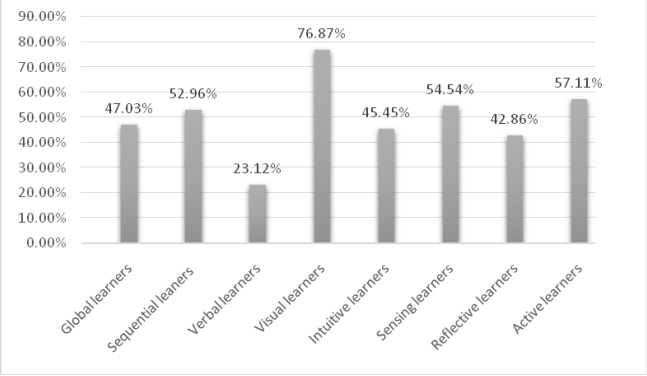

Figure 1. Percentages of sub-dimensions of index of learning style (ILS)

DISCUSSION AND CONCLUSION

In the classroom, teachers mostly focus on finding the ways students learn best (Felder & Spurlin, 2005). Knowing the preferred learning styles of leaners may support improvement of the quality of learning and teaching. As Sabine Graf mentioned, identifying the preferred learning style of learners is the road to improving learning and teaching in the classroom (Graf et al., 2009). Knowing the preferred learning style of learners helps teachers first to know how the learners can do well in a subject, as well as prepare teaching material that suits students' preferred learning styles. Mismatching often results in poor performance in the class; therefore, providing classroom materials according to learners' preferred ways of learning can make teaching and learning an effective and enjoyable experience for both teachers and learners.

This study illustrated that engineering students have different preferences and characteristics in acquiring knowledge. Visual learners tend to learn in diagrams, charts, figures and pictures as well as certain subjects in engineering courses. This paper contributes that knowing preferred learning style of students will help teachers to make environment in class according to the students' needs so that they can learn easily and enhance their academic achievement.

ACKNOWLEDEGMENT

This paper was fully sponsored by the Office for Research, Innovation, Commercialisation and Consultancy Management (ORICC), Universiti Tun Hussein Onn Malaysia (UTHM), Johor, under vote number U311.

REFERENCES

Alias, N. A., & Zainuddin, A. M. (2005). Innovation for better teaching and learning: Adopting the learning management system. Malaysian Online *Journal of Instructional Technology, 2*(2), 27–40.

Creswell, J. W. (2008). *Educational research, planning, conducting, and evaluating quantitative and qualitative research* (3rd ed.). Upper Saddle River, New Jersey: Pearson Education.

Eishani, K. A., Saa'd, E. A., & Nami, Y. (2014). The relationship between learning styles and creativity. *Procedia-Social and Behavioral Sciences, 114*, 52–55.

Eva, S., & Kristýna, J. (2016). Detection of learning styles in the focus group. *Procedia Social and Behavioral Sciences 217*, 177–182.

Felder, R. M., & Spurlin, J. (2005). A validation study of the index of learning styles. International *Journal of Engineering Education, 21*(1), 103–112.

Felder, R. M. (1996). Matters of style. *ASEE Prism, 6*(4), 18–23. Retrieved from www4.ncsu.edu/unity/lockers/users/f/felder/public/PapersILS-Prism.htm.

Felder, R. M. (1993). Reaching the second tier: Learning and teaching styles in college science education. *College Science Teaching, 23*(5), 286–290.

Felder, R. M., & Silverman, L. K. (1988). Learning and teaching styles in engineering education. *Engineering Education, 78*(7), 674–681.

Felder, R. M., & Soloman, B. A. (1997). *Index of learning styles questionnaire.* Retrieved from http://www.engr.ncsu.edu/learningstyles/ilsweb.html.

Felder, R. M., Brent, R., & Prince, M. J. (2011). Engineering instructional development: Programs, best practices, and recommendations. *Journal of Engineering Education, 100*(1), 89–122.

García, P., Amandi, A., Schiaffino, S., & Campo, M. (2005). Using Bayesian networks to detect students' learning styles in a web-based education system. In *Proceedings of the Argentine Symposium on Artificial Intelligence* (pp. 115–126). Rosario, Argentina.

García, P., Amandi, A., Schiaffino, S., & Campo, M. (2007). Evaluating Bayesian networks' precision for detecting students' learning styles. *Computers and Education, 49*(3), 794–808.

Graf, S., & Kinshuk, T. L. (2008). Learner modelling through analyzing cognitive skills and learning styles. *Handbook on Information Technologies for Education and Training*, 179–194, Berlin Heidelberg: Springer.

Graf, S., Liu, T. C., & Kinshuk, K. (2008, October). Interactions between students learning styles, achievement and behaviour in mismatched courses. In *Proceedings of the international conference on cognition and exploratory learning in digital age (CELDA 2008). IADIS International Conference* (pp. 223-230).

Graf, S., Liu, T. C., Chen, N. S., & Yang, S. J. (2009). Learning styles and cognitive traits –Their relationship and its benefits in web-based educational systems. *Computers in Human Behavior, 25*(6), 1280–1289.

Graf, S., Viola, S. R., & Kinshuk, T. L. (2006). Representative characteristics of Felder-Silverman learning styles: An empirical model. *Proceedings of the IADIS International Conference on Cognition and Exploratory Learning in Digital Age (CELDA)* (pp. 235-242). Barcelona, Spain.

Graf, S., Viola, S. R., & Leo, T. (2007). In-Depth analysis of the Felder-Silverman learning style dimensions. *Journal of Research on Technology in Education, 40*(1), 79–93.

Koh, Y. Y., & Chua, Y. L. (2012). The study of learning styles among mechanical engineering students from different institutions in Malaysia. *Procedia – Social and Behavioral Sciences*, pp. 636–642.

Krosnick, J. A., & Presser, S. (2010). Question and questionnaire design. In P. V. Marsden & J. D. Wright (Eds.), *Handbook of survey research* (2nd ed.), (pp. 263–314). USA: Emerald Group Publishing.

Letele, M. J., Alexander, G., & Swanepoel, Z. I. (2013). Matching/mismatching of teaching and learning styles in rural learning ecologies of lesotho: Does it enhance academic achievement. *J Hum Ecol, 41*(3), 263-273.

Mansor, M. S. A., & Ismail, A. (2012). Learning styles and perception of engineering students towards online learning. *Procedia-Social and Behavioral Sciences, 69,* 669-674.

Mohamad, M. M. B., Mei Heong, Y., & Tze Kiong, T. (2014). Conceptions of learning through learning styles and cognitive dimension in vocational education. *Journal of Technical Education and Training, 6*(1).

Mohamad, M. M., Sulaiman, N. L., Sern, L. C., & Salleh, K. M. (2015). Review the composite of students' characteristic and cognitive dimension in vocational education. *Global Journal of Business and Social Science, 1*(March), 164–175.

Mohamad, M. M., Yusof, Y., Muhammad Hanafi, N., Yee, M. H., & Tee, T. K. (2013). Connecting learning styles and cognitive dimension in building construction education. In P*roceedings of the International Conference on Social Science Research,* ICSSR, 2013, June 4-5th. Penang, Malaysia.

Romanelli, F., Bird, E., & Ryan, M. (2009). Learning styles: A review of theory, application, and best practices. *American Journal of Pharmaceutical Education, 73*(1).

Yee, M. H., Yunos, J. M., Othman, W., Hassan, R., Tee, T. K., & Mohamad, M. M. (2015). Disparity of learning styles and higher order thinking skills among technical students. *Procedia – Social and Behavioral Sciences, 204*, 143–152.