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A Study on Effective Learning of Novice Programmer among Engineering Students at UiTM Cawangan Pulau Pinang

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ABSTRACT

Learning is a process of seeking knowledge in a very creative way. The process varies among students. Different subjects have different techniques in learning. This study will identify the suitability of learning styles focusing on programming subject for novice users. We choose the most established learning model, which is VARK Model to find the best approach on students' learning styles. VARK stands for Visual (V), Aural (A), Read/Write (R), and Kinaesthetic (K). We concentrate on three learning styles, which are Visual, Auditory, and Kinaesthetic, and on how it influences student's enthusiasm in learning programming. The results show that the students prefer active learning that involves face-to-face interaction in order to understand the programming course across the three mentioned learning styles. Hence, this creates significant challenge to apply blended learning method in this course.

Keywords: novice, programming, engineering, learning, students

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INTRODUCTION

Within the explosive, fascinating open world, and globalization era, the use of computer as a gadget or personal assistant is everywhere. People rely on this technology, both for working and social communication. Knowledge on developing an application of computer is known as programming. Hence, programming courses are widely offered throughout almost all major programs in the universities especially in sciences and engineering programs. Students have to learn fundamental course of programming as an elective course in their programs. These students are called novice programmers.

Programming is a subject that students need to understand technically and practically. Novice programmers need to build their skills in writing code, execute, and debug a program in order to develop a system. Thus, teaching novice programmers with the skills associated with software development is a very challenging process (Kim & Lerch, 1997).

According to Derus & Ali (2012), the abstract concept of programming structure and designing a program is very difficult for students to understand. The problems involved understanding the role of variable position in computer memories, arrays, looping, and functions. The results of their study showed that students understand better through practical labs and visualization method. Another study by Nnass et al. (2016), the researchers highlighted eight items of significant difficulty faced by students of non-native English speakers. The top three of the problems are syntax, all programming concepts, and deriving programming structure from the root of the problem. The study also highlighted that the students with lack of English proficiency are unable to understand the syntax and programming concept.

The study from Baist & Pamungkas (2017) has proven that the same problem faced by the novice students, they are confused and unable to understand the concept of programming, structure, and the syntax of the programing language. Therefore, a careful consideration in choosing the appropriate learning styles is crucial to help novice programmer in understanding and constructing the programming process. The concept of learning styles has to be specifically focused on engineering students in this case.

Students learn in many ways such as seeing, hearing; reflecting, acting, reasoning logically and intuitively, and visualizing. Rutherfoord (2008) defined learning styles as the characteristic techniques in which learners learn, understand, and acquire information. Various learning styles models have been developed. Therefore, intensive research is important to understand different learning style that is appropriate with all kinds of student (Franzoni et al., 2008). Narrowing the scope, the kind of students reflects the course in which they are majoring (Felder & Brent, 2005).

To find the best teaching method is by identifying the students' learning styles. Learning style is an approach of learning a concept. According to Felder et al. (1988), engineering students learn best with visual, sensing, inductive, active, and creative global. The diverse styles of learning have to be provided by instructors in the most creative ways. This outcome of the

learning styles is also in line with the outcome reported by Havola et al. (2011) which emphasizes on the fact that undergraduate engineering students prefer visual, sensing, active, and global learning styles. These results were used to improve their teaching method for mathematics curriculum. In 2016, Tulsi and Poonia conducted a study about learning style on massive respondents across several fields of engineering. Their target group was master's degree of computer sciences, civil, electrical, electronics, communications and mechanical engineering. The results significantly highlighted visual, active, sensing and sequential learning styles were voted fairly among students. Anyhow, there was no dominant learning style leading across another. Kourakos et al. (2017) has reported that respondents of chemical engineering students from University of Athens and University of Denmark prefer active, visual and sensitive learning styles.

All of above studies are in line with the VARK Model proposed by Fleming and Sorenson, (2001). VARK stands for Visual (V), Aural (A), Read/Write (R), and Kinaesthetic (K). VARK model is based more on the physiological or perceptual characteristics. Hence, our studies will concentrate on the three learning styles which are Visual, Auditory, and Kinaesthetic.

Research questions

1. What is the learning style of engineering students in UiTM Cawangan Pulau Pinang?
2. How to improve the teaching method for programming course by understanding the learning style of the student?

Objectives

1. To investigate the learning styles among engineering students by narrowing the scope on programming course.
2. To examine the suitable learning styles in teaching programming course to the engineering students.

METHODOLOGY

For the purpose of this study, online questionnaire survey has been conducted to identify the suitability style for learning and teaching programming among the novice programmer. An appropriate number of participants were chosen to perform the collection and analysis of data from engineering students in UiTM Cawangan Pulau Pinang. In this section, we would describe them in three parts, which is learning style model, data collection, and data analysis. In the first part, we describe the learning style model that helps us understand and construct the questionnaire. In the data collection part, we will describe the participant's information used in the study, the data collected from them, and how the data has been analyzed. In the data analysis part, we discuss on how we construct the questions based on each learning style.

Learning Style Model

The learning styles that we identified which are Visual, Auditory and Kinaesthetic are closely related to the VARK Model. It is a sensory model that is an extension of the earlier neuro-linguistic model (Yassin & Almasri, 2015). The acronym VARK stands for Visual (V), Aural (A), Read/Write (R), and Kinesthetic (K). VARK focuses on the different ways of receiving and presenting information. The VARK Inventory provides metrics in each of the four perceptual modes, with individuals having preferences for anywhere from one to all four. Figure 4 presents the VARK model (adapted from Fleming & Sorenson, 2001).

Figure 1 shows the four approaches in VARK Learning Styles which are visual, aural, read/write, and kinaesthetic. According to VARK Model, visual learners prefer maps, charts, graphs, diagrams, brochures, flow charts, highlighters, different colors, pictures, word pictures, and different spatial arrangements. Aural learners like to explain new ideas to others, discuss topics with other students and their teachers, use a tape recorder, attend lectures and discussion groups, and use stories and jokes. Read/write learners prefer lists, essays, reports, textbooks, definitions, printed handouts, readings, manuals, Web pages, and taking notes. Kinaesthetic learners like field trips, trial and error, doing things to understand them, laboratories, recipes and solutions to problems, hands-on approaches, using their senses, and collections of samples. However, in this study, we only deliberate on visual, auditory, and kinaesthetic.

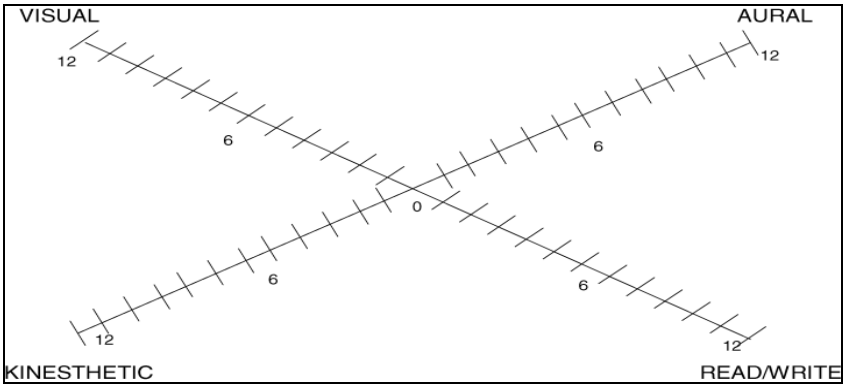

Figure 1 VARK Model

Visual is one of the original basic learning styles where learner learns best by seeing. This kind of learning style may involve the uses of flowcharts, diagrams, maps, graphs, and other illustrated and reading materials. Meanwhile, visual learners recall information by visualizing the source, tend to follow the teacher with their eyes while the teacher moves around the classroom, and always notice details or are very neat in the presentation of written work (Nethravathi & Agrawal, 2017). As visual learners remember best what they see, they tend to forget something that they hear. Visual learners prefer the visual sense, must see to understand, and learn best by reading and watching (Vincent & Ross, 2001).

Auditory, however, needs the students to learn best through listening such as lectures, discussion, audio and video technologies, recording, conferencing or learning through study

groups and communication in class. Auditory learners know how to listen to others, can be bright at oral work, but their performance on tests is mediocre, and they cannot stop chattering (Thakur et al., 2017). Despite of that, auditory learners remember much of what they hear rather than what they see. They enjoy listening and talking and have outgoing personalities and difficulty with written instructions. They must hear to understand and learn best by listening to an explanation (Kanar, 2013).

Compared to visual and auditory, kinaesthetic learners use the hands on approach as they learn most effectively through experience, undertake experiments, practical sessions, role playing and field work. Kinesthetic learners are familiar with everyone around them and have a short concentration span. Kinaesthetic learners requires both information perception such as touching, tasting, smelling and information processing such as moving, relating, doing something active while learning. They are poor listeners, learn by doing, express emotions physically, and have an outgoing personality. They must touch or feel to understand. They learn best by engaging in hands-on activities (Askar & Davenport, 2009).

Data Collection

In this study, the primary data is collected through online questionnaires. The scope of respondent covers: (1) degree of civil engineering students; (2) diploma of civil and mechanical engineering students. Since their major is in engineering, they have no or less programming knowledge. Therefore, we identify them as novice programmers. The questionnaires are distributed in the middle of the semester.

The questionnaire is distributed in order to investigate the learning style among novice programmers from the engineering field. The content of the questionnaire is split into four components, which are; 1) personal background; 2) basic knowledge of computer; 3) user perception in programming; and lastly 4) learning style that emphasizes on visual, kinesthetic and auditory. The auditory learning style focus on listening and verbal, visual focus on illustration, memorizing and attention, while kinaesthetic focus on action, active and independent.

Data Analysis

In order to differentiate the students across three learning styles, several sets of questions have been constructed and adapted from previous studies (Mendoza et al, 2014, Alharbi et al, 2011). The analysis was to identify and understand the learning style of respondents, which are; (1) Visual; (2) Auditory and (3) Kinaesthetic.

To understand the students' learning style, fifth teen questions were addressed across the three learning styles of visual, auditory and kinaesthetic subsequently. Students have to carefully answer based on three scales, which are; (1) Never applies to me; (2) sometimes applies to me; and (3) Often applies to me. The first 5 questions to identify visual style of learning were as

follows:

Q1: I prefer my notes in picture and diagrams.
Q2: I remember something better if I write it down.
Q3: I try to imagine when I need to memorize something
Q4: To keep my focused, I prefer to look at the person.
Q5: I feel distracted when there is sound around me.

In the second learning style of auditory, the next 5 questions were addressed as follows:

Q6: I prefer listening rather than reading on my own.
Q7: I feel lost when listening to long explanation
Q8: I cannot adapt when people speak fast
Q9: I prefer interaction explanation compared to reading text
Q10: I prefer typing compared to writing

The last 5 questions were designated (Q11-Q15) for learning style of kinesthetic. These questions were addressed to identify the capability of independent learning and self-adventure among students.

Q11: I prefer doing without reading instructions.
Q12: I learn best when I have the opportunity to do it
Q13: I like to trial and error rather than following the steps
Q14: I cannot study continuously in few hours.
Q15: I think better when I have the freedom to move around.

RESULTS AND DISCUSSION

The survey has been conducted to identify the learning pattern across 58 students of mechanical and civil engineering courses covers for both diploma and degree levels. Table 1 shows the respondents personal background where the highest respondents come from Civil Engineering Degree students followed by students from Diploma in Mechanical Engineering and lastly Diploma in Civil Engineering. Out of 58 respondents, 37 are male while 21 are female from the age of 18-25.

Table 1
Respondents' personal background

Gender		Age		Education Level		Program		
Female	Male	18 - 21	22-25	Diploma	Degree	Civil Eng (Degree)	Civil Eng (Diploma)	Mechanical Eng (Diploma)
21	37	50	8	28	30	30	7	21

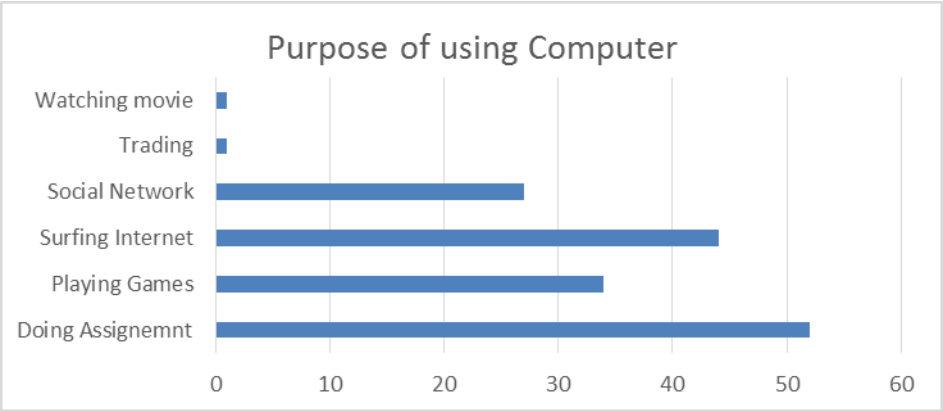

Figure 2 Purpose of Using Computer

In the beginning, we identify the purpose of the students using the computers. This is very important for us to understand the student's general interest in computing. Figure 2 illustrate that most of the students used the computer to do assignment, while some of them prefer surfing the Internet followed by playing games and for social networking. Only few of the students prefer watching movies and doing trading using the computer. Thus, we can conclude that students are more likely to rely on computer for the education purposes. This shows that computer usage can be a very great necessity to students in their studies.

Figure 3, 4 and 5 below shows the results for three learning styles based on the questionnaire explained in the data analysis method. The x-axis mentioned scale of 1) never applies to me; 2) sometimes applies to me; and 3) often applies to me. Meanwhile the y-axis represents the percentage scores for all respondents.

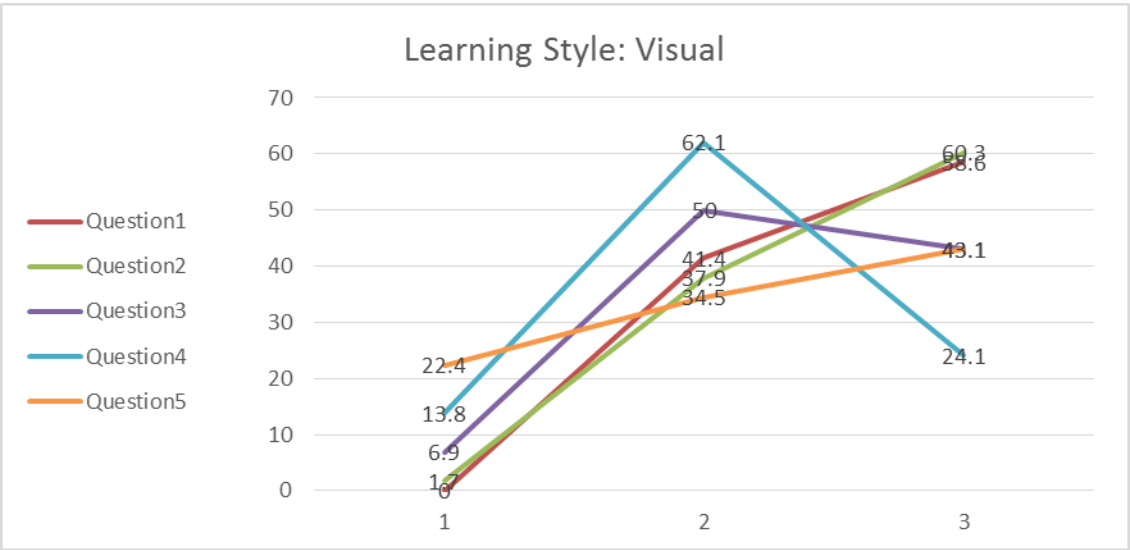

Figure 3 Visual Learning Style

In Figure 3, question 5 which discussed the students' distraction due to sound during the class has the highest percentage for scale 1. Question 4, which focused on eye-to-eye contact, has the highest percentage for scale 2. Meanwhile for scale 3, the students highly agree they will focus more on listening and writing simultaneously which is mentioned in question 2. The result shows that students require visible instructor to communicate throughout the learning process. Therefore, in this case, active or face-to-face learning is crucial instead of passive or online learning. On the other hand, students also emphasized that creative notes are helpful for better understanding.

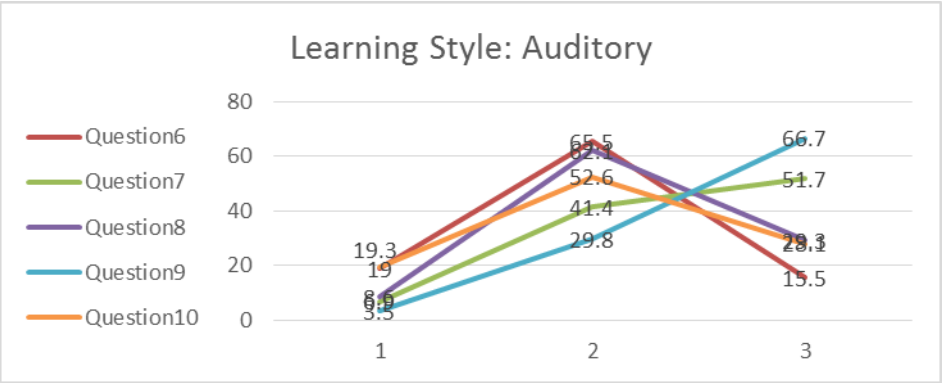

Figure 4 Auditory Learning Style

Figure 4 depicts the result for question 6 to question 10 on auditory learning style. Question 6 has the highest percentage for both scale 1 and 2. This means listening to explanation is not that significant compared to reading on their own. Question 9 has the highest score for scale 3. This indicates the interaction explanation gives a good impact in understanding programming. The result shows that students prefer two-way communications instead of distance learning for programming class.

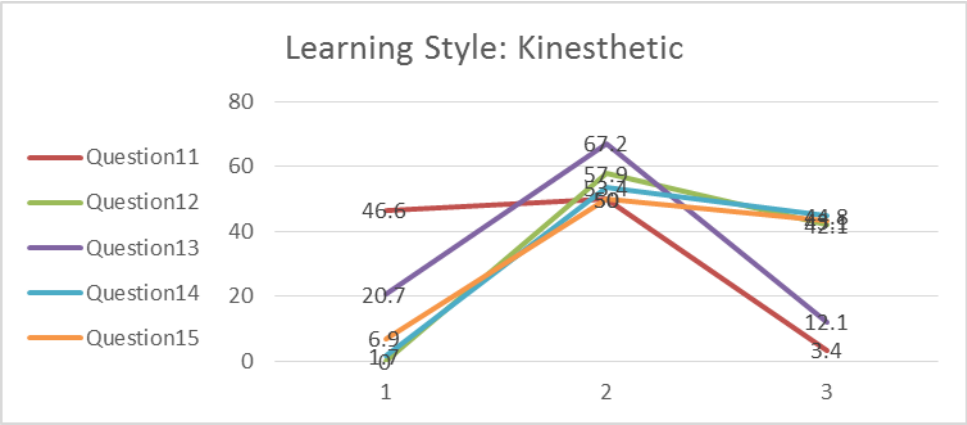

Figure 5 Kinaesthetic Learning Style

For kinaesthetic learning style, Figure 5 illustrates the result of question 11 until question 15. Questions 11 and 13 have the highest percentage for scale 1 and scale 2 subsequently. Both of the questions indicate students do not prefer unplanned work. Instead, they required technically guided lesson. However, question 14 has the highest percentage for scale 3. In this question, students do not prefer to study continuously for long period. Questions 11, 13 and 14 clearly show that students prefer short lecture but longer practical sessions. From this result, we can conclude for kinaesthetic activity, students agree that learning is enjoyable if they have the opportunity to do it on their own.

CONCLUSION

As a conclusion, three ways of learning styles, which are Visual, Auditory and Kinaesthetic, have been constructed in order to identify the novice programmer learning style. Based on our findings, on top of these three learning styles, students learn effectively when it comes to traditional way of learning. They prefer face-to-face interaction with instructor, hands-on experience, and enjoy creative learning materials. These findings are in line with the engineering students' background that focuses on technical skills as their nature of work. The challenge here is our results were not well-suited with current technology of blended learning. To make sure the students are aware of the new technologies, implementing traditional learning method in conjunction with blended learning should be considered. For the next paper, we would like to study deeper on each learning style focusing on the activities that have been identified. We want to explore and find out the activities related to the learning styles, which can ease students in understanding the programming course in line with blended learning.

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