PERCEPTUAL LEARNING STYLES OF PRE-SERVICE TEACHERS IN ENGINEERING EDUCATION

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Abstract

Thies (1979) defined learning style as a biologically and developmentally imposed set of personal characteristics that make a teaching method effective for some ineffective for others. To deliver an effective teaching in class, lecturers should know what the students’ preferences are. This paper is to explore the challenges related to Perceptual Learning Styles for pre-service teachers in higher education. The fluctuating of learning styles is debating year by year. The concept of learning styles however is not without controversy and disagreement. However the concept has been useful in areas such as improving students’ performance. Lecturers are not aware of their own learning styles and that their learning style preferences may differ from their students learning style preferences. Individual differences have been seen to play an important role in students’ successes and failures. A student could learn about it visually by reading, auditory by lectures. Since the issues of learning styles still debating, this research is attempts to identify learning styles of engineering education students or pre-service teachers in Faculty of Technical Education according to their gender and their specific field. Engineering education in this faculty contained three major filed which are electrical, mechanical and civil engineering. There are 48 students involved in this research. The significant differences of learning styles between gender and specific filed; mechanical, electrical and civil was investigated. Using Perceptual Learning Styles Questionnaires (PLSPQ) as the research instrument, the result showed that students preferred learning styles was kinaesthetic. Male students score higher in visual and kinaesthetic while female students more preferred in auditory. For the specific field group students, mechanical and civil engineering students higher score in visual and kinaesthetic while electrical engineering more preferred in auditory.

Keywords: learning styles. Perceptual learning styles, engineering education, pre-service teachers
Introduction

Learning in a structured education setting may be thought of as a two-step process involving reception and processing of information. In the reception step, external information and internal information become available to students. Students select the material they will process and ignore the rest. External information will come from observable through the senses and internal information means arising introspectively. The processing step may involve simple memorization or inductive or deductive reasoning, reflection or action and introspection or interaction with others. Students learn many ways by seeing, hearing, reflecting and acting, reasoning logically and intuitively, memorizing and visualizing and drawing analogies and building mathematical models. Learning is the process whereby knowledge is created through the transformation of experience (Kolb, 1984). Learning is affected by learning styles whereas in the case of students who are able to employ multiple learning styles learning outcome is higher (Felder, 1995; Reid, 1987). Since learning styles play a crucial role in learning process, educators should not neglect the problem of addressing it. Once lecturers become aware that different students learn differently they will determine students learning styles and accommodate them. According to Felder (1996), how much students learn in the class is determined partially by the students’ ability and prior preparation, and the capability of his or her learning style and the lecturers teaching style. Many researchers have stated that effective teaching is the main predictor of students’ success. In the past, most educators were advocating that students, not teachers, are the central factors in academic success and many would argue teachers play a great role in students’ academic performance. Darling-Hammond (1997) argues teacher education program must be redesigned to prepare teachers to provide diverse learners with different teaching strategies. Rita Dunn (1993) holds that teachers cannot identify student’s styles without using a multidimensional instrument. Without evaluation even experienced teachers may misinterpret students’ behaviors such as hyperactivity or inattentiveness. Hence, the need to assess the learning styles of students becomes obvious in order to accommodate different learners. Engineering education is the activity of teaching engineering and technology, at school, college and university levels. The goal of engineering education is to prepare people to practice engineering as a profession and also to spread technological literacy, increase student interest in technical careers through science and math education and hands-on learning.
Dimension of Learning Style

In traditional learning, educators can easily get an insight into how their students work and learn. Knowing how student learn can help in many ways to enhance teachers teaching. Identify learning styles of students is on way how to enhance teaching and learning (Sabine et.al, 2009). First teachers can benefit by getting information about how their students are use to learn, which provides them deeper understanding and might help when explaining or preparing learning material. Furthermore, making students aware of their learning styles and showing them their individual strengths and weakness can help students to understand why learning sometimes difficult for them and is the basis developing their weakness. In addition students can be supported by matching the teaching style with their learning style. Providing students with learning material and activities that fit their preferred ways of learning can make easier for them.

Learning styles can be identified through naturalistic observation; just watching and observing students as they work in class or with learning materials or different context of learning. Learning styles will also identified by interventionist methods where the lecturer deliberately tries out teaching presentation method to gauge how well an individual or group relates to that (Peter and Jenifer, 2005). Thomas and Amit (2007) identified learning style is a component of the wider concept personality. They reviewed five learning styles; Kolb Learning Style Indicator, Gregorc Style Delineator, Felder and Silverman Index, VARK Questionnaires and Dunn and Dunn Productivity Environmental Preference Survey to describe learning style modes and find the common measure of learning style. Based on describing all the models they conclude that students can and should be developed neither their abilities to use learning styles that are nor their natural modes and preferences. They believed that student performance improves as a result of our use of the learning styles instruments but they did not have an empirical data to support that belief.

Susan and Linda (1998) reported there are many reasons to incorporate student’s learning styles in lecturer’s teaching. The pointed some consideration; making teaching and learning a dialogue. In this point they summarize that teachers should assume that students are “empty vessels” and teachers’ role is to fill them with knowledge. A few researches on student learning suggest the metaphor of dialogue emphasizes the interactive, cooperative,
relational aspects for teaching and learning. In other words lecture in class no longer scripted delivery information but may also variety of learning to engage students with teachers’ teaching. Second point is responding to more diverse student body. Diversity of student body can affect classroom setting in many ways including diversity of learning styles. For example, students can group based on their preferences or tend. Third point is making teaching more rewarding. Educators can teach the best way which students can learn best. The administrator of the academic institutions can make effort to consider student learning style for equal satisfaction to teaching practices. Moreover, matching teaching style to learning style is not main factor to solve all classroom conflicts. But improving educators, lecturer and teachers understanding of learning style can cater all learning modes as reported from Felder (1996) which are; helping students understand their preferred learning style and formulate successful learning strategies.

Learning Styles with Behavioral, Cognitive and Constructivist

Perceptual Learning Styles (PLS) is defined by Reid (1987) who classifies learning styles into auditory (hearing), visual (seeing), tactile (hands-on), kinaesthetic (whole-body movement), group (like to work in group) and individual (like to work individually). Learning styles rooted in the theories of learning such as behavioural, cognitive and constructivist. Skinner (1980) proposed behavioural theory deals with the observable changes in behavior and reinforcement of such desired behaviors. According to this theory, students are able to learn best by being rewarded at the ‘right responses’. Such responses, in the educational literature are known as ‘operant conditioning’. This theory advocates students’ learning process through replication of certain learning behavioral patterns based on tangible rewards or punishments. These rewards can be associated, for instance, with merit marks, various forms of academic approvals and special privileges. According to this theory, the educators should emphasize on high-level positive reinforcement in the class and use of materials that are high in structure through which students can work gradually towards better educational achievement.
Cognitive theory of learning, as a novelty, originated by Jean Piaget (1971), is based on the assumption that information should be acquired and retained for use in the future if learning is to become learner constructed, relevant and built upon prior knowledge. Cognitive learning is often organized in chunks and is built-in the memory of the learner, enabling learners to use such information in the future. Cognitive models give learners control by introducing conceptual framework and relying on the learner to build connections. Piaget describes knowledge by emphasizing the concepts of assimilation and accommodation. Assimilation is the process by which the learner incorporates the logic of his/her own development and existing understanding or interpretative category into the meaningful whole. Accommodation refers to the process by which human beings adapt their developing understanding and expectations to the realities and constraints of the social and physical world in order to arrive at better understanding and explanations (Miller, 1993). Educators, in this regard, must actively involve students in the process of learning. Therefore, Grasha (1996) warns tasks that provide variety and novelty will capture students’ attention better, but care must be taken not to overload the cognitive system with too much information.

Constructivist theory, mostly propagated by Bruner (1987), as another alternative to the former theories of learning, asserts that learners do not simply absorb and store information but they make active interpretations of experiences and draw sound independent conclusions. Thus, students from the early schooling age develop active independent learning attitude and construct knowledge rather than receive it. Apart from cognitive approach to learning, educators became more concerned with how students use, receive, construct or deconstruct knowledge (Miller, 1993).

Based on the above theories, early theoretical and experimental studies on learning styles were most probably extended and expanded by Thelen as cited in James (2001) also cited in Almasa et.al (2009) who related learning styles to the dynamics of group at work. Then, being influenced by earlier theories of learning of the 70s, many researchers began extending and developing new theories on the learning styles such as, for instance, Myers (1962), Gardner (1983), Reid (1987), Messick (1984), Riding and Rayner (1998).
Perceptual Learning Styles

The perceptual learning style defined as a preference for one of the following learning modalities - auditory, visual or tactile. According to Sarasin (1998), the perceptual perspective allows us to take into account aspects of several well-recognized learning-style theories by synthesizing their important characteristics into an approach that is based on behaviors and/or actions that can be easily perceived in a classroom situation. Sarasin claims that aspects of the learning style theories of Gregorc (1995), Butler (1998), Sims & Sims (1995), McCarthy (1991), and Harb, Durrant & Terry (1993) reflect an approach based on the primary senses (visual, auditory or tactile) involved in learning. As the name suggests, visual style refers to a preference for learning through vision, and visual learners rely on their sight to take in information. They organize knowledge in terms of spatial interrelationships among ideas and store it graphically (Nilson, 2003). Learners who prefer the auditory style learn through hearing or listening to things. They learn best when they can hear themselves express an idea (Nilson, 2003). Tactile learners prefer to learn by doing and by touching. They learn best by being active, and they often rely on physical interaction in order to master a concept (Sarasin, 1998).

Perceptual Learning Styles Questionnaires (PLSPQ)

Joy Reid (1987) as cited in Almasa et.al (2009) developed PLSPQ specifically for foreign language students but in this research, researcher try to assess the engineering students using this instruments. The questionnaire assesses preferred learning styles of the students based on how students learn best using their perceptions: visual, auditory, kinesthetic, and tactile preferences, and two social aspects of learning: group and individual preferences. There are several reasons behind choosing this instrument; it is easy to administer, it is easy to interpret, it is self-scoring, and not scored by an external agent, it is relatively quick to administer and complete, it has easily reportable scales, and it has reliability and validity supported by the research. PLSPQ consists of 30 self-report questions. Subjects are expected to indicate how much they agree with each item on a scale from 1 to 5 when they learn. Each number notes certain measurement such as: (5) strongly agree, (4) agree, (3) undecided, (2) disagree and (1) strongly disagree. According to PLSPQ description
visual learners are most comfortable with pictures, images and graphs while studying and retaining information. Example of question for this type of learner would be “I learn better by reading than by listening to someone,” or “I learn better by reading what the teacher writes on the chalkboard.” Auditory learners learn best when hearing the information and, perhaps, listening to the lecture. Thus, the learner needs to express verbally what he/she learns, solve problems by talking about them and discusses the material in the class. Example question for this type of learner would be “I learn better in the class when I listen to someone,” or “When the teacher tells me the instructions I understand better.” Kinesthetic learners prefer active participation experiences, for example role-play or moving around. Such students learn best by experience and by being involved physically in classroom experiences. A combination of stimuli, for example an audio tape combined with an activity helps learner understand new material. Example question for this learner would be “I prefer to learn by doing something in the class,” or “When I do things in the class, I learn better.” Tactile learners prefer hands-on work, for example, handling materials or taking notes. Working on an experiment in the laboratory is the best way for such students to learn new material. Writing notes or instruction can help such learners to remember information easily and physical involvement in the class pays major role in their retention of the information. Example question for this type of learner would be “I learn more when I make something for a class project,” or “I learn more as I make drawings while I study.” Group learners prefer studying with others. Group studying make them feel comfortable and it is best way for them to acquire knowledge. Students also value class interaction and class work with other students, and they remember information when they work with two or three classmates. The stimulation of group work will help such learner to understand new information better. Example question for this type of learners would be “In class, I learn best when I study with others,” or “I get more work done when I work with others.” Individual learners prefer studying alone and they learn best independently. Such students learn new material best when reading it themselves.

**Research Methodology**

This study reports data obtained from final year students with diploma holder admission. 48 students involved in this study have a different background of engineering preferences. There are three major fields in this group of students which are; mechanical,
electrical and civil engineering. This course is designed to prepare students as teachers when they complete their degree in Technical and Vocational Education. The students will go to schools doing their practical period and they will call pre-service teachers. They will teach an engineering education subjects which contained both task theory and hands-on. This course required students to learn many subjects including the general subjects such as English, Communication Skills besides their main course subject in engineering education. As teachers to be students need prepared themselves with strong root in behavioral, cognitive and constructivist basis so that they can know how to cater students’ learning styles relate with their teaching styles soon. In this research the PLSPQ distributed to 48 students; 20 males and 28 females.

**Research Findings**

After the analysis done, the percentage of students’ learning styles had calculated. Figure 1 shows the overall learning style finding based on the PLSPQ categories.

![Figure 1: Perceptual Learning Styles Preferences](image)

Figure 1 shows that male students more prefer in visual (33%) and kinaesthetic (36%) while female students are in auditory (43%). Female students like to learn in group (63%) while 58% male students also prefer learn in group.
Figure 2 presents the major field of students which are mechanical, electrical and civil engineering. The result shows mechanical engineering students score 38% in kinesthetic learning styles and 34% in visual. Electrical engineering students prefer learn with auditory styles (36%) and civil engineering students score high in kinesthetic styles (42%).

Figure 2: Students’ Learning Preferences

The results of shows in visual learning items majority students agree that when learning new skill, they will rather watch someone demonstrate the skill than listen. In auditory learning preferred most of the students learn better in the lecture class rather than listen to someone. High score of students like to learn by doing exercises and drills in the class which are one of characteristics of kinaesthetic learners. Tactile learners is the lowest score among the others learning preference most of students undecided regarding tactile learning styles. The dominant learning styles of engineering education pre-service teachers were visual where the learners comfortable with pictures, images and graphs while studying and retaining information

Discussions
The importance to determine students’ learning styles and make students aware about different approaches to learn. By emphasizing learning styles, we focus on the learner and by doing so we are getting the learner to reflect on how he or she learns. Sarasin (1998) stresses the importance of educators taking interest in students’ preferred learning style since it will help them answer the fundamental question, “How do my students perceive and process information”. The view is that if we know the learning style of our students, we can tailor our teaching style to meet their learning preferences, and teach the material to gear toward their strengths. Another important goal is to strengthen learner weaknesses by helping students overcome the limitations of specific learning styles. Sarasin (1998) emphasizes the importance of promoting strategies that are not specific to one learning style. By exposing learners to a variety of strategies that may help them to flex or expand their learning style, we help them develop more as independent learners. When our students participate in classroom activities by working in pairs and groups, which was often the case in this classroom context, we provide them an opportunity to not only interact with classmates who use different learning styles, but also to learn from them. Nilson (2003) claims that “all learners learn more and better from multiple-sense, multiple-method instruction”. Although many neurons connect the ear to the brain, we retain only ten to twenty percent of what we hear.

In summary this study can found the dominant learning styles for engineering education students’ are visual. Students preferred learning in visual styles because they may prefer reading, observing, and more data for their interpretation or more visual aids, such as movies, diagrams, pictures and graphs. Recommendations are suggested in the last chapter, which are; the importance to determine learning styles of the students and that there should be an effort from the educator’s side to accommodate those differences in the classroom. When the learning styles are determine it is suggested that instructor take into consideration differences among the students when designing the course material Students are also advise to try to adjust to different learning circumstances in order to avoid any confrontations when exposed to learning styles that does not suite them.

Many factors influence students achievement at all levels. Learning styles of the students are as well one of many factors that need to be considered when researching
student’s attitudes and achievements. The results of the research has shown the importance to determine students learning styles, and that difference do exist in learning styles among the students from students of different gender. The research suggests that students should be made aware of their learning style preferences. Students may take for granted that their learning styles are habitual. They may not even be aware of their learning styles or of the styles of other students. The awareness of their learning styles may encourage them to realize the importance of learning styles and that it plays crucial role in their learning. According to Pask (1976) cited in Almasa (2009), knowing ones learning style is important in learning. Conducting a survey research is one of the ways to asses students learning styles and than make available the results to the students.

References


