

Analysis of Learning Styles of Engineering Students For Improving Engineering Education

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Abstract : Outcome based education is a buzzword in all fields of technical education specifically in engineering education. We talk of active , cooperative and collaborative learning to achieve the desired outcomes and to make the students learn because the faculty is teaching , but are the students learning ? This a critical question to ponder upon as the learning style of the students have a big impact on the way they perceive and learn. An analysis of their learning styles is definitely going to improve the engineering education. The present study aims to assess the learning style of undergraduate students in engineering by using Felder's and Solomon's Learning style index so as to accommodate the streamlining of pedagogy in classroom teaching.

Keywords : Learning styles, Classroom teaching , Outcomes based Education , student learning.

Introduction :

A deep focus on the engineering education reflects on the fact that there are many difficulties in gearing the engineering education to achieve desired quality engineers. To the best-intentioned educational initiatives by engineering colleges nationwide have had little success in increasing access to the richly textured future afforded by careers in engineering as the research over the globe says that only 10% of the engineers are employable. The big challenge is not only to increase this number but simultaneously greater stress should be on quality too. Concentrating only on increasing the numbers is like putting the wagon before the horses. Given the intensity of challenges the future engineers will be required to face , it is high time to come out of our routine business. We need to make engineering education more relevant to future needs and more interesting to a wider, more diverse group of students. The devil of the discussion is how to renew engineering

education. This a critical question to ponder upon as the learning style of the students have a big impact on the way they perceive and learn. Most of the research on learning styles have found that in engineering courses, learning can be improved by the application of different learning styles to teach various courses. Yet most of the engineering educators assume not only that all students adopt (or should adopt) a uniform learning style, they expect the same learning style to be applied to all areas of engineering studies (Felder, 1993, 1996; Holt & Solomon, 1996). The objective of the present study is to analyze the learning styles of students so as to make learning happen by accommodating the various styles while teaching in classroom.

Learning Styles and Their Indicators :

The concept of learning style owes its evolution in psychology. The basis of all these theories is that all individuals differ in the ways they learn or prefer to receive , assimilate and demonstrate their knowledge. Every individual is created differently .Learning style basically refers to understanding that learns in his own preferential way for operating in one way over another. Felder and Brent define learning styles as characteristic cognitive, affective, and psychological behaviours that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment. Learning styles do not encompass the ability to learn rather it refers to the ways they prefer to learn. One of most accepted understandings of learning styles is that student learning styles fall into three "categories:" Visual Learners, Auditory Learners and Kinesthetic Learners. These learning styles are found within educational theorist Neil Fleming's VARK model of Student Learning. VARK is an acronym that refers to the four types of learning styles: Visual,

Auditory, Reading/Writing Preference, and Kinesthetic.

David Kolb (1984), one of the main classifiers of learning styles, identified the four basic learning styles as: convergent (good at problem solving, decision making, and the practical application of ideas); divergent (good imaginative ability and awareness of meaning and values); assimilative (good at inductive reasoning and creating theoretical models); accommodative (efficient in carrying out plans and like getting involved in new experiences). He found that engineers usually have a convergent learning style.

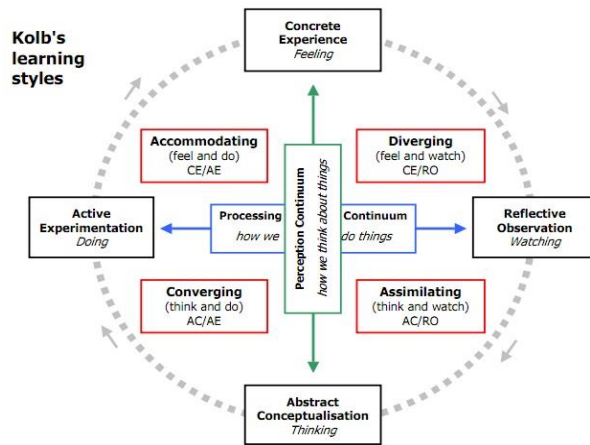


Figure 1 : Kolb's Learning Styles

Felder and Solomon Learning Style: They have segmented the individual learners in four different categories shown in the following figure :

SENSORY Sensory learners prefer concrete, practical, and procedural information. They look for the facts.		INTUITIVE Intuitive learners prefer conceptual and theoretical information. They look for the meaning.
VISUAL Visual learners prefer graphs, pictures, and diagrams. They look for visual representations of information.		VERBAL Verbal learners prefer to hear or read information. They look for explanations with words.
ACTIVE Active learners enjoy working in groups to figure out problems. They like to try things out see how it works and enjoy physical experiments.		REFLECTIVE Reflective enjoy individual learning. They like to think things through first before they do something with them.
SEQUENTIAL Sequential learners prefer to have information presented in an orderly manner. They put together the details in order to understand the big picture emerges.		GLOBAL Global learners prefer a systematic approach. They see the big picture first and then fill in the details.

Figure 2 : Felder and Solomon Learning Style Dimensions

Framework of the Research Study :

Learning style is important for many reasons; however, there are three vital ones. First of all, people's learning styles will vary because everyone is different from one another naturally. Secondly, it offers the opportunity to teach by using a wide range of methods in an effective way. Sticking to just one model unthinkingly will create a monotonous learning environment, so not everyone will enjoy the lesson. In other words, learning and teaching will be just words and not rooted in reality. Thirdly, we can manage many things in education and communication if we really recognize the groups we are called to. Of course, we may not know every detail; however, being aware of our students' learning styles, psychological qualities and motivational differences will help us regulate our lessons appropriately and according to the conditions (McCarthy, 1982; Felder, Silverman, 1988; Coffield et al., 2004). The advantages of identifying learning styles have an important place in the lives of individuals. When the individual knows his/her learning style, she will integrate it in the process of learning so s/he will learn more easily and fast and will be successful. Another advantage of the identification of the own learning style by the student is that it will help the student to become an effective problem solver. The more successful the individual is at solving the problems s/he faces, the more control s/he will take over his/her own life (Biggs, 2001). It is important that individuals receive education in areas suitable for their learning styles. A person educated in an area having no relationship to his/her learning style may lack confidence and s/he may be less successful; s/he may as a result become frustrated. Knowledge of learning style also provides information to the student as to why s/he has learnt in a different way than others. It helps to control the process of learning. It is vital because one of the most important signals in learning is to learn to be autonomous, that is, for the individual to take responsibility for his/her own learning. Because of this, s/he should know what learning style is. This has to be part of the learning process to enable the individual to obtain knowledge, which constantly shifts and changes, without any help from others. Briefly, confidence in learning will consistently rise when learners know how to learn. Learning to learn and grasping knowledge in a suitable manner will lessen the need for an overbearing control by teachers. At this point, teachers guide the students. The students take responsibility for their learning, they are at the centre of the process and everything is

under their control. They search answers to the problems and benefit from their unique performances and preferences in their learning styles. Those people will identify their aims, unlike those whose learning style preferences are not identified. They know what they want to learn and “how.” This awareness will change their perspectives on learning new things (Fidan, 1986). In order to understand the learning preferences of engineering students in western Maharashtra, Felder’s and Solomon’s learning index questionnaire. The questionnaire assesses preferred learning styles of the students. There are several reasons behind choosing this instrument; it is easy to administer, it is easy to interpret, it is relatively quick to administer and complete, it has easily reportable scales, and it has reliability and validity supported by the research. The questionnaire was administered online and a total of 395 responses complete in all aspects were received.

The result of the test are shown as follows :

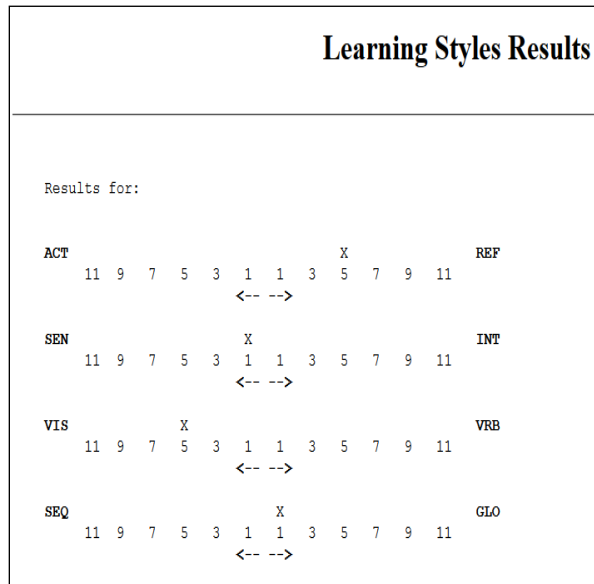


Figure 3: Display of Learning Style Results

These results can be interpreted with the help of following points:

1. If a student score is between -3 to 3, he has no preference towards any pole of the scale. Such student is fairly well balanced between the two poles.
2. If a student score is between -5 and -7 or between 5 and 7, he has a fairly moderate preference for any one pole of the scale
3. If a student score is between -9 and -11 or between 9 and 11, he is strongly attracted towards any one pole of the scale

Analysis of Engineer Learning Styles :

The learning styles of all 395 student responses were analyzed and are compiled in the following table :

Table 1 : Percentage Of Students With Different Learning Styles

Dimension	Percentage of students towards the Poles	
Processing	Active (72%)	Reflective (28%)
Perception	Sensing (45%)	Intuitive (55%)
Input	Visual (85%)	Verbal (15%)
Understanding	Sequential (61%)	Global (39%)

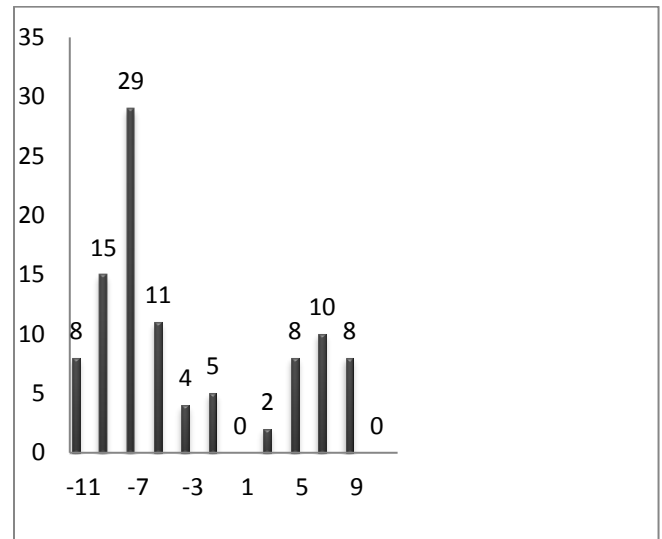


Figure 4 : Percentage of Active Vs. Reflective Learners

The figure 4 above clarifies that most of the student respondents are active learners. Such students tend to learn by discussion methods. They understand better by explaining to others. Hence they should be involved in peer discussion and they should study in groups preferably.

The figure 5 shows that around 55 % of the students are intuitive learners .Such students are good at grasping complex mathematical concepts . They are good at mathematical formulations and working on abstract concepts. They would love to be innovative in finding relationships and possibilities. At the same time they are prone to make careless mistakes due to their impatient nature.

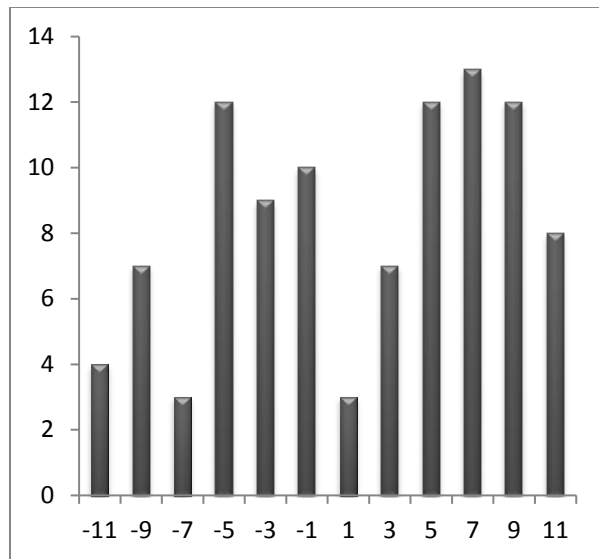


Figure 5 : Percentage of Sensing Vs. Intuitive Learners

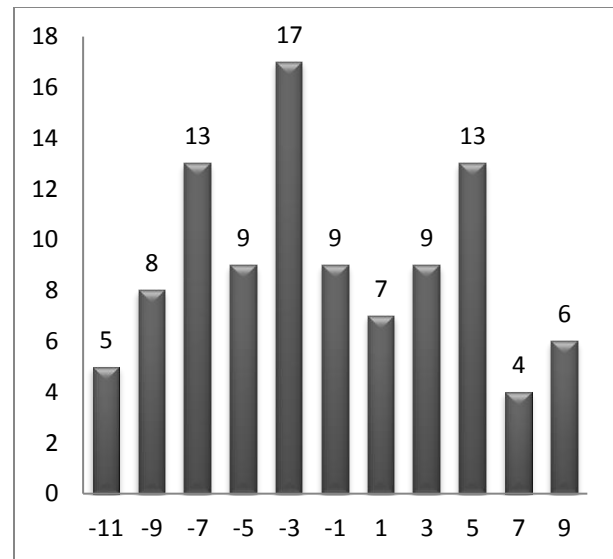


Figure 7 : Percentage of Sequential Vs. Global Learners

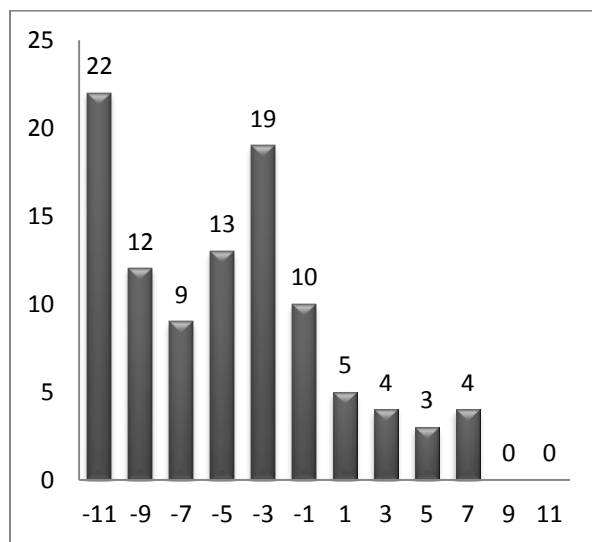


Figure 6 : Percentage of Visual Vs. Verbal Learners

As per the presentation in figure 6, we observe that the percentage of visual learners is extremely high. They look for things like colour codes in the notes , pictorial presentation of ideas, concept notes etc.

Figure 7 indicates that there is a higher percentage of sequential learners as far as western Maharashtra is concerned. They tend to gain understanding through logical steps. They work through and get the big picture if the pieces are logically connected.

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Conclusions :

The survey conducted by Felder Solomon learning index shows that most of the engineering students are active , intuitive ,visual and sequential learners while most of the engineering pedagogical styles tend to emphasize the opposite methods. The faculties should take care to use appropriate strategies which will help in making learning experiences of these students better . they should use the teaching styles as per the learning preference of the students sobtained from the index.This will make the students motivated and interested in their studies and no doubt we will be in a position of generating employable engineers.

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