Section A-Research paper

'Students' learning styles and motivation in classroom'

Daljeet Singh

Mechanical Engineering Department, Thapar Institute of Engineering and Technology, Patiala

Abstract

A study of the diverse student learning styles and its relationship with student motivation in the classroom has been presented. The significance of an awareness and understanding of different types of learners is emphasized. The methods or activities suggested by researchers to accommodate the needs of diverse learners are presented. A few novel activities that have been used in both small and large engineering classes are presented. The use of models and animations for visual learning and a simulation game for active / kinaesthetic learning has been discussed. The benefits of these interventions and the associated limitations are also discussed. It is suggested that similar activities if planned carefully for the different types of leaners, even in a few sessions, can significantly increase the students' motivation in the classroom. The cultural differences between the students in the west and their Asian counterparts are also highlighted and may give important insights into the learning styles, behaviour and motivation of the students.

Keywords: learning styles, interventions, student motivation

Introduction

In order to improve the students' learning experience (kinaesthetic aspects of learning; *Flemings VARK learning model* [1], and to make teaching more creative and effective by considering the learning styles of different students, significant research has been reported worldwide. One of the most important works in this area still remain to be Felder's [2] papers on the learning styles of students and the mismatch with the teaching styles of engineering teachers. Felder has talked about inductive and deductive learners, sequential and global, active and reflective learners. The type of teaching method mostly used in engineering classes is based on a formal lecture wherein the professor uses the sequential method of instruction. In fact the entire education system uses this approach; the course curricula are sequential, books are sequential and the lectures are sequential too. The problem with this approach is that all the students in the class do not have this learning style and may be more tuned with the inductive type of learning. These learners like to see the problem or the application first, before they are explained the underlying principles and theory of a particular area or topic. The authors have outlined ways in which the different types of learners can be accommodated

in the class. If this is not taken care of, the students generally lose interest and motivation, become passive, and this in turn affects their performance. This lowers the morale of the teachers as well who may become critical of the students which makes things even worse. It also affects the well being of the instructor. But the mismatch between the learning styles of students and teaching styles of engineering teachers can be overcome with awareness and gradual practice in the classroom.

The different learning styles reported in the literature have been discussed in the paper. A few interventions used in undergraduate engineering classes are also illustrated. For example, the students in the first year Engineering Drawing class come from different backgrounds and are new to the system. The nature of the course requires the students to imagine/visualize two and three dimensional objects and drawings. Over the years, it has been observed that most of the students find it difficult to imagine or understand new concepts from two dimensional images/figures drawn on the board in the classroom. The literature also suggests the effect of certain parameters like age and gender differences on spatial visualization ability [3]. So the use of physical and virtual models has been suggested.

Another reason to choose this approach was to provide variety to the students as writing and drawing on the board can become monotonous. It becomes quite boring, especially for those students who prefer to learn through the audio-visual and kinaesthetic approach. Some students like to learn by discussing with fellow students and by teaching others. The attention span of any audience is only about 30 minutes or less in a lecture of one hour. So, interventions like Think-Pair-Share (a pair of students discuss a given topic for say, five minutes and then share with the class) can also help in student engagement. In order to plan and implement such interventions, an understanding of the different learner types is desirable.

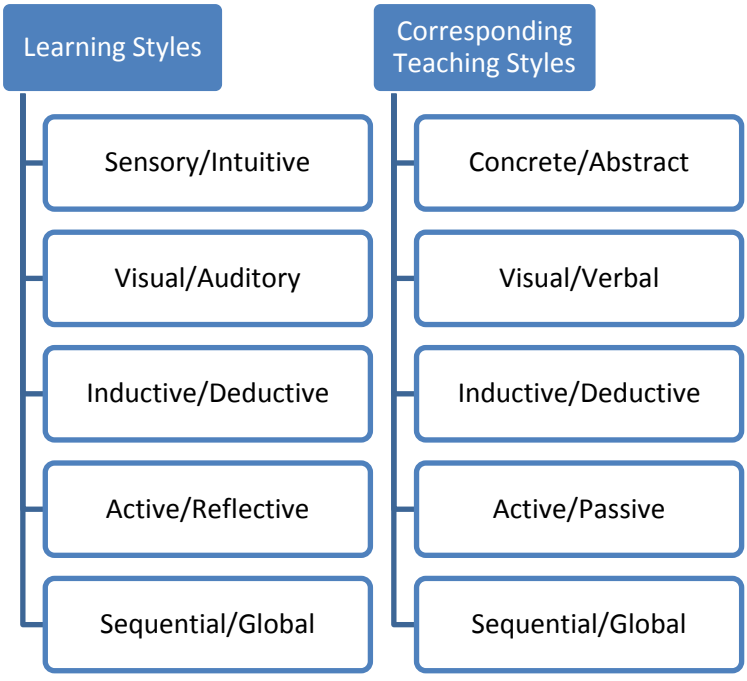

Fig. 1 Preferred learning styles and the corresponding teaching styles [2]

A brief classification of diverse learning styles is presented below.

A Classification of Learning styles

The different learning styles can be summarized as per the classifications below [2] and shown in Fig.1.

1. Sensory and Intuitive: Sensory learning style is associated with gathering data and processing through the senses. The students with sensory learning style like facts, observation, data and details, but do not like complications. Intuitive learners are bored with repetition and detail, but do like complications. Their learning is more attuned with the abstract and theoretical concepts. It is linked to visualization, imagination, hunches. Sensors are good at memorizing facts; intuitors are good at grasping new concepts.

2. Visual and Auditory: Visual learners learn and remember more with the help of pictures, diagrams, flowcharts, videos, presentations. Auditory learners understand better with the help of spoken words. They like to hear and then discuss what they have learnt.

3. Inductive and Deductive: In Inductive learning, the problem or application is presented first and the underlying principles are inferred. Deductive learning is more consequential, in the sense that the principles are presented first and the final application or the solution of the problem is deduced later. Felder [2] says that induction is the natural human learning style. We have always, since childhood, observed the real life problems or phenomena and have drawn inferences.

4. Active and Reflective: Active learners like to experiment and engage themselves in activity. They do not like to sit passively in a classroom. On the other hand, reflective leaners prefer to think about the problems or the information presented and reflect on them. The instructors should include both practical problem-solving (for the active leaner) and reflection on the concepts presented (for the reflective).

5. Sequential and Global: Sequential learners prefer the presentation of information in a step-by-step sequential way or in an orderly progressive fashion. The global leaners on the other hand, understand the concepts or solve problems in a non-linear way. They may not be able to understand the concepts in the beginning but suddenly see the solution in a flash one day. So the teachers need to be patient with these learners and give them more time to understand and solve the problems.

Some authors have discussed more aspects or factors that influence student learning. The learning styles or preferences may also be influenced by cultural or regional differences [4]. It has been observed that the Asian learners are quiet and reflective in the American classroom having the native extroverted and highly participating students. It has been seen that the students are more independent in western cultures as compared to the Asian learners who are more parents or family dependent and need hand holding and support.

A Learning Styles Inventory (LSI) has been given by Dunn et al. [5]. They have proposed the learning style elements *environmental stimulus* (light, temperature); *emotional stimulus* (persistence, motivation); *sociological stimulus* (peers, adults); *physical stimulus* (perceptual strengths, time of day—morning vs. after-noon); and *psychological stimulus* (global/analytic, impulsive/reflective).

The effect of left brain and right brain activity in the students may also influence the learning of students. Left brain learners prefer structured information, logical reasoning process, analytical problem solving, verbal expression and linear information processing [6]. Right brain learners, being more creative and intuitive prefer abstract thinking, visual presentation and non-linear processing of information. Some of the learning styles mentioned earlier correspond to the left brain and right brain activity as well.
Some other factors that may be worth considering include age and gender of students, peer pressure and other aspects related to adolescence, different levels of maturity, moral values, ethics etc.

Interventions in classroom to accommodate different learning styles and motivate students

An understanding and awareness of the different learning styles is important for the engineering teachers as they do not come from a background of education. Their learning is mainly based on the teaching experience acquired over the years. In order to complete the knowledge of student psychology, preferences and learning styles, efforts should be made. An exposure to published literature, discussion and reflection with peers and attendance of workshop/s is desirable.

Knowledge of the learning styles has to be followed by actual implementation in the classroom, so that student motivation can be enhanced and experience gained from the observation. In order to address this and some of the issues outlined above, it was decided to use some interventions to cater to the different learning styles. Three dimensional models and props of cardboard, thermocol, wood and also, virtual *models* using a CAD (Computer-Aided Design) software were made for the first year students (refer section 1). The help of students was sought in case of bigger or complex models having many parts, for the demonstration.

Another intervention was tried in a smaller class, which can be considered to be more challenging and practical. A *simulation game* was used in a third year undergraduate course, to highlight the benefits of Toyota Production System. Sheets of paper were given to the students to make paper aeroplanes. The room used was a tutorial classroom where the tables were of sufficient size and height and the overall setting was amenable to the planned activity. The tables were placed to simulate the workstations in a production line. Coloured paper was used for different markings on the tables. Some of the students became workers

who made the planes on different workstations, one student was the timekeeper (for noting the cycle time) and one became the manager to supervise the operations.

An intervention of *Think-Pair-Share* was applied in a smaller tutorial class. In this activity, the students think about a problem or presented concept for some time (say five minutes), discuss about the same in pairs and then share the observations/thoughts/ideas with the class. The students get an opportunity to reflect, then verbalize their ideas and share with the peers.

The use of the intervention was started itself from the feedback of a few students who had approached the instructor in the beginning of the course. Their problem was related to understanding the concepts of orthographic projections and visualization. As it is one of the important learning outcomes, so, it was thought that something should be tried to address their problem.

So, the different interventions were planned. The feedback taken later on, after the use of the different interventions, was instant, i.e. within the classroom, by asking the students. Also, it could be seen that the interventions were working, by the engagement of the students, their motivation level, the sparkle in their eyes and the satisfaction shown by their body language, which becomes so obvious after many years of experience of interacting with the students. Despite this, the improvement was documented/evidenced by the student feedback taken centrally in the middle of the semester. A feedback form was also prepared by me which had questions related to the learning experience of the students in general (questions about the strengths and limitations of the course and the instructor and what they would like to change about the course) and specific questions related to the use of the models. The students' response was really heartening and motivating. There were a few pointers to improvement in the future as well (these related to the design of tutorial classes). All the students appreciated the effort put into the making and use of interventions in the class and suggested that such techniques should be continued in the future as well.

Discussion

A discussion on the strengths and limitations of the interventions used for the benefit of students with different learning styles is presented below.

Use of props, models

The physical and virtual 3D models, when used in the lecture class, made students enthusiastic and motivated to learn the concept being discussed. It helped in extrinsic motivation, especially for the students who prefer the visual learning style. But making appropriate complex models can be very difficult and time consuming. Large models can be difficult to carry to the classroom.

Think-Pair-Share

This intervention was used in tutorial classes, where pairs of students were asked to discuss the engineering drawing problems in pairs, and then come up with solutions on their own. The students then shared their thoughts with the whole group. This brought clarity and helped in building the students' confidence. Many teachers may be having an opinion that students should sit on their respective seats and do problems in an isolated way, otherwise there would be chaos and noise from the discussion, and students would not be working on their own. But that mind-set is changing now and leading to increased student enthusiasm in the tutorial class. This can lead to a better learning experience for the students.

But this has to be kept in mind that the students have some inhibitions in the beginning to try the new things as they are more ingrained in the traditional cultural and educational values, particularly in the Asian cultural-social context [7]. So, a break from that traditional mould takes some time and has to be done gradually. Trying the new techniques has been found easier with the first year undergraduate students as compared with the third year or final year students.

Simulation games

The simulation game (making paper aeroplanes at different workstations) helped to construct an actual industry setting (production line). The students were doing all the activities on their own and thus were active learners. The understanding of the concept of lean manufacturing was remarkable which earlier was only theoretical and abstract. The students were so excited to actively use the lean techniques of one piece flow, Kanban, jidoka etc. The instructors also feel relieved and motivated, that the students actually appreciate the simulation game.

But a limitation is that it has to be done in smaller groups, most of the time. In the present case, the class was broken into two groups and two separate sessions were held. It needs a lot of creativity and planning on the part of the instructor. Sometimes, simulation kits have to searched and procured for complicated parts and assemblies which might not be readily available.

But, the above limitations can be overcome with some effort, in order to give the students a great learning experience. Some activities may be planned to cater to different learners and then continuous improvement may be done in the subsequent semesters.

Conclusion

It has been seen that there are different types of learners in the classroom. But there is a lack of awareness about the same, especially among the engineering teachers. If the instructors can cater to different learning styles by being aware and consciously trying different interventions or activities, then the student motivation in the class can be increased. The traditional lecture delivery method needs to be changed or complemented with innovative activities or interventions. The engineering instructors have to read literature in this area and

try to understand the students' psychology. The mismatch between the student learning styles and teachers' teaching styles can be reduced by using this paradigm. The student outcomes can be achieved more effectively, which is a very significant requirement in today's era of outcome-based education.

References

[1] N. Othman and M. H. Amiruddin, "Different perspectives of learning styles from VARK model," *Procedia-Social Behav. Sci.*, vol. 7, pp. 652–660, 2010.

[2] R. M. Felder and L. K. Silverman, "Learning and teaching styles in engineering education," *Engr. Educ.*, vol. 78, no. 7, pp. 674–681, 1988.

[3] M. Robert and E. Chevrier, "Does men's advantage in mental rotation persist when real three-dimensional objects are either felt or seen?," *Mem. Cognit.*, vol. 31, no. 7, pp. 1136–1145, 2003.

[4] S. Joy and D. A. Kolb, "Are there cultural differences in learning style?," *Int. J. Intercult. relations*, vol. 33, no. 1, pp. 69–85, 2009.

[5] R. S. Dunn, K. J. Dunn, and G. E. Price, *Learning style inventory*. Price Systems, Lawrence, KS, 1981.

[6] A. Soyoof, M. Jokar, M. A. Razavizadegan, and E. Morovat, "The effects of learners' brain hemisphericity on their degree of vocabulary retention: A case study of Iranian high school students," *Procedia-Social Behav. Sci.*, vol. 98, pp. 1844–1849, 2014.

[7] J. Choi, "Understanding Students' Beliefs About Knowledge and Learning in a Sociocultural Context: The Case of Korean Middle School Students BT - The Psychology of Asian Learners: A Festschrift in Honor of David Watkins," R. B. King and A. B. I. Bernardo, Eds. Singapore: Springer Singapore, 2016, pp. 53–70.