

Learning Theories for Tertiary Education - A Review of Theory, Application, and Best Practice

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Abstract - Tertiary education is an important element in economic and social development and a major determinant of a university student's career path. Learning theories describe how information is captured, processed and stored during a learning process. Better understanding of learning theories is very important for the university teachers to design their teaching process and thereby create an environment that facilitate higher order thinking and deep learning. This review describes different learning theories and their potential use in the tertiary education context.

Keywords—Learning Theory; Tertiary Education; Learning Styles.

I. INTRODUCTION

Every university student who gets an opportunity to enter to the tertiary education is a unique individual with a great potential who needs mostly a kind of a stimulating environment to grow and develop intellectually, physically, emotionally and socially. (i) A teacher who act as a guide; (ii) making learning exciting and allowing the natural curiosity of students to acquire knowledge and skills; and (iii) promoting respect for things and people; are three key elements that are most helpful to establish such a learning environment in tertiary education. Elaborating further, a university student should be a knowledge hunter and a teacher should be a guide who directs them to correct path instead of just being a primary source of information. As in the word of Albert Einstein, “Learning is an experience, everything else is just information”. Therefore, for students to construct knowledge, they need the opportunity to discover knowledge and practice skills by themselves. Providing opportunities for students to get hands-on experiences and allowing them to have adequate time and space to master the learning materials allow them to achieve individual discovery and construction of their own knowledge and skills. It is also important to give the students an opportunity to study things that are meaningful and relevant to their interests and career goals. Understanding and developing appropriate teaching tools and techniques around student interests also helps teachers to motivate students for learning and discovering knowledge. Further when students get ownership in their own learning, they are motivated to work hard and master the skills necessary to reach their learning goals.

Promoting respect for things and people is also important as it allows to create a positive and inclusive environment for all the students in the community.

In this paper our focus is to bring together the findings and key points from a review of literature associated with learning theories and how they can incorporate into tertiary education. This survey will provide a basis for a subsequent study to examine the factors affecting on skills development in the tertiary educational setting.

II. LEARNING THEORIES

Learning theories can be viewed as models or concepts that describe how information is captured, processed and stored during a learning process. According to Fernando (2014), these learning theories can be basically divided to into 6 main categories called: behaviorism, cognitivism, social learning theory, social constructivism, multiple intelligence, brain-based learning.

A. Behaviorism

Both Ivan Pavlov's classical conditioning and B. F. Skinner's operant conditioning lay the foundation for this theory (Woolfolk 1995).

a). Classical Conditioning

Under ‘Classical Conditioning’ the idea is to create a conditioned response by manipulating unconditioned stimulus and response with a conditioned stimulus. Ivan Pavlov's famous experiment further demonstrates the concept behind the theory of classical conditioning (or responding conditioning). Every time Pavlov brought out the dogs' food he rang a bell. After doing this for a certain period of time, Pavlov rang the bell without presenting food. The dog then found to be salivated just from the sound of the bell. Figure 1 shows an example on how university teachers can incorporate Ivan Pavlov's classical conditioning theory for their teaching process.

According to McKeachie and Svinicki (2010), one method to encourage students' participation is to create an expectation of participation. It is a common known fact that students drive from credits and marks. According to Davis (2009) “token method” is a good strategy to encourage students' active participation in in-class discussion. The idea is to award the student with a token for each and every active participation in in-class discussion. There can be students who are from cultures whose norms discourage speaking in public. However

this is one of the important skills the university students should develop before they enter to the work world. In many professional contexts they may need to speak up in groups, they may need to offer information, they may need to ask question or provide opinions for different solutions. Students cannot master these skills just by reading on how to do these things. It is one of those skills best developed with practice

and also it is one of those skills develop better with feedback. In-class discussion is one important tool that sharpens their ability in that aspect. Incorporating these type of rewarding methods to teaching activities encourages students to actively participate in in-class discussions and thereby master these skills.

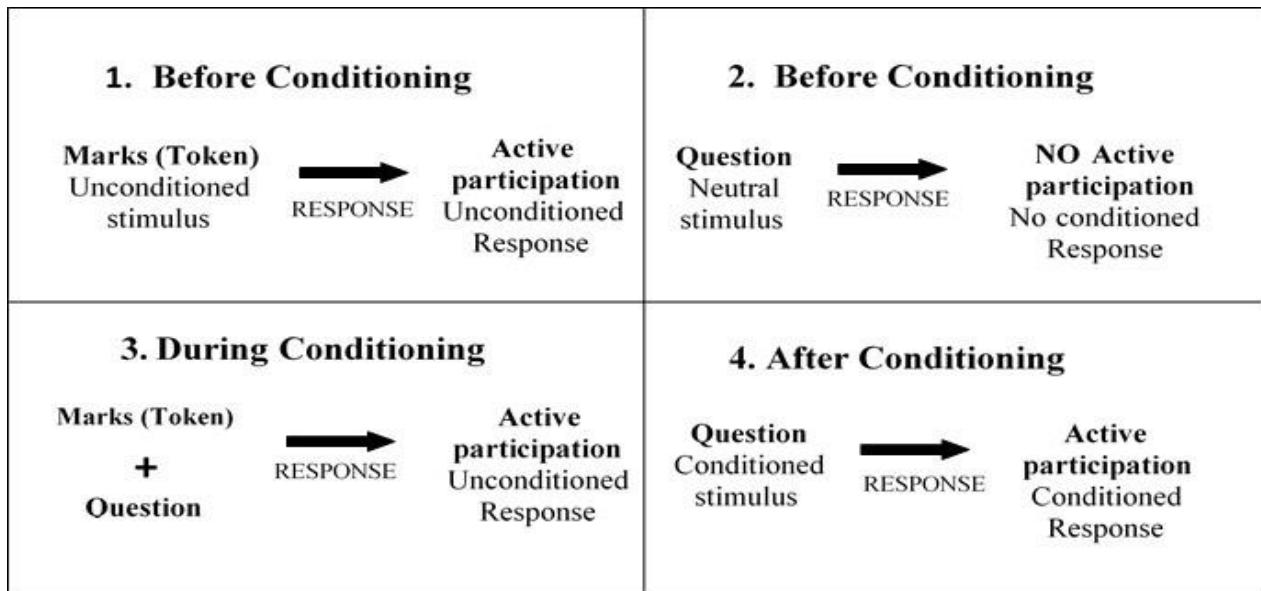


Figure 1: An Example on How to Use Pavlov's Classical Conditioning Theory to Promote in-Class Discussions

b). Operant Conditioning

Under operant conditioning controlled response is given based on the behaviour. This response can be either a reward or a punishment. (Woolfolk 1995). As shown in Figure 2 it is divided into four basic quadrants: positive reinforcement, negative reinforcement, positive punishment and negative punishment.

One can describe it as a learning technique that helps to control or develop a behavior via reinforcement of stimulus-response patterns. Skinner's experiments with pigeons by rewarding them upon a desired behavior further helps us to understand this concept. Using this technique, he was able to teach pigeons to dance and play bowling. In the same way, it is believed that humans develop their behaviors based on the rewards or positive reinforcement they receive. If students see that they are receiving positive reinforcement with the actions they are doing, it will encourage them to continue to do the same actions and thereby allow them to develop a long lasting positive behaviors.

III. DOMAINS OF LEARNING

There are three main domains of learning called, (i) cognitive: focus is on intellectual skills (knowledge) (ii) affective: focus is on the areas of feelings or emotions and (iii) psycho-motors: focus is on the areas of physical and manual skills (skills).

A. Cognitive Domain

The cognitive domain by Bloom et al. (1956) is the most used domain of the three domains where the primary focus is on the development of knowledge and intellectual skills. This includes recalling or recognizing information, procedural patterns and concepts that serve in the development of intellectual abilities and skills (Clark 1999). According to Atherton (2011), there are six major categories of cognitive processes starting from the simplest to the most complex called: knowledge, comprehension, application, analysis, synthesis and evaluation.

B. Affective Domain

The affective domain by Krathwohl, Bloom, and Masia (1964) describes how people deal with things emotionally such as values, appreciation, feelings, enthusiasms, attitudes and motivations. The five major categories that come under affective domain from the simplest behaviour to the most complex are, receiving, responding, valuing, organizing and conceptualizing; and characterizing by value or value concept. According to Atherton (2011) the attention given for this domain is low and is less intuitive in comparison to cognitive domain.

C. Psychomotor Domain

The focus of psychomotor domain is on the areas such as coordination, physical movement, and use of the motor-skill. Practicing is the key element for the development of these skills. Further these skills can be measured in terms of precision, speed, distance, procedures, or techniques in

execution. As summarized by Atherton (2011), the five major categories that come from the simplest behavior to the most complex are called imitation, manipulation, precision, articulation and naturalization.

Each of these three domains can be thought of as degrees of difficulties. That is one cannot effectively address higher level

skills until they achieve the lower level skills. According to Randall (2011), this divisions outlined are not absolutes and there are other systems or hierarchies that explain the development of these skills and knowledge and how to improve them. However, Bloom's taxonomy is easily understood and is probably the most widely used learning theorem.

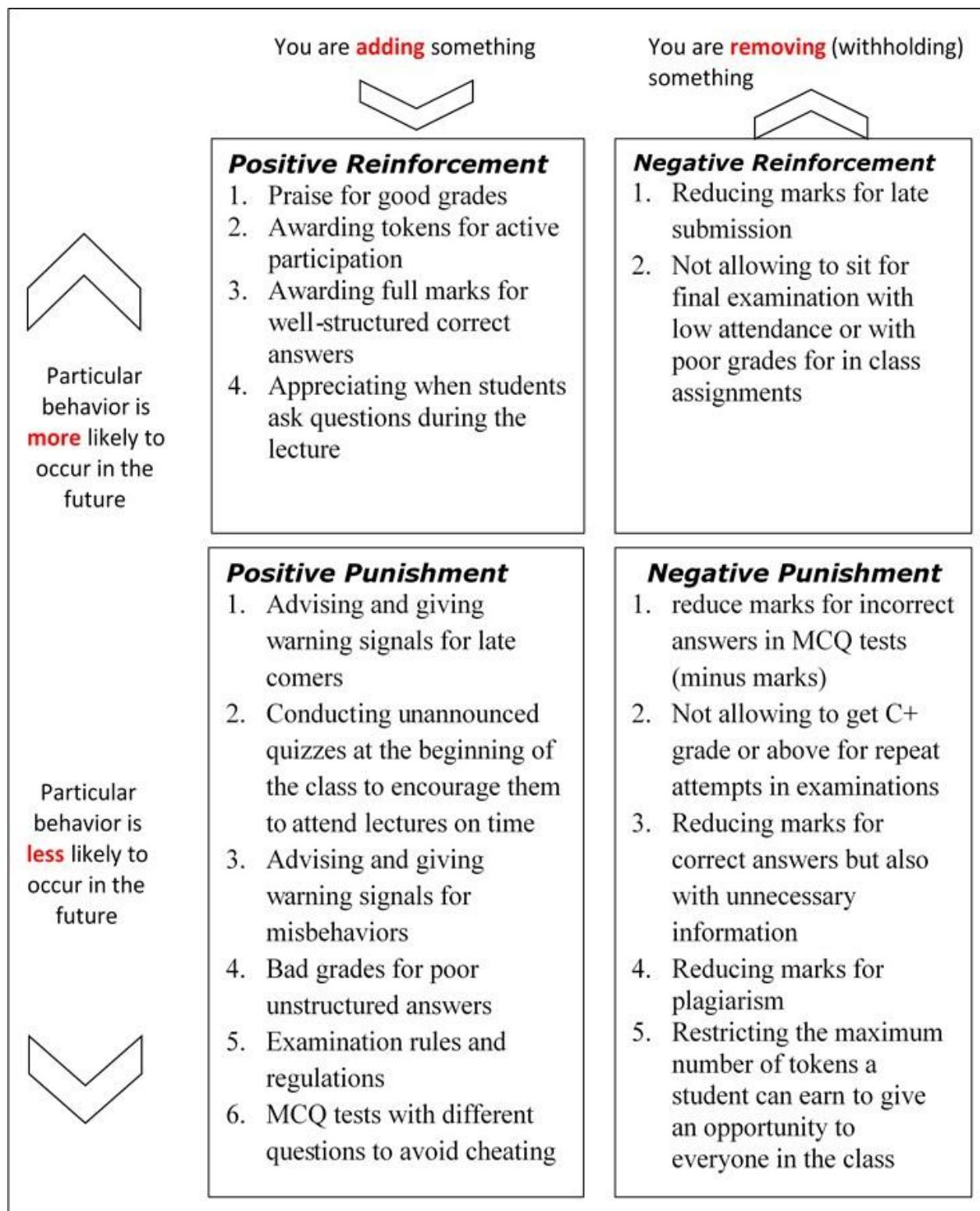


Figure 2: Examples on How to Incorporate Theory of Operant Conditioning to University Education

Unlike college students, university students are genuinely interested in master these skills as they are more matured enough to feel the sense of responsibility of their own learning. Their main expectation from the university education is to get an opportunity and environment to master these skills and thereby make themselves more prepared and qualified before they enter to the work world. However the two domains: cognitive and psychomotor are almost exclusively emphasized within most of the university educational systems while the affective domain is largely ignored. Of cause, the skills develop under cognitive and psychomotor domains are certainly useful in the learning process and they should not be ignored. However more attention should be given to bring the affective domain up to the same level as the other two, because, the best learning can be done only when all these three domains are utilized in conjunction with each other. Imbalance between these domains can make young people more aggressive and selfish and thereby hinder the opportunity to create a friendly healthy learning environment that support student leaning.

IV. LEVELS OF LEARNING

Taxonomy simply means “classification” (Atherton 2011). Bloom’s taxonomy and SOLO taxonomy are two well-known taxonomies that discuss under cognitive domain.

A. Bloom’s Taxonomy

Blooms’ Taxonomy is a systematic demonstration of how learners develops their level of performance from simple to complex in cognitive domain of learning. This comprises with six stages from the simplest level to the most complex called know, understand, apply, analyze, synthesize and evaluate (Woolfolk 1995).

Bloom’s taxonomy is not the only system of classification for cognitive domains. However, it is a widely accepted system as it clearly illustrate how students can gradually improve their intellectual abilities form simplest to complex and how and why certain questions, learning activities are better choices for assessing different levels of student mastery. It is university teacher’s responsibility to understand and aware about the existence of these different levels of student mastery ranging from simple recitation of information, to formulating informed opinions regarding complex problems and therby facilitate a learning environment that allows the student to achieve these levels.

According to Cox (1994) stage 1 and 2 of Bloom’s taxonomy (Know and understand) can be achieved either through “active” or “passive learning” but the remaining stages can only be achieved through “active learning”. So when designing the learning outcomes, lesson plans, university teachers should pay attention to select the most appropriate action verbs in order to guide the student to reach the intended learning outcomes. Another aspect of Bloom’s taxonomy is that, the words have been carefully selected such that they represent different levels of knowledge while making them measurable. For an example, the first level represents just knowing and for the teacher to measure the student’s level in that aspect, he can ask student to list some items of a given topic. It is also recommended to not to use the two words “know” and “understand” when designing intended learning outcomes as those words are so general. Instead university teachers can use

action verbs that come under both headings in order to guide the student for a particular action. After carefully designing the intended learning outcomes with the help of Blooms taxonomy, all the activities and assessment can be balanced and aligned according to those outcomes.

Therefore, Bloom’s Taxonomy is kind of a standardized language that articulating precisely what the university teachers need to do to promote students’ deep learning and higher order thinking skills.

B. Biggs’s SOLO (Structure of the Observed Learning Outcome) Taxonomy

SOLO Taxonomy is another systematic way of describing how a learner’s performance develops from simple to complex levels in their learning. It was developed by J. B. Biggs and Collis (1982), and was well described in (J. Biggs and Tang 2007). It has 5 stages starting from simplest to complex called pre-structural, uni-structural, multi-structural which are in a quantitative phrase and relational and extended abstract which are in a qualitative phrase.

Under *pre-structural* phase students gain the ability to acquire some unconnected information which has no organization and hardly any meaning. Then in *uni-structural* level students gain the ability to make simple and obvious connections, but their significance is not yet grasped as a whole. Under *multi-structural* level students further develop their ability to make number of connections between individual items and obvious connections, but still their significance as a whole are yet to be identified. Under *relational* students start to understand the significance of the parts in relation to the whole. Finally, under *extended abstract* students gain the ability to make connections not only within the given subject area, but also beyond it, and even develop the ability to generalize and transfer the principles and ideas to related matters.

Therefore teaching and learning activities in the university curriculum should be carefully designed such that the students can progressively master these levels. If not the knowledge and skills they acquire form the university curriculum would enable the students only to get through the examinations without giving any further support for them to meet the need and challenges of the work world.

V. LOWER ORDER THINKING SKILLS AND HIGHER ORDER THINKING SKILLS

A. Lower Order Thinking skills (LOTS)

Lower order thinking includes passive activities such as reading, writing, and listing. In lower order thinking it is not expected the student to apply the knowledge to solve a given (complex) problem, under this the student is expected to recall and slightly understand the materials. So if a person only obtains lower order thinking skills, he will not gain the ability to deal with real life situations or handle complex problems. However we cannot totally ignore lower order thinking skills as it lays the foundation for the skills required to move into higher order thinking (Higgins, Keen, and Falk 2012).

B. Higher Order Thinking skills (HOTS)

Higher order thinking is a learning process that is more difficult to achieve or guide to reach that level. It requires more cognitive process in the creation of new knowledge with in depth analysis, evaluation, and synthesis. Further it requires active learning and teaching techniques than that of when learning or teaching facts and concepts. Critical thinking and problem solving abilities are also required to move into higher order thinking (Higgins, Keen, and Falk 2012).

As described in Section IV A), the 6 levels in the Bloom's taxonomy are labeled to differentiate between levels of thinking and learning. The first two levels of the taxonomy: know, and understand focus on helping learners to develop their lower order thinking skills [LOTS] whereas the top four levels: apply, analyze, synthesize and evaluate focus on helping learners to develop their higher order thinking skills [HOTS] (Alexander 2012).

From all these things we can understand that the process of learning is hierarchical in nature: in other words learning moves upwards from relatively simple straightforward activities to much more complex activities that require higher order knowledge and skills. For example, it is much easier to 'list down central tendency measures' as 'mean, median, mode' than to 'choose which measure is most suitable to summarize a given set of data'. Therefore teaching and assessment activities should be designed such that student can develop both LOTS and HOTS while giving more emphasis on HOTS.

VI. DEEP AND SURFACE LEARNING

According to Floyd, Harrington, and Santiago (2009), 'deep learning' is about the ability to achieve higher order thinking skills such as synthesis and evaluation, and a personal commitment to learn the material. In contrast, 'surface learning' is associated with rote learning and the focus is mostly on earning a passing grade instead of gaining thorough understanding of the concepts. The students who use only surface learning strategies, their main focus in their learning process is to avoid failure with the minimum amount of effort and involvement (Cano 2007, Draper (2009)). Shallow learners also believe that they can understand the material correctly. But the truth is they usually fail to see the connections between concepts that deep learners do. Deep learners on the other hand can transfer the concepts they have learned to a variety of situations and thereby create various connections within their knowledge and understanding.

From the view of mathematics and statistics, surface learning includes activities such as memorizing facts and formula without understanding the logic. One problem that merge with surface learning is that it may be enough to support short-term memory but not enough for long term memory. On the other hand deep learning involves of the hard work of understanding where the given formula come from, the logic behind it, connecting new information with the existing knowledge, solving real-world problems using the knowledge etc.

From Bloom's and SOLO taxonomy it is quite obvious that knowing is not just a "yes or no" thing. Instead, there are several levels of understanding from surface to deep. Therefore when designing questions for tutorials, examinations etc. university teachers should give attention to

guide students to reach to each of these knowledge levels and thereby move from surface to deep learning and also LOTS to HOTS. It is also important to note that we cannot totally ignore surface learning as it provides the base for deep understanding. Our attempt should therefore focus not to eliminate surface learning but to use surface learning to lay the foundation to help the students to gain deep understanding.

According to Floyd, Harrington, and Santiago (2009), students who are sufficiently engaged with course materials and recognize the value of a course as high, have a greater chance to get an overall positive learning experience. Further these students are more likely to incorporate lot of deep learning strategies during their learning process. In contrast, learning strategies associated with lower course values and less engagement contribute only to surface learning. Also it is quite obvious that the modern work world expects more diverse skills and abilities rather than just memorizing fact and figure from a university student. Therefore, university students should always try to engage in deep learning instead of merely depending on surface understanding about the materials.

VII. ACTIVE LEARNING

According to Moore and McCabe (1989), for effective teaching of introductory statistics courses specially for those who do not want to become professional statisticians but to become professionals who will use statistics for their work, the curriculum should maintain a balance between *content* (what teachers want students to learn), *pedagogy* (what teachers do to help students learn) and *technology*. Defining intended learning outcomes with the help of Blooms' taxonomy and properly inform the student about the intended learning outcomes allow the students to know what teachers want them to learn (*content*). Equally important the teachers to understand what they should do to guide the students to achieve the predefined intended learning outcomes.

In the educational literature, integrating active learning methods to teaching process is one of the most recommended and widely accepted strategies that allow the teachers to improve teaching effectiveness at most academic levels. According to Ledolter (1995), active learning methods can include activities such as projects, in class-discussion in which the students get a predominant role and ownership in their own learning. In addition to that other active learning methods such as laboratory exercises, role-play, in-class discussions, group projects, and activities with class-generated data, student written and oral presentations can also enhance students' enthusiasm for learning. According to Moore and McCabe (1989) with the rapid growth of technology, incorporating the available tools and techniques (e.g., statistics software) is equally important to emphasize statistical literacy rather than tedious calculations. According to Kvam (2000), 'cooperative learning' is another form of active learning in which small group interaction within the classroom helps students to gain knowledge through peer teaching and team work. Further, Johnson, Johnson, and Stanne (2000) believe that cooperative learning methods have a positive impact on student learning as it allows to create a dynamic environment where students are motivated to ask questions and comment on related matters that appear unclear to them.

According to Northern-Ireland-Curriculum (2000), by incorporating active learning sessions teacher can change their role from “teacher-centered classroom” to “learner-centered classroom”; “product-centered learning” to “Process-centered learner”; “teacher as a ‘transmitter’ of knowledge” to “teacher as an ‘organizer’ of knowledge” and “teacher as a ‘doer’ for students” to “teacher as an ‘enabler’ facilitating students in their learning”. It also make an impact on the behaviour of student by changing his role from “being passive recipient of knowledge” to “active and participatory learner”; “focusing on answering questions” to “asking questions”; “being Spoon fed” to “taking responsibility of their own learning”; “competing with one another” to “collaborating in their learning”; and “wanting to have their own say” to, “actively listening to opinions of others”.

However, active learning classes can be more labor intensive and time consuming. Sometimes the activities could take quite a long time than was expected. Incorporating properly designed ‘lesson plans’ (Ding and Carlson 2013) will allow the university teachers to overcome these problems.

VIII. LEARNING STYLES

Students are different from one another and it is important to give them an opportunity to show their talents and learn in a way that work for them. According to Bourne (2014), the term ‘learning styles’ refers to the concept that individuals are different to one another with respect to what mode of instruction or learning technique that work most effectively for them.

Assessments of learning styles usually involves asking people to evaluate and rank what type of presentation tools and techniques they prefer and/or what kind of activities they find most engaging effective for their learning process (Pashler et al. 2008). For an example some learners can capture things very easily through visual forms of information such as pictures, plots and diagrams, while others capture things more easily through written and verbal explanations. Some people prefer to learn actively and interactively while others work better on their own.

Considering these different aspects many different models have been introduced for learning styles. Kolb’s learning styles model, Neil Fleming’s VAK/VARK model, Peter Honey and Alan Mumford’s model, Anthony Gregorc’s model, Sudbury model of democratic education, NASSP Learning Style Model are to name a few. However this section focuses only on the first two models that are easier to apply, more popular in higher education and more relevant to university students.

A. Kolb’s learning Styles Model and Experiential Learning Theory

According Kolb’s learning theory there are four distinct learning styles that give rise to four-stage learning cycle. According to Kolb’s learning Cycle the process of effective learning comprises with a series of events that integrates the functions of feeling, reflecting, thinking and acting. The learner moves through a cycle comprising of four phases: concrete experience (CE), reflective observation (RO), abstract conceptualization (AC) and active experimentation (AE). For an example if we think about an experiential learner, by directly involving himself in new experiences, the

learner enters the first phase of the cycle, concrete experience (CE) phase. As he observes others and reflects on his own and other’s experiences, he proceeds to the reflective observation (RO) phase. Next, he attempts to integrate his observations and perceptions into logical theories, thus moving into the third phase of abstract conceptualization (AC). When he uses concepts to make decisions and solve problems, he exhibits the final phase of the learning cycle, active experimentation (AE). It is important to note that learners can enter to the cycle at any point according to their preference on the activities associated with a particular part of the cycle.

B. Neil Fleming’s VARK Model

Another most common and widely used categorizations of the various types of learning styles is Fleming’s VARK model (Fleming 2001). It categorizes learning styles into four main categories called: Visual, Auditory, Read-write, and Kinesthetic. According to Dzubak (2007), stimulating the brain via multi-sensory models can increase the likelihood that the information will be retained or remembered.

IX. CONCLUSION

It is clear that the process of learning is hierarchical in nature: in other words learning moves upwards from relatively simple straight-forward activities to much more complex activities that require higher order knowledge and skills. Further, in tertiary education both the teacher and the student should take active and equal responsibility on the learning process in order to achieve a sustainable learning experience and a strong, solid foundation on which to build their careers.

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