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Using new learning theory in maritime education

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Abstract: The psychomotor and affective domain was not incorporated effectively in the Bachelor Degree in Maritime Technology as compared to the cognitive domain. Hence, this study aimed to develop a training module for naval cadet officers based on psychomotor and affective domains using a simulator. The problem statements were identified through a gap analysis on the competencies of cadet officers who had undergone training on board Royal Malaysian Navy ships. The gap analysis suggested that there were critical weaknesses in the basic naval competencies and soft skills that need to be overcome by the Psychomotor and Affective Training Module in Navigation (LAKSANA). The module was developed based on instructional design ADDIE Model (Analysis, Design, Develop, Implementation and Evaluation) and Constructive Alignment Principle using the Navigation Simulator. This training module used the Behaviourism and Constructivism Theories through student-centred learning to develop cadet officers' characters based on Bloom Taxonomy.

Key words: cognitive domain; maritime; psychomotor

1. Introduction

This paper presents a literature review covering theory and teaching model that was applied in this research. Two teaching theories that has become the basis of this research is the theory of behaviorism and constructivism theory. Both theories have been applied in the implementation of LAKSANA module. The ADDIE Model is also being used as instructional design in developing LAKSANA module. In addition, the principles of Constructive Alignment are applied to the implementation of LAKSANA module as to encourage the psychomotor and affective domain in learning for the cadet officers. Four areas of maritime training modules at the University of Bremen, Constanta Maritime University, Tian Jin University and the Academy of Military Training (ATMA) have made a comparative study to develop an effective module to overcome the basic competence of the profession and to improve the naval cadets' soft skills. Finally, this paper presents a literature review concerning the appropriateness of the use of simulators in teaching and learning to apply the psychomotor and affective domain of students.

The challenges faced by the country in human capital development are to have the ability to improve its citizens' intellectual development (Khaled Nordin, 2011). The development of human capital or human resources is among the agenda emphasized by the Government of Malaysia in 10th Malaysia Plan (10th MP). The ability of human capital in various fields will determine the country towards achieving Vision 2020. A country will be left behind if they do not have the human capital that can be leaders to future generations. Education is a very effective medium for human capital development. Planned and well organized education policies would be able to form a perfect and balance human capital for national development in the 21st century (Khaled Nordin, 2011).

Higher Education Institute (HEI) was given the responsibility to generate human capital that can meet the needs of the country Malaysia (Khaled Nordin, 2010). IPT with support from the Ministry of Higher Education (MoHE) should provide the policies for the production of human capital required by the state. In line with this requirement, National Defense University Malaysia (UPNM) aims to produce intellectual leaders of character to meet the human capital needs of the stakeholder (NDUM Strategic Plan, 2009). Thus, the graduates should develop the competencies in military profession and soft skills in academic studies they are in. The Ministry of Higher Education also stressed that each academic program must implement the cognitive, psychomotor and affective in teaching and learning. With the implementation of higher taxonomic levels in all three domains, NDUM is sure would have meet the human capital needs of the Malaysian Armed Forces (ATM). Academic programs offered in NDUM such as Bachelor of Maritime Technology (BMT) should provide an appropriate pedagogy to produce graduates specifically for the Royal Malaysian Navy (RMN).

In education, the term pedagogy means teaching procedure which contains the principles and methods of teaching with scientific research in order

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to get effective teaching outcome (Soon Sang Mok, 2011). Strong knowledge in pedagogy allows teachers to choose the most effective teaching methods, providing educational materials that attract, engage students in learning, provide opportunities for interaction, priority assessment and provide a boost in learning style (Abdull Sukor Shaari, 2011).

2. Related works

A theory is an explanation that has been proven through scientific studies about knowledge (Clement & Battista, 2009). Learning theory is a description of something that causes a learning to show its effect (Cobb, 1988). According to Clement and Battista (2009) theory of learning may be classified to behaviorism, cognitivist and constructivism. Behaviorism theory introduced by Ivan Pavlov and later strengthened by Thorndike and Skinner stated learning is related to a change in behavior (Merrian & Caffarella, 1999). Behaviorism thinkers devote test on the relationship between the stimulus and the reprisals that led to changes in the behavior of the animals. In general theory of behaviorism expressed that teaching and learning may affect a person's behavior or behavior for good or otherwise. This theory also explains the person's behavior may be predictable, observed and controlled by researchers.

Though cognitivist also argues that learning is an internal process which only occurs in human's mind that cannot be observed directly through behavior (Carroll, 1993). He expressed cognitive experts like Piaget focused the study on the learning in problems solving process and thoughts according to age level and capability of students. The learning theory that was presented is aimed more on to critical thinking, problem solving, discovering and categorization. According to this theory, humans have cognitive characteristic in which during learning process the human brain is functioning in arranging all the knowledge available in mind.

As a result of the Cognitivist thinking, another thought about how humans learn which is called constructivism exist. According to constructivist, knowledge is actively fostered by an individual who thinks (Bruner, 1986). A person does not passively absorb any knowledge delivered to him. Students will learn something new through the continuation of available knowledge to form a new knowledge through mutual interaction with teachers and friends. Most thought believes ordinary people build knowledge and not just receive knowledge from others. Humans are able to build knowledge by testing their mind towards new situations and combine it with available knowledge (Cobb, 1988).

Several models such as Robert Glaser Model, SIM Model, Taba Model, Cooperative Model and Inquiry Model have been identified to compare each model of teaching and learning as well. Robert Glaser (1962) suggested a model that separates teaching process to the four main components namely the objective of teaching, knowledge of students, teaching and assessment methodology. This model emphasizes students' feedback as an important aspect in the process of teaching and learning. Meanwhile, the objective of teaching needs to be determined in accordance with the available knowledge of the student. Once the objective of teaching is identified, the teaching methodology should be chosen to achieve the objective set. Finally, the assessment should be conducted to the teaching process with the aim to improve the teaching implementation to increase its effectiveness. Robert Glaser teaching model has been applied through the design, implementation, assessment and feedback against LAKSANA module for the teaching and learning process.

Teaching Model SIM (Strategic Instruction Model) also describes that teaching process is done through the interaction between lecturers, students, the content and objective of learning. The SIM model was introduced in the Learning Research Center, University of Kansas in 1978 based on teaching through communication between lecturers and students in conductive learning environments. Based on this model, the learning objective should be determined for any learning goals. The SIM model highlights a good relationship between lecturers and students so that the two way interaction will create an effective learning atmosphere. This model also emphasis on the conductive environments in accordance with education aims. LAKSANA module makes use of this model through the two way communication and simulator is used to create a conductive environment as to achieve optimum learning outcomes. Taba Teaching Model stressed that the preparation of teaching materials in a system can trigger the thinking skills of students (Taba, 1962). The order of knowledge in the process of teaching and learning is prioritize in this model. Taba Model stimulate students in the cognitive domain onto a learning concept that make up the facts by the similarities and differences, classify facts to a category, summarize the relationship between categories and finally made a conclusion. Based on this model, researchers can plan and develop teaching content of LAKSANA module to the psychomotor and affective domain based on Bloom's Taxonomy.

Similarly Cooperative Learning Model is a teaching model that aim to help students learn the knowledge or basic skills which is taught based on student-centered learning method (Slavin, 1987). The model was formed specifically to stimulate learning which involves procedure knowledge from the finesse principles to advanced proficiency which is achieved gradually. This model requires students to observe actions taken by the teachers before students do by themselves. It also applied through group work in LAKSANA module to enhance psychomotor and affective domains of a cadet officer.

Inquiry model is a survey process to get the answers or conclusion from raised questions and problems. Survey method requires students to

identify the problem, forming a hypothesis or research question, planning the research activity, conduct the study in order to gain answer before making a conclusion. This model suggests two types of inquiry techniques, namely guided inquiry and open inquiry. Guided inquiry requires lecturers to guide students to run all the appropriate research process carried out in baccalaureate level. Meanwhile, in the open inquiry, the research process is conducted by the students themselves which is suitable to be implemented at a higher level of education such as postgraduate and doctor of philosophy studies. Inquiry Model was applied to get the answer for the competency level of cadet officers upon practical training on board of a ship and also the compatibility of the simulator to be used in the implementation of LAKSANA Module.

In order to process an effective learning, the LAKSANA module needs to ensure that the cadet officers are ready for learning. The LAKSANA module content was planned according to the capability of students and sorted by level of Bloom's Taxonomy. Teaching aid tool is provided through the use of simulators to create an atmosphere that is conducive for both teaching and learning. The use of simulator will also attract students' interest to learn since it will create a new experience in the maritime field. Curiosity towards the navigation equipment in the simulator will motivate them in learning. The LAKSANA module using the basic tasks of a professional seaman and real scenarios on board of a ship to raise the experience and interest of a cadet officer. As to perpetuate the memory during the learning process in LAKSANA module, cadet officers need to have knowledge before training and able to relate theory with the assignments given. Dale (1969) states that the understanding will be achieved exceed 90% if learning is done through the assignment. LAKSANA module diversifies the assignments based on marine soldier profession and soft skills required. Inauguration is made continuously following the level of psychomotor and affective domain. At the end of the module, the assessment test will be conducted to know the competency level of each cadet officers.

Facilitator is guiding cadet officers to apply the knowledge learned in the lecture via assignment in the module. Facilitators will stimulate the cadet officers to become critical-thinking persons before making a decision to resolve a problem. In addition, cadet officers are trained to communicate effectively to work in a team. Discipline, morale and positive attitude is being taught to the cadet officers through the assignments which are related to the Navy profession.

3. Discussions and findings

Behaviorism Theory, which is also known as attitude theory focuses on human behavior that can be studied, controlled and measured (Cannon & Caffarella, 1999). A study made by the Behaviorist found that a human is responding to a stimulus. Strengthening generated by rewards or incentives to stimulate student acts including how they learn something new.

Behaviorist believes changes in behavior will occur as a result of a new experience (Merrill, 2001). A person is considered to have learned something if he can show changes in behavior. According to this theory, the important thing is that the input in a form of stimulation and the output as the response to someone. For example, the stimulus is a lesson given by a teacher, while the response is a reaction of students towards the stimuli. Behaviorism theory prioritizes evaluation to determine changes in the behavior of a targeted student.

Among the personalities involved in the formation of behavioral learning theory are Ivan P. Pavlov, JB Watson, Edward L. Thorndike and B.F. Skinner. According to the behaviorist, learning is permanent changes that occur in a person due to practical or experiences. Behaviorist focus on behavior aspects of human in which the changes can be observed and measured. Most behaviorist learning theory is developed through observation and tests on the changes in the behavior of the animals studied. Behaviorism theory is very influential in the 1950s and 1960s and is still used to this day. The theory of behaviorism theory consists of classical conditioning Pavlov, Watson classical conditioning theory, theories of Edward Thorndike and Skinner's theory of operant conditioning.

According to Pavlov, the stimulation can cause a reaction resulting from a given stimulus. For example, when cadets enter the simulator, they feel excited because the experience of being in the simulator is unprecedented. Watson and Rayner also have conducted studies to prove that human emotions can be classified as classical conditioning. Watson said that the teacher can influence learning through stimulus and generated response. In the learning process, the theory put forward by Skinner was named the Operant Conditioning theory in which operant means response that becomes the elements in producing changes towards students (Skinner, 1954).

According to Skinner again, learning occurs in operant conditioning process through the various response activities undertaken. The theory of Operant Conditioning must be strengthening just after the reaction occurs to the students. Positive reinforcement is a follow-up stimulus given after the occurrence of a behavior that may increase the required behavior. Soon Sang Mok (2011) stated that the strengthening of a stimulus can increase the probability of a recurrence of an operant behavior. According to the definition given, it can be concluded that the strengthening of a stimulus that can cause a recurrence of a desired behavior. Consolidation is in two aspects, namely positive reinforcement and negative reinforcement. Positive reinforcement is a reward given to encourage the person to do it consistently. This consolidation is considered by Skinner as a basis for enhancing the effectiveness of the learning process.

Thorndike (1913) states that training is a very suitable to be implemented as to increase the stimulation of the response if it is made on a recurring basis. For instance, LAKSANA training module can be repeated to provide opportunities for cadets to practice according to their capabilities. Thus, the cadet officers became even more impressed because behavioral changes are resulted from the training module which has been implemented repeatedly in the simulator.

Thorndike's theory has been applied in LAKSANA module in order to develop the strategies for an effective teaching and learning. Among the issues highlighted in the LAKSANA module are as follows:

a. The facilitator always identifies the readiness of the cadets in the aspects of psychomotor and affective domain.

b. Creating stimulus through training in the simulator to ensure the effect of learning is exciting.

c. Reward or positive reinforcement such as marks, grades and points is given after undergoing the test.

d. Determining a conductive learning environment with navigation equipment that comes in the simulator.

Behaviorism theory requires the facilitator to observe the behavior of a cadet officer, control their behavior and measure the abilities shown. The facilitator should give incentives such as motivation to the cadets, especially to those who have lack of interest in the training module. Through the stimulus given, the facilitator can observe the behavior of cadets before and after training. The ability of cadets are tested and measured using the assessment rubric developed by the researchers. Facilitators may indirectly shape the character based on the assessment performed against the cadet officers.

Control of the students is very important during the learning process. Skinner operant theory was applied in the teaching and learning process as in LAKSANA module. Facilitator gives positive reinforcement in order to attract cadets to participate actively when LAKSANA module is conducted. When cadets show behavioral changes, facilitator will motivate them through words of encouragement after a task is done correctly. When the cadets make a mistake, the facilitator can give words of encouragement so that they try again and not give up so quickly.

The facilitator can provide strengthening continuously, periodically or after a training session of LAKSANA module. The facilitator can consolidates the training continuously and observing the reaction shown by the cadets. Consistent and ongoing guidance is needed to improve understanding of officer cadets in the LAKSANA module. Behaviorism theory states that a consistent reinforced stimulus can form a desired norm in teaching as well as learning (Skinner, 1954). To determine whether the behaviorism theory can be applied as planned, LAKSANA module was developed based on the following:

a. Specific tasks for each training session in LAKSANA module will be explained to the cadets before being implemented. The task given is being tested first through a pilot study to determine the feasibility and appropriateness.

b. The objective of each Psychomotor and Affective Module has been set in LAKSANA module. The objectives are stated specifically and brief to the cadets.

c. LAKSANA modules contained the psychomotor and affective domain tasks which are totally based on levels in Bloom's taxonomy. Tasks will be identified beginning from an easy stage before undergoing a more difficult task. The ability in early stage must be achieved before moving to a more challenging task.

d. A consolidation application is achieved through a continuous formation of character in LAKSANA module. Training modules are repeated by the officer cadet with the guidance of a facilitator. Cadet Officers are given the opportunity to repeat at least three times for each training module. The effectiveness is measured by the assessment after each modules has been undergoes by cadets.

e. Cadet officers preparedness is achieved through the continuation of existing knowledge and new knowledge to be learned. New learning situations are created through simulation in simulator technology in order to boost the motivation of cadet officers.

f. Drills are carried out so that the cadets achieving the required competencies. Training in the LAKSANA module will be diversified according to the learning outcomes for training modules.

g. The feedback received from the facilitator and officer cadet as a guide to improving the LAKSANA module.

Constructivism theory according to Bruner (1986) is a teaching based on the human ability to learn something. Constructivist thought that humans would be able to build knowledge and not only gain knowledge from others. Cobb (1988) stipulates that students build knowledge through existing experience and applying it to new knowledge obtained by their own intellectual. Constructivism is a theory of teaching and learning that support the basic principle of knowledge built by students themselves (Clements & Battista, 2009). Students who have the knowledge must get the guidance from the lecturers so that they can build new knowledge.

The theory of constructivism encourages students to actively participate in educational activities and lecturers only guide students to carry out these activities (Cobb, 1988). Bruner (1986) describes the students-oriented learning enable students to analyze their own experience and encourage them to become more responsible to themselves. In constructive learning, the students build knowledge through a combination of new information with existing knowledge for the purpose of understanding in learning (Clements & Battista, 2009). This means students who attend college should have knowledge in topics that have been

studied. The basic principles of constructivism states that learning occurs when students are able to restructure existing idea and relates them with a new idea. Constructivist learning theory also states that learning is formed through the build of knowledge based on experience (Clements & Battista, 2009). Learning is formed as a result of existing experience and knowledge. According to this theory, the lecturer should provide appropriate activities to link existing knowledge with new knowledge to be learned.

Bruner (1986) consider learning as a constructive process because the individual is required to rearrange the perception in their mind first. In the context of the theory of constructivism, knowledge is built in the mind based on actual experience, which is knowledge built up through prior learning with the latest learning associated with it. Students built knowledge actively in constructive learning when they are able to balance the role as a lecturer and a student to rely on each other (Bruner, 1986). The lecturer who acts as a facilitator should welcome students who have different characteristics. Constructivism theory requires lecturers to provide a suitable method of transferring knowledge to students.

Constructivism is an approach that provides opportunities for students to develop an understanding. Based on the experience and existing environments, lecturers should be more focus on the students' needs. Constructivism can be done in various forms such as student-oriented learning, case studies, cooperative learning and collaborative learning (Bruner, 1986). Constructivism theory is applied to the formation of character in cadet officers through cooperative learning as in LAKSANA module.

Cooperative learning requires a lecturer plays an important role as a facilitator while the students are directly involved in learning activities (Abdull Sukor, 2011). The lecturers should encourage them to interact with each other and exchange opinions between them to facilitate the construction of knowledge. The simulator used has various types of equipment that can encourage and stimulate their learning as to build their knowledge. Student-centered learning is the result of activities undertaken by them and not from the teaching which is done passively (Clements & Battista, 2009). Lecturers act as facilitators who help cadets to develop knowledge in learning. Lecturers will identify their existing knowledge and make teaching plan methods that are suitable for them. To implement LAKSANA module lecturer should provide training scenarios in the simulator to give an opportunity for the cadets to build their knowledge. In constructivist learning, lecturer acting as guides to stimulate the construction of knowledge through problem solving, a conducive environment for learning, an observer who can monitor learning and encouraging progress in building new knowledge (Winn, 1993).

The role of cadet officers in constructivism learning also requires them to be responsible in their study. Cadet Officers should also have the initiative to ask questions, analyze and make decisions in order to solve a problem. Discussions are also important in helping cadets to strengthen their ideas, express opinions and listen to ideas from their colleagues in groups before reaching a decision. The cadet officers should also have information and communication technology skills to help them to get new ideas and knowledge. Constructivist learning occurs when a cadet officer combine existing knowledge with new knowledge to form a thought or idea. The lecturers will guide and assist cadets in the learning process in which the lecturer acts as a facilitator. The advantages of constructivism learning caused the cadet officers to become a critical thinking individual in understanding a problem, build confidence and encourage their leadership.

4. Conclusion

In conclusion, a quasi-experimental method was used to measure the effectiveness of this module through paired samples t-test before and after the cadet officers did their trainings. The quantitative data were collected from 38 cadet officers who had undergone the training module for 14 weeks. The quantitative analysis proved that the LAKSANA module was very effective in developing psychomotor and affective domains that eventually overcome the competencies and soft skills weaknesses of the cadet officers. In addition, qualitative analysis through responds from senior naval officers, maritime technology lectures and cadet officers themselves also confirmed the effectiveness of the LAKSANA module. The findings of the research has contributed to the development of a training module, human capital development for the navy and creating assessment mechanism for psychomotor and affective domain to evaluate the cadet officers performances.

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