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International Conference on Education, Science and Technology 2019 Journal of Physics: Conference Series 1387 (2019) 012037 IOP Publishing doi:10.1088/1742-6596/1387/1/012037 1 Implementation of Problem-Based Learning to Improve Critical Thinking Skills in Entrepreneurs Learning Hasanah, and Muh Nasir Malik Universitas Negeri Makassar, Makassar, Indonesia Abstract. Critical thinking skill is highly required to face the industrial era 4.0

in the 21 st century that is integrated into the knowledge, skills and attitudes and mastery of ICT. The purpose of this study was to see the effect of applying Problem Based Learning to improve critical thinking skills in Entrepreneurship learning. This research employed the quasi- experimental method to compare the results of the experimental class treatment with the control class.

The design used in this study was the non-equivalent control group design. The sample of this study was students of the Electronics Engineering Education study program at the Faculty of Engineering, Makassar State University who were registered in the entrepreneurship course.

The results showed that: (1) the application of Problem Based Learning on Entrepreneurship Learning could significantly improve critical thinking skills, and (2) the application of Problem Based Learning could improve student learning activities. 1. Introduction The development of the 21st century is mainly indicated by the widespread use of information and communication technology in all aspects of life.

Technology connects the world that transcends geographical boundaries causing it to be limitless. The development of information and communication technology has made

changes to the qualifications and competencies needed in the workforce. Changes in the standard of academic performance have occurred along with the development of information communication technology (ICT) and global economic growth [1]. Changes in standards should be accompanied by some adjustment on the educational sector to prepare students facing it.

Information and communication technology facilitate communication between members of the community and the workforce that is no more limited by both space and time. Global economic growth demands increasingly fierce competition in every aspect of life, thus the market is no longer limited by geographical barriers, but has become global. Students in the 21st century need to be equipped with ICT skills and understanding of global economic developments.

The learning process must accommodate them. The application of information and communication technology in all aspects of life in the 21st century requires a change of competence needed in the workforce. The results of the Trilling, B.,

and Fadel, C [2] study state that graduates of high school, diplomas and higher education are still less competent in terms of;1) the oral and written communication; 2)critical thinking and problem-solving skills; 3) work ethics and professionalism; 4) teamwork and collaboration; 5) work in different groups; 6) the use of technology; and 7) project and leadership management. The competencies and abilities that must be possessed by someone in the 21st century are very complex.

According to Wagner (3), there are seven types of life skills needed in the 21st Century, namely: 1) the ability to think critically and solve problems; 2) collaboration and leadership; 3) agility and adaptability; 4) initiative and entrepreneurial spirit; 5) ability to communicate effectively both orally and in writing; 6) ability to access and analyse information; and 7) curiosity and imagination.

Education in the 21st Century integrates the knowledge, skills, and attitudes, as well as the mastery of Information and Communication Technology (ICT). Those aspects can be developed through various models of learning activities in accordance with the characteristics of competencies and International Conference on Education, Science and Technology 2019 Journal of Physics: Conference Series 1387 (2019) 012037 IOP Publishing doi:10.1088/1742-6596/1387/1/012037 2 learning materials.

The skill needed in education in the 21st Century is the Higher Order Thinking Skill (HOTS) which is indispensable in preparing students to face global challenges. 21st Century Skills in the current industrial era 4.0, which are integrated into Knowledge,

Skills and ICT attitudes and mastery skills can be developed through; 1) Critical thinking skills; 2) Communication skills; 3) Creativity and innovation skills; and 4) Collaborative Skills. The four skills are packaged in the learning process.

Barry [4] identified ten skills needed to work in the 21st century, namely; 1) critical thinking skills; 2) communication; 3) leadership; 4) collaboration; 5) adaptability; 6) productivity and accountability; 7) innovation; 8) global citizenship; 9) ability and spirit of entrepreneurship; and [10] ability to access, analyse, and synthesize information. Education offered in the 21st century must prepare students to face global economic competition.

Partnership for 21st Century Skills emphasizes that 21st-century learning must teach 4 competencies, namely; 1) communication; 2) collaboration; 3) critical thinking; and 4) creativity. Furthermore, Frydenberg &Andone [5] stated that to face learning in the 21st century, everyone must have critical thinking skills, digital literacy knowledge and abilities, information literacy, media literacy and mastering information and communication technology.

Based on several opinions and studies related to 21st-century skills, it can be concluded that 21st- century learning must teach 4 competencies, namely: communication, collaboration, critical thinking, and creativity. However, this study examines critical thinking skills only. According to Redecker et al. [6], critical thinking skills include the ability to access, analyse, and synthesize information that can be learned, trained and mastered by students.

This is in line with what Yasushi Gotoh [7] revealed, "Critical thinking as a set of skills and dispositions which enable one to solve problems logically and to reflect autonomously by means of cognitive regulation on one's own problem-solving processes. Meaning, it is a set of skills and tendencies that allow a person to solve problems logically.

Critical thinking skills can also be interpreted as a person's thinking ability in making decisions. With critical thinking skills, a person is able to think rationally and logically in receiving information and systematic in solving problems. Critical thinking skills can be referred to as the ability to analyse an idea using logical reasoning.

Facione, Facione, and Sanchez [8] said that "Critical thinking is a process of making a reasoned judgment based on consideration of available evidence, contextual aspects of a situation, and pertinent concepts". Based on some experts' opinions, it can be concluded that critical thinking skills are the ability to think logically, reflectively, systematically and productively which are applied in making judgments and making

good decisions.

Someone needs to have critical thinking skills and need to learn them because these skills are very useful and act as provisions in facing real life, and also these skills increase the independence of students. This point is very relevant to entrepreneurial learning. Development of critical thinking skills of students on entrepreneurship learning is done through applying Problem Based Learning.

Entrepreneurship courses are compulsory subjects for students of the Faculty of Engineering, Makassar State University. The aim of entrepreneurship learning is to build the entrepreneurial spirit of students from an early age. Entrepreneurship is a process of applying creativity and innovation in solving problems and finding opportunities to improve life.

Entrepreneurship is all aspects related to attitudes, actions, and processes carried out by entrepreneurs in pioneering, running and developing their business. Based on these reviews, it can be concluded that the purpose of entrepreneurial learning is to train critical thinking skills (Critical Thinking) in understanding causal relationships, analysing differences and similarities, abstract thinking in problem-solving [9].The application of Problem Based Learning in entrepreneurial learning is very relevant for improving critical thinking skills. 2.

Research Methods The method of this research was the quasi-experimental that compared the results of the treatment of the experimental class with the control class. This study used the Non-equivalent Control Group Design. In this design, the experimental group and the control group were not randomly selected. For more details, see the table below: International Conference on Education, Science and Technology 2019 Journal of Physics: Conference Series 1387 (2019) 012037 IOP Publishing doi:10.1088/1742-6596/1387/1/012037 3 Table 1.

Research Design Group Pretest Treatment Post-test A O1 X O3 B O2 O4 Notes : Group A: Experimental class Group B: Control Class X: Use of PBL models 1& O 2: Pre-test for experimental class and control class O3& O 4: Post -test for experimental class and control class The study samples were students of the Electronics Engineering Education program at the Faculty of Engineering, Makassar State University who took part in entrepreneurship courses in the odd semester of 2017/2018.

Samples of 2 classes were taken, 1 experimental involving 20 students and 1 control class involving 20 students. The experimental class was treated using the Problem Based Learning (PBL) learning model, while the control group was not given treatment. 3.

Result and Discussion Problem Based Learning (PBL) applied in teaching Entrepreneurship to improve critical thinking skills is a learning method that uses problems as a focus of learning to develop problem-solving skills, mastery of material and self-regulation, so the objectives of this study are as follows: (1) students can train their critical thinking skills and can solve problems well.

Thinking skills and the ability of students used tests (pre-test and post-test) to solve problems and (2) students can collaborate with friends in a group properly. Students' collaborative abilities were measured through observation in their activities. Table 2.Descriptive Statistics of Learning Outcomes . Experimental Class Control Class Pre-test Post-test Pre-test Post-test Subject 20 20 20 20 Mean 20,55 81,65 18,75 71.50 Median 21,50 81,5 20,00 71,5 Deviation Standard 6,108 5,806 5,829 8.525 Variance 37,313 33,713 33,987 72,684 Range 20 23 20 34 Lowest Score 10 67 10 53 Highest Score 30 90 30 87 Total Score 410 489 377 429 Data of student learning outcomes were obtained after performing the test twice, namely the pre- test and post-test.

The initial ability test (pre-test) was a test given to students in the experimental class and the control class before being given treatment. This test was used to determine the initial ability of students in each group whether it was feasible to compare or not. The final ability test (post-test) was a test given to students both experimental and control classes after being treated.

This data aimed to determine the results of the final ability of students in the experimental class and control class after International Conference on Education, Science and Technology 2019 Journal of Physics: Conference Series 1387 (2019) 012037 IOP Publishing doi:10.1088/1742-6596/1387/1/012037 4 receiving different treatment in the delivery of material.

Data on student learning outcomes in the experimental class and the control class can be seen in Table 2. Based on Table 2 it is identified that there were differences in learning outcomes of students between the experimental classes taught using the PBL model with the control class taught using conventional learning models.

This can be seen from the average value of the student learning outcomes in the experimental class and the control class. The average pre-test value in the experimental class was 20.55 while in the control class 18.75. After giving different treatments to the two classes, the average value of post-test learning outcomes in the experimental class was 81.65 while in the control class it was 71.50. The data shows the average learning outcomes in the experimental class were higher than the control class.

Data on frequency distribution and categorization of student learning outcomes are presented in Table 3. Table 3.The distribution of frequency and categorization of student learning outcomes. Experimental Class Control Class Pre -test Post -test Pre -test Post -test Category Freq % Freq % Freq % Fre q % Very Good 0 0 7 35 0 0 1 5 Good 0 0 12 60 0 0 9 45 Fair 0 0 1 5 0 0 9 45 Low 20 100 0 0 20 100 1 5 Total 20 100 20 100 20 100 20 100 Table 3.

shows an increase in student learning outcomes in the experimental class and the control class seen based on the learning outcomes at the pre-test and post-test. The distribution of pre-test values, both in the experimental class and the control class is in a low category. These results indicated that the experimental and control classes had the same initial abilities in entrepreneurship learning.

The distribution of post-test values in the experimental class and the control class is in the low, fair, good and very good categories. The very good scores were obtained by 7 students or 35% in the experimental class and 1 person or 5% in the control class. In the good category, there were 12 students (60%) from the experimental class and 9 students (45%) from the control class.

In the fair category, there was 1 student (5%) from the experimental class 9 students (45%) from the control class. The data illustrated that there were significant differences in learning outcomes between the experimental class and the control class. Therefore, it can be concluded that the application of Problem Based Learning to Entrepreneurship Learning can improve critical thinking skills proved by tests on students' ability to solve problems and their activities in learning.

This is supported by the results of Bagus et al [10] showing that the application of Problem Based Learning during the learning process could improve students' ability to think critically. This is indicated by an increase in the ability to solve problems and make conclusions through critical thinking. Problem-Based Learning application encourages students to have the ability to think critically in various activities such as asking questions, discussing problems, and finding solutions related to problems faced.

The results of the descriptive analysis of student learning activity data with the application of the Problem Based Learning and conventional learning models can be seen in Table 4. Table 4 shows the differences in student learning activities outcomes in entrepreneurship learning between experimental classes taught using the problem base learning model with the control class taught with direct learning model. This highlights the difference in average student learning activities in both classes.

The average score of student learning activities in the experimental class is 110 with a total of 20 students. International Conference on Education, Science and Technology 2019 Journal of Physics: Conference Series 1387 (2019) 012037 IOP Publishing doi:10.1088/1742-6596/1387/1/012037 5 Table 4.Descriptive Statistics Student Learning Activities.

Score Statistics Experimental Class Control Class Subject 20 20 Average 104,35 84,60 Median 106 86,5 Deviation Standard 6,19 10,58 Variance 38,34 112,14 Range 20 43 Lowest Score 91 53 Highest Score 11 0 96 Total scores 2087 1692 The average score in the experimental class which consisted of 20 students was greater than 96. Data on frequency distribution and categorization of scores on student learning activities. Table 5.Frequency Distribution and Student Learning Activity Score Categorization.

Experimental Class Control Class Freq % Freq % Very Active 20 100 10 50 Active 0 0 9 45 Less Active 0 0 1 5 Total 20 100 20 100 The data shows that there are differences in the learning activities of students taught using the Problem Based Learning model with students taught using conventional learning models. The number of students in the experimental class who reached the high activity category was 20 with a percentage of 100%.

While the control class, after being taught using the direct learning model, showed only 10 students reaching the high category with a percentage of 50%. This shows that there was the influence of the application of the Problem Based Learning model in improving student learning activities. This is supported by research conducted by Ali Muhson [11] that the implementation of Problem-Based Learning (PBL) in learning entrepreneurship can increase the attention and active role of students in the learning process. 4.

Conclusion Based on the results of the research and discussion above, it can be concluded that: (1) the implementation of the problem-based learning (PBL) model in Entrepreneurship learning at the Faculty of Engineering, Makassar State University could significantly improve students' thinking skills, (2) The implementation of learning models problem-based learning (PBL) in Entrepreneurship learning at the Faculty of Engineering, Makassar State University could improve student learning process activities, (3) Problem-Based Learning (PBL) could increase students' knowledge and understanding of learning material.

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