

The Application of Creative Problem-Solving Models for Improving Activities and Learning Outcomes of Land Measurement Techniques

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The number of Class X students of SMK Negeri I Al-Mubarkeya, Aceh Besar who did not reach the Minimum Completeness Criteria (MCC) score in the last three years has encouraged researchers to conduct this research. The aim was to reveal the increase of learning activities and learning outcomes of Land Measurement Techniques for Class X students of SMK Negeri I Al-Mubarkeya, Aceh Besar with the Creative Problem-Solving Learning Model. This study was designed as a Classroom Action Research, conducted in Class X of SMK Negeri I Al-Mubarkeya, Aceh Besar, with a total of 24 students. The observation sheet instruments of student learning activities have been validated by experts and the evaluation sheets have met the requirements of validity, power difference and level of difficulty. The results showed that in two cycles of research, the implementation of the the Creative Problem-Solving Learning Model could increase learning activities from 75% to 81% and improve learning outcomes from an average of 60.69% to 84.48%.

Keywords: *Creative Problem Solving, Learning Activity, Al-Mubarkeya.*

Introduction

The idea of creative problem-solving is widely used in different fields of life. It specifies the mental process of searching for a solution to a specific or a general problem for a better output. It is believed that through the creative problem-solving approach, the solution of a problem or set of problems must be novel and reached independently. When the creative problem-solving approach is applied toward a specific issue, the traditional approach of problem solving fails. Meanwhile, such approaches encourage identifying new opportunities along with a fresh perspective through innovative ideas. Through such techniques, one can formulate a plan to



tackle the problems in any situation. A common notion is that Alex Osborn is the very first person who introduced the idea of creative education foundation during the 1940s. He further analysed the term brainstorming and together with Sid Parnes, they developed an Osborn-Parnes creative problem-solving process. Although over the ages, this approach is yet to be found very productive in problem solving.

Various principles are observed in the existing literature to define creative problem solving or CPS. The very first principle specifies that divergent and convergent thinking must be balanced. It means that learning is key towards creativity and both divergent and convergent thinking must be balanced. The second principle to apply to CPS specifies that the problem must be addressed like a question. This shows that when the problems are reshaped along with the challenges as an open-ended question with multiple possibilities, it is easier to find lot of solutions. Through this approach there is the possibility to generate a lot of information. Meanwhile, the third principle for CPS is to judge whether to defer or to suspend ideas. Furthermore, it is believed that while applying the CPS model, there is a significant focus on yes rather than no. It means that when there is time to generate the information, language matters.

The application of the CPS model is observed in different fields of life. For example, Beda, Smith and Orr (2020) have examined the productivity of the creative problem solving model. While Wang (2019) has analysed the learning creativity and its fostering in the L2 classroom while applying the CPS model. For this purpose, the author collected a sample of 64 students who are enrolled in two Year-2 classes at the public high school of Taiwan. For addressing the study objective, participants completed two tests of creative thinking which were based on the evaluation of creative thinking skills both at the beginning and end of their study. Over four months, respondents were supposed to take part in four creative writing tasks which were based on the CPS model. By examining the student's response to the assigned task, this study provides the evidence that students generally indicate a positive feeling about the effect of the CPS model because of its major facilitation role in English skills. However, there is a significant area yet to be covered in the field of education where the application of the Creative Problem-Solving Model is quite necessary.

For this reason, authors like Van Hooijdonk, Mainhard, Kroesbergen, and van Tartwijk (2020) have applied the CPS model in the education field. They have the view that one problem generating a creative idea is often observed under isolation rather than based on the knowledge exploration.

The Department of Modelling Design and Building Information (MDBI) of SMK Negeri 1 Al-Mubarakya aims to prepare students to become productive people and to be able to work independently or fill job openings in the business/industrial world as a middle-level workforce according to their competency in their area of expertise. Students are also expected to be able

to conduct their own employment (entrepreneurship). To achieve this purpose students are equipped with a variety of subjects that contain applied knowledge and skills, one of which is the Land Measurement Technique.

The Land Measurement Technique is one of the subject areas of expertise which is important to be mastered by students who will work in the field of civil engineering, because work in the field of civil engineering is always related to land surveying. But in reality, not all students have mastered the knowledge and skills set of the Land Measurement Technique. This means that the achievement of Land Measurement Technique learning outcomes for Class X students of SMK Negeri 1 Al-Mubarkeya is low (see Table 1 below).

Table 1: Land Measurement Technique Learning Outcomes of Students of SMK Negeri I Al-Mubarkeya

No	Year	Total Students	Learning Outcomes			
			< 75		≥ 75	
			Amount	%	Amount	%
1	2015	21	9	43	12	58
2	2016	20	8	40	13	60
3	2017	23	10	43	12	57

Based on an initial survey conducted at SMK Negeri 1 Al-Mubarkeya, a number of problems were identified estimated to be related to low learning outcomes of the Land Measurement Technique subject, including low student motivation and the unavailability of the latest GPS and total station practice equipment, with the most urgent being that learning is still teacher centred. For this reason, research was conducted with the aim of uncovering an increase in learning activities and learning outcomes of Land Measurement Techniques in Class X students of SMK Negeri 1 Al-Mubarkeya, Aceh Besar with the Creative Problem-Solving Learning Model.

LITERATURE REVIEW

A. *Learning*

Learning can be interpreted as an activity carried out by the teacher in such a way that the behaviour of the students changes for the better (Sugihartono, 2007, and Darsono, 2002). The purpose of learning is essentially a change in behaviour that is relatively permanent which includes three domains, namely cognitive, psychomotor and affective (Darsono, 2002). Different dimensions of learnings are presented in the contemporary literature. However, the word learning is used routinely while discussing teaching in higher level education (Neugebauer, Coyne, McCoach, & Ware, 2017; Schmitt & Schmitt, 2020). All those researchers in the field of education agree with the argument that learning is much deeper than the concept of memorisation and recalling of information (Finn, Thomas, & Rawson, 2018;

Gao, Kim, Kim, & Kim, 2018). However, the phenomenon of deep and long-lasting learning primarily depends upon understanding, relating different ideas, making connections between the existing and new body of knowledge, developing a critical level of thinking and the ability to transfer knowledge (Bao, Wang, Ding, & Shang, 2017; Yang, 2017; Zhao et al., 2019). The traditional concept of learning is that it starts in childhood. However, a contemporary notion is that learning is a process through which we use our experience to deal with a new situation which ultimately results in learning something new. For this reason, the process of learning also comprises beliefs, notions, personality traits, gut feelings, intuitions, and values etc. The literature also specifies that treating people with utmost respect can be a significant factor towards learning. Whereas, learning opportunities should reasonably be attached to past positive experiences. Meanwhile, people learn best when their physical learning environment is quite comfortable.

The authors also believe that learning is a process which leads to change as a result of past and present experience in a given situation. Meanwhile it also increases the performance and future learning as well. From the perspective of students, learning is something done by themselves which further specifies how students respond to their experiences. During the whole learning process, it is quite essential for the students to enhance their intellectual skills and thinking process like problem solving and scientific inquiry of issues (Dewi, Poedjiastoeti, & Prahani, 2017; Forawi, 2016; Özsoy & Ataman, 2017). Some authors also claim that learning is a relatively permanent change in personal knowledge or behaviour of a person due to some experiences. Based on this concept, three major components are observed in the title of learning. These are the during of change which includes both short term and long term, the locus of change and finally the cause of change. In the field of education, learning has become one of the most used words. Some authors believe that learning is an individual, indescribable process and a complex social activity. Meanwhile, learning is a quantitative increase in the body of knowledge, and it is like the acquiring of knowledge through some information. At the same point in time, researchers in the field of education believe that learning is storing information which can be reproduced, and it is like acquiring facts, skills and methods and can be used when it is necessary.

B. Learning Activities and Outcomes

Learning activities are all student activities in the learning process, ranging from physical activities to psychological activities. Learning consists of three important components, namely external conditions, internal conditions and learning outcomes. The highs and lows of a student's learning activity are influenced by the techniques or learning models applied by the teacher (Mulyasa, 2007). For students, learning outcomes reflect their success in participating in learning on a subject (subject). As for the teacher, student learning outcomes are a picture of their success in teaching students. Learning outcomes obtained from learning activities carried out by students, in this case the higher the learning activities, the higher the learning

outcomes should be (Mulyasa, 2007). Meanwhile, learning activities are those activities which are developed or designed to bring or to create learning capabilities among the students by the teachers. Meanwhile, learning by design is a process through which the teacher mindfully designs specific learning activities depending upon the knowledge process. Some learning activities stimulates experiential learning, while others mobilise conceptual thinking at the same time. The pedagogical effectiveness of the learning element covers that the teacher considers the learning activities based on the knowledge processes and with the creation of a link between various activities and knowledge objectives. In addition, a range of activities like dissemination activities, discussion activities and demonstration activities are also entitled as learning activities (Siemens & Tittenberger, 2009). In this regard, students are assigned various tasks to perform while reflecting their learning capabilities. These tasks include learner submissions and assessment. The learning outcomes specify a set of knowledge or skills which students should reasonably acquire by the end of the specific class or program. Furthermore, learning outcomes describe the context, knowledge and skills which are reflected by the students through an assigned task. However, good learning outcomes reflect and emphasise the integration and application of the knowledge instead of merely focusing on the study material, handouts or the articles.

C. Creative Problem-Solving Learning Model

The Creative Problem-Solving Learning Model is a learning model that directs students to be able to solve problems creatively. Problem solving will always involve five characters, namely objective finding, fact finding, idea finding, solution finding, and acceptance finding. The role of the teacher in learning that applies Creative Problem-Solving is directing students to solve problems creatively by providing subject matter / discussion topics that can stimulate students to think creatively in solving problems (Suwarna, 2005). In recent years, it is believed that creating problem solving or CPS is a change agent which can work for the innovation in any type of business or educational institute. Different types of problems may exist which need different types of solutions as well. For effective CPS, various steps are identified in the existing literature: (i) identification of the problem and associated traditional terms, (ii) establishing goals and objectives, (iii) empowering all the participants during a learning process, (iv) developing a screening the criteria for choosing the exact ideas, and (v) focusing on how to sell the creative idea. In both steps of brainstorming and mind mapping, various ideas are suggested by the teammates during the Creative Problem-Solving Model. Initially, all the ideas are welcomed with no elimination. In an organisation, various members are encouraged to participate where the creative problem-solving process provides them with good recognition. Various studies including the department of education at the United States World Economic Forum, and Bloomberg who have clearly indicated that tomorrow's jobs are entirely dependent on creative problem-solving skills. However, this an interesting debate which can further clarify what are the key skills and expertise which are required to solve problems in the future.

In existing literature, various benefits of creative problem-solving approach have been identified. These benefits include (a) good techniques to understand the subject matter, (b) challenging student abilities, (c) providing student satisfaction, (d) increasing student learning activities, (e) helping students transfer knowledge into real life, (f) helping students develop new knowledge, and, (g) building students' sense of responsibility (Asikin and Pujiadi, 2008). The learning steps implemented are as shown in Table 2 below.

Table 2: Learning Steps with Creative Problem Solving

CPS LM	Steps of Learning	Learning Activities
1	2	3
Initial Activities		
Fact Invention	<ol style="list-style-type: none"> 1. Give guide questions, tell a story and ask students to put forward responses to embed knowledge and understanding student at some point concept. 2. Explain the learning objective which is will be done. 	Respond to questions, express knowledge and understanding related to the concept.
Core Activities		
Problem Discovery	<ol style="list-style-type: none"> 1. Respond to the question, put forward knowledge and understanding which is related with the concept. 	<ol style="list-style-type: none"> 1. Ask and answer about which theory will be studied.
Ideas Discovery	<ol style="list-style-type: none"> 2. Student in groups to deliver response or opinions or solve problem from teacher. 	<ol style="list-style-type: none"> 2. Make observations, experiment and discussion for experience immediately

		accordingly to instructions and instruction.
Answer Discovery	3. Students think and look for alternative true answer for solving the problem	3. To do comparison and analysis of opinions that have been given by group members to look for answers that are relatively correct.
Determination of Answers	4. The teacher gives input on the opinions of students and gives an explanation about the correct resolution	4. Screening the right and wrong concepts as well uncovering weaknesses and strengths
Reflection Activities		
	5. Ask students to do repetition with questions and answers about the material that has been studied and concludes the subject matter.	5. With the guidance of the teacher, students do repetition and conclude the subject matter
Closing Activities		
	6. Post-test is done by giving questions at the end of lesson	6. Students work on the final evaluation problem

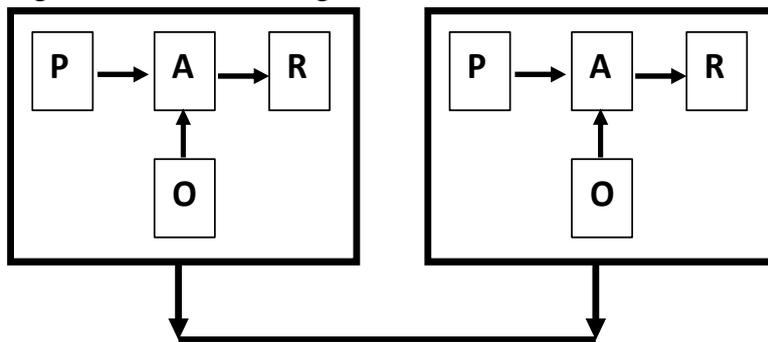
METHOD

A. *Research Design*

This study was designed as Classroom Action Research, which aims to reveal the increase in learning activities and learning outcomes of Land Measurement Techniques of Class X students of SMK Negeri 1 Al-Mubarkeya, Aceh Besar with the Creative Problem-Solving Learning Model. The number of students in a group of students in Class X DPIB SMK Negeri I Al-Mubarkeya is 24 people.

Classroom action research is carried out until an increase in classical learning activities is above 75% and learning outcomes are at the minimum threshold of MCC, which is ≥ 75 . Each cycle includes the stages of planning, action, observation and reflection. This class action research was carried out in collaboration with researchers, class teachers and students. The research cycles can be seen in Figure 1.

Figure 1. Research Design



Information:

P = Planning

A = Action

O = Observation

R = Reflection

The observation sheet instrument has gone through expert validation, the test sheet instrument has been statistically validated by calculating the validity of the test, the difference in power, and the difficulty index.

The criteria for the success of the action are: (a) If the observations of student activities reach a high criteria (more than 75% of active students), (b) If the results of student tests reach an average of equal or more than the Minimum Completeness Criteria (score of 75).

Results and Discussion

This research was conducted in two cycles, each meeting two times through four stages, namely: Planning, Implementation, Observation, and Reflection. At the end of every meeting in each cycle an evaluation test was held. The following are the results of the study:

A. *Learning Activities*

Recording of student activities during the study gives results as shown in Table 3 below.

Table 3: Recording of Learning Activities

No	Learning Activities	Percentage
1	The First Cycle	75 %
2	The Second Cycle	81 %

The increase in learning activities seems to be quite significant, especially in finding answers to the problems raised, both by the teacher and from fellow students' questions. Besides that, it was also seen that the enthusiasm of students in discussions also increased considerably. The results of recording the increase in learning activities are in line with relevant research findings (Asikin and Pujiadi, 2008).

Whereas observations of subject teacher activities by peer teachers showed quite good results (as in Table 4 below).

Table 4: Teacher Activities of Land Measurement Technique

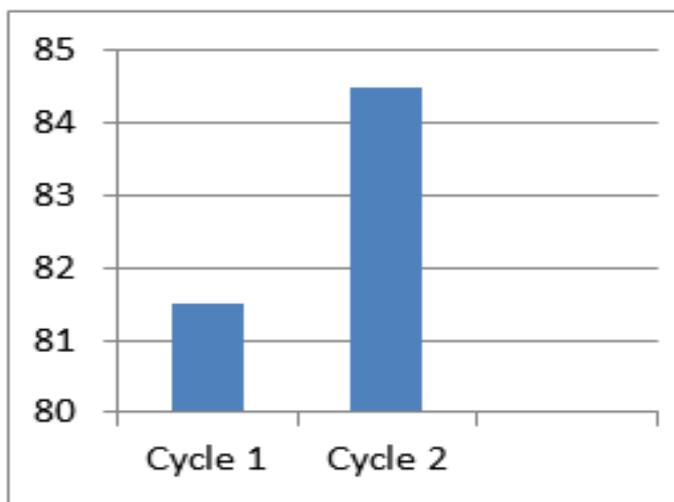
No	Aspects Observed	Criteria	
		Cycle 1	Cycle 2
1.	Delivering goals and motivating students. a. The teacher conveys the learning objectives and informs the learning model that will be used, namely the Creative Problem-Solving learning model. b. The teacher provides motivation.	Good	Good
2.	Presenting information. The teacher conveys a general explanation of the subject matter that will be delivered.	Good Good	Good Good

Table 5: Learning Outcomes for Each Cycle

No	Cycle	Students with Outcomes ≥ 75		Average	Performance Criteria
		Amount	%		
1	1	22	91.52	81.52	Good
2	2	24	100	84.48	Good

Graph of learning outcomes can be seen in Figure 2 below.

Figure 2. Graph of Learning Outcomes



Improved learning outcomes look good enough especially in cycle 2. The answers to the problems raised by the teacher are given in various variations and all are correct. This illustrates that learning has succeeded in encouraging the development of student creativity. The findings of this study are supported by theories already put forward and are in line with relevant research findings (Asikin and Pujiadi, 2008).

Conclusions

The creative problem-solving approach is not a new concept in the present world. However, the future outlook and innovative outcomes are significantly dependent on this model. This Classroom Action Research has successfully revealed that the application of the Creative Problem-Solving Model in the Land Measurement Techniques subject at SMK Negeri 1 Al Mubarkeya, Aceh Besar can increase student learning activities (75% - 81%) and average learning outcomes (81,52 - 84.49). Such outcomes have reasonably provided significance in the field of education. In connection with this it is suggested that the headmaster of SMK Negeri 1 Al Mubarkeya, Aceh Besar, facilitate teachers in applying the Creative Problem-Solving Model. Peer teachers need to apply the Creative Problem-Solving Model in the Land



Measurement Technique subject to improve learning activities and outcomes, and subsequent researchers need to examine other aspects relevant to the Creative Problem-Solving Model.

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REFERENCES

- Asikin, M. & Pujiadi. (2008). Pengaruh Model Pembelajaran Matematika Creative Problem Solving Berbantuan CD Interaktif Terhadap Kemampuan Pemecahan Masalah. *Jurnal Lembaran Ilmu Kependidikan* Jilid 37, No. 1, Juni 2008. Semarang.
- Bao, H., Wang, H., Ding, B., & Shang, S. (2017). *Cloud-based knowledge sharing in cooperative robot tracking of multiple targets with deep neural network*. Paper presented at the International Conference on Neural Information Processing.
- Beda, Z., Smith, S. M., & Orr, J. (2020). Creativity on Demand—Hacking into Creative Problem Solving. *NeuroImage*, 116867.
- Darsono, Max, dkk (2002). *Belajar dan Pembelajaran*. Semarang : CV. IKIP Semarang Press.
- Dewi, I. N., Poedjiastoeti, S., & Prahani, B. K. (2017). Elsii learning model based local wisdom to improve students' problem solving skills and scientific communication. *International Journal of Education and Research*, 5(1), 107-118.
- Finn, B., Thomas, R., & Rawson, K. A. (2018). Learning more from feedback: Elaborating feedback with examples enhances concept learning. *Learning and Instruction*, 54, 104-113.
- Forawi, S. A. (2016). Standard-based science education and critical thinking. *Thinking Skills and Creativity*, 20, 52-62.
- Gao, B., Kim, H., Kim, B., & Kim, J.-I. (2018). *Artificial Landmarks to Facilitate Spatial Learning and Recalling for Curved Visual Wall Layout in Virtual Reality*. Paper presented at the 2018 IEEE International Conference on Big Data and Smart Computing (BigComp).
- Mulyasa. (2007). *Menjadi Guru Profesional; Menciptakan Pembelajaran Kreatif dan Menyenangkan*. Bandung: Rosdakarya



- Neugebauer, S., Coyne, M., McCoach, B., & Ware, S. (2017). Teaching beyond the intervention: the contribution of teacher language extensions to vocabulary learning in urban kindergarten classrooms. *Reading and Writing, 30*(3), 543-567
- Özsoy, G., & Ataman, A. (2017). The effect of metacognitive strategy training on mathematical problem solving achievement. *International Electronic Journal of Elementary Education, 1*(2), 67-82.
- Siemens & Tittenberger (2009), Handbook of Emerging Technologies for Learning, Rederived from: shorturl.at/cnFNZ
- Sugihartono, dkk. (2007). *Psikologi Pendidikan*. Yogyakarta: UNY Press.
- Suwarna, Moch. (2005). Slamet, Setya Raharja, *Satunggalna*, Barkah Lestari, I Made Sukarna, Sri Winarni, Prihadi. *Pengajaran Mikro*. PT.Tiara Wacana Yogyakarta.
- Schmitt, N., & Schmitt, D. (2020). *Vocabulary in language teaching*: Cambridge university press.
- Van Hooijdonk, M., Mainhard, T., Kroesbergen, E. H., & van Tartwijk, J. (2020). Creative Problem Solving in Primary Education: Exploring the Role of Fact Finding, Problem Finding, and Solution Finding across Tasks. *Thinking Skills and Creativity, 100665*.
- Wang, H.-c. (2019). Fostering learner creativity in the English L2 classroom: Application of the creative problem-solving model. *Thinking Skills and Creativity, 31*, 58-69.
- Yang, Y. (2017). *Knowledge sharing: From atomic to parametrised context and shallow to deep models*. Queen Mary University of London.
- Zhao, K., Feng, J., Xu, Z., Xia, T., Chen, L., Sun, F. Li, Y. (2019). *DeepMM: Deep Learning Based Map Matching with Data Augmentation*. Paper presented at the Proceedings of the 27th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems.