Ilkogretim Online - Elementary Education Online, 2021; Vol 20 (Issue 5): pp. 5797-5804
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2021.05.653

Active LearningwithCreativeProblem-Solvingto Enhance Creativity

Nantarat Klinhom, KingMongkut's Institute of Technology Ladkrabang, Thailand., 61603016@kmitl.ac.th
Paitoon Pimdee, KingMongkut's Institute of Technology Ladkrabang, Thailand.,paitoon.pi@kmitl.ac.th
PunneeLeekitchwatana, KingMongkut's Institute of Technology Ladkrabang, Thailand., punnee.le@kmitl.ac.th

Abstract- The aim of this study was to synthesize active learning with creative problem-solving toenhance creativity. This study used literature reviews and qualitative data collection of key content andcomponents related to the learning process. The results showed that combining active learning withCreative problem-solving could enhance creativity via 3 steps: lesson introduction, learning andconclusion, and knowledge integration and feedback. These steps were found to be integrated with 5steps of creative problem-solving, including problem understanding, solution finding, solutionselection, solution acceptance, and solution application. This integration may enhance the students'thinking process to apply problem-solving skills and the connection of knowledge to resolve problems.In addition, it may enhance student creativity to develop various innovations, according to the preferredcharacteristics in the current environment

Keywords: Active Learning, Creative Problem-Solving, **Creativity**

I. INTRODUCTION

According to the constructivism concept, active learningis a learning management process, which focuses on the process rather than the material. This enables students to connect knowledge, or develop knowledge, via practical use of media or learning when teachers introduce, stimulate, or facilitate. It emphasizes learning, which focuses on the students' roles and participation.

Active learning allows students to learn via analytical and synthesized thinking processes, leading to problem-solving and knowledge sharing between students.Standford Teaching Commons, (2015) stated that active learning can help to efficiently achieve learning targets or objectives. This is because it enhances the students' freedom of thought, actions, judgment, and creativity. Moreover, it allows the student a chance to participate in a practical manner, using their own judgments and decision-making skills. The teachers' role is to supervise and stimulate by asking, or using various teaching techniques, to support students in the analysis, synthesis, and practical application of equipment to learn creatively.

Active learning can enhance cooperation by introducing group exercises, leading students to become more dedicated and motivated to make the best use of their skills. When students enthusiastically participate in a suitable learning environment, the students become more dedicated and responsible to attaining achievement. Similarly, when students are involved in the decision making process, they become dedicated towards learning and are more likely to reach their full potential. Consequently, teachers need to adjust their learning management approach to be consistent with changes in society, technology, and advances in the learning of students. In lectures, teachers need to become student advisors to guide and develop the students in locating knowledge, applying skills, and creating an understanding towards meaningful learning.

Tissana Khammanee, (2008) and Bundit Thipakorn, (2007) stated that learning management has been developed to be consistent with global changes in the 21st century. This has been achieved by pushing students to develop a thinking system using problem-solving; and should be prioritized and enhanced in the Thai educational system. The quality of higher education programs across institutions is required to be adjusted by focusing on communication and creativity alongside knowledge in specific subject areas. Although creative problem-solving is important, it is not necessarily related to the number of educational products, but rather the invention and creation of suitable technology. Creative problem-solving can enhance students' ability to conduct research for project problem-solving, empowering the search for knowledge and development of innovation. This facilitates students to possess the ability to creatively solve problems and leads to developing thoughts of innovation. Subsequently, this may prepare students to contribute to society and the creative economy, helping support personnel recruitment across key organizations. In support, The Office of the National Education Commission, (1999) ; Suwanroj et al.,

(2018)stated that creativity in higher education is important to produce students with an ability to think, adapt to decision-making situations, and suitably apply knowledge. In particular, creativity is most important for solving problems and creating new things of value Sujarit Phienchob, (1997).The author sees benefits from the above-mentioned issues to stimulate students to learn and solve problems via various creative solutions.

OBJECTIVE

To synthesize active learningwith creative problem-solving to enhance creativity.

II. LITERATURE REVIEW

Active Learning

Gifkins,(2015)defined learning activity as organizing students to interact with content using various approaches, sharing their ideas via learning activities or data development processes. This is proposed to help stimulate students' thoughts, as opposed to only using information transfer. One way this can be achieved is by using a target for the development of abilities, emphasizing participation, discussion, and application of concepts, in order to achieve advanced ideas and analytical thinking. Bonwel, (1991)defined active learningas a learning activity, which is organized under 2 basic assumptions, 1) learning is a natural effort of humans, and 2) each person has a different learning method. According to Meyers and Jones,(1993)and Fedler and Brent,(1996)active learningrequires students' roles to change from knowledge receivers to knowledge participators. McKinney,(2008)presented an active learning activity to help students learn using different approaches. The author focused on mini-research proposals, or projects,which involved learning activity management. The research processes enabled the students to define interesting topics, plan the learning, develop work, and provide feedback about what was learned. Essentially, it included project-based learning,or problem-based learningwith creative problem-solving, to enhance creativity.
Therefore, it can be concluded that active learning provides an opportunity for students to think, listen, speak, read, write, or share their opinions, while they are performing activities. This can lead to knowledge development to solve the problem systematically and creatively, enable interaction, allows sharing of knowledge, and provision of learning feedback amongst students and teachers.

Table 1: *Learning steps in the synthesis of Active Learning*

Authors	Active Learning Procedures
Baldwin & Williams, (1988)	**Presented 4 steps of Active Learning:** 1.Preparation: teachers lead students to the content by motivating students to be enthusiastic to learn. 2. Group exercise: teachers separate students into groups to work, conclude, and share knowledge together. 3. Application: allows students to do exercises and a post-test. 4. Following up: additional research by completing reports or diaries.
Johnson et al.,(1991)	**Presented 3 steps of Active Learning:** 1. Introduction (3-5mins):provides the students the connections between the content and background. 2.Teaching: teach (10-15 mins) and organize other activities (3-4 mins) to change the atmosphere and provide opportunities for teachers to interact with students. 3.Conclusion: students conclude content from the lessons by themselves (4-6 mins). Teachers allow students to conclude their understanding by writing important content on a paper to share with classmates, or teachers may assign students to present in front of the class.

Authors	Active Learning Procedures
Moore,(1994)	The Concluded learning steps of Active Learning consis of 4 steps: 1.Introduction: leads students to lessons by using daily situations to motivate students. 2. Practice: assigns students to search for their imagination of the content in each unit by using group exercises to present their imagination. 3. Conclusion: teachers and students conclude the content of the lessons together. 4.Evaluation: teachers assign students to complete exercises and evaluate them using observation forms, activity forms, and recordings.
Wathanyu Wuthiwan, (2010)	The Concluded learning steps of Active Learning consis of 4 stepsas follows: 1. Interest, which is a step to preparing studentsby motivating them with interesting activities. 2. Doing which teachers organize activities by different methods by focusing on letting students plan for solutions. 3. Conclusion and feedback: students conclude ideas together and present. 4. Knowledge application: teachers organize activities to enhance students' ability to apply ideas to new situations.

From Table 1, the synthesis of active learningcan be conducted using 3steps:

Step 1: Lesson introduction, review previous lessons by motivating students through games or exchange of ideas to stimulate activity participation.
Step2 : Learningand creating activities by various methods to support students to plan and find answers in lessons.
Step3 : Conclusion ,knowledge integration and feedbackby students to conclude results from activities; connecting knowledge and providing feedback to let others know.

Problem-Solving

Good,(1973)defined problem-solving as an operation under difficult conditions or situations that requires information (related to problems) to define and test a hypothesis under controlled data collection to find relationships. Souillard & Kerr,(1990)stated that problem-solving is a type of game in which intelligence can be used with communication activities. Students need to have academic knowledge and the creativity to work with others. For example, conversations, discussions, idea-sharing and problem evaluations to propose conclusions for practical solutions. This is consistent with Johnson & Morrow,(1981),who proposed that problem-solving was the communication between at least 2 persons to share knowledge and information to resolve problems. This includes the feelings towards obtaining skills and knowledge to suitably apply in daily life. In addition, Caswell,(2006)stated that problem-solving is a method to find answers in real life, which may not be initially known or clear at the beginning. Nevertheless, they may appear through the steps while problems are being solved. Treffinger et al., (2008) explained that group problem solving is for open-ended problems and complex problems, yet these problems cannot be resolved without the required knowledge, therefore no solutions can be defined in advance. These problems are considered to have no clarity and need creativity in order to be solved.If students have a low understanding of concepts and are unable to present and use a clear approach, students will have difficulty in solving problems.Thus, it is necessary to develop approaches such as multiple representations and reinforce the students' understanding of concepts so that the problem-solving skills of students are high (Maria et al., 2020).

It can be concluded that problem-solving is a method in which each person has to find a solution by themselves. Problem-solving is different depending on the environment, atmosphere, emotion, and feelings upon when the problems occur and need to be resolved.

Table 2:*Synthesis of creative problem-solving*

Author	Creative problem-solving process
Osborn & Parnes, (1977)	Developed a creative problem-solving process to solve complicated problems and discovered possible solutions which were most suitable in an environment. There were 5steps,as follows: 1. Fact finding 2. Problem finding 3. Idea finding 4. Solution finding 5. Acceptance finding
Treffinger, et al.,(2004)	Improved creative problem-solving (CPS) Version 6.1consists of 4 components and 8steps,as follows: Component 1:Understanding the Challenges 1. Constructing Opportunities 2. Exploring Data 3. Framing the Problem Component 2:Generating Ideas 1. Generating Ideas Component 3:Preparing for Action 1. Developing the Solution 2. Building Acceptance Component 4:Planning Your Approach 1. Planning Your Approach 2. Designing Process
Reali,(2010)	Developed a different creative problem-solving process, which contains imagination of the future and survey acceptance steps, in case there are members who disagree with the group problem-solving process. They can provide additional comments and help improve problem-solving together to reduce conflicts. There are 7stepsasfollows: 1. Facilitate 2. Imagine the future 3. Find the question 4. Generate ideas 5. Craft solution 6. Explore acceptance 7. Plan for action
Higgins, (1994)	Concluded a creative problem-solving process consisting of 7main steps, as follows: 1.Environment analysis: information gathering related to internal and external incidents to find problems. 2. Problem perception: awareness that problems exist before solving them. 3. Problem identification: a step to define the objectives of problem-solving processes and consideration of the evidence used in problem-solving. 4. Hypothesis and environmental factors define potential problems in the future. 5.Option creation in problem-solving: listing of problem-solving methods which are known, and creating additional options for problem-solving. 6.Solution evaluation: an evaluation of problem-solving options systematically based on prior defined methods and possible results from various solutions. 7. Solution application: when there are clear problem-solving guidelines, plans to achieve them are required and need to be followed.
Carmeli et al., (2013)	Concluded creative problem-solving processes consisting of 4main steps, as follows: 1. Problem identification and construction 2. Information search and encoding 3. Solution or generation of alternatives

Author	Creative problem-solving process
	4. Idea evaluation and selection

In Table 2, the author concludes that there are 5 steps in the synthesis of creative problem-solvingprocesses:

Step 1: Problem understanding: fact finding and the perception and understanding of problems which need to be identified.
Step 2: Problem-solvingguidelines and idea finding: the finding of ideas, guidelines or problem-solvingmethods, by creating new concepts about problems.
Step 3: Solution selection: the selection of suitable problem-solving, which is possible and reasonable.
Step 4: Solution acceptance: the selection of the best solution and solution acceptance, based on comprehensive factors to support predicted outcomes.
Step 5: Solution application: the application of practical problem-solving and evaluation of applied problem-solving.

III. METHODOLOGY

This study is qualitative research. The author performed the literature review related to active learning with creative problem-solving using qualitative data collection, both domestically and internationally from 39 sources. In order to achieve the main objective of this study, the important content and process components were selected.

IV. RESULTS

Based on the literature review and synthesis of active learning, the identified creative problem-solving to enhance creativity is concluded in Figure 1.

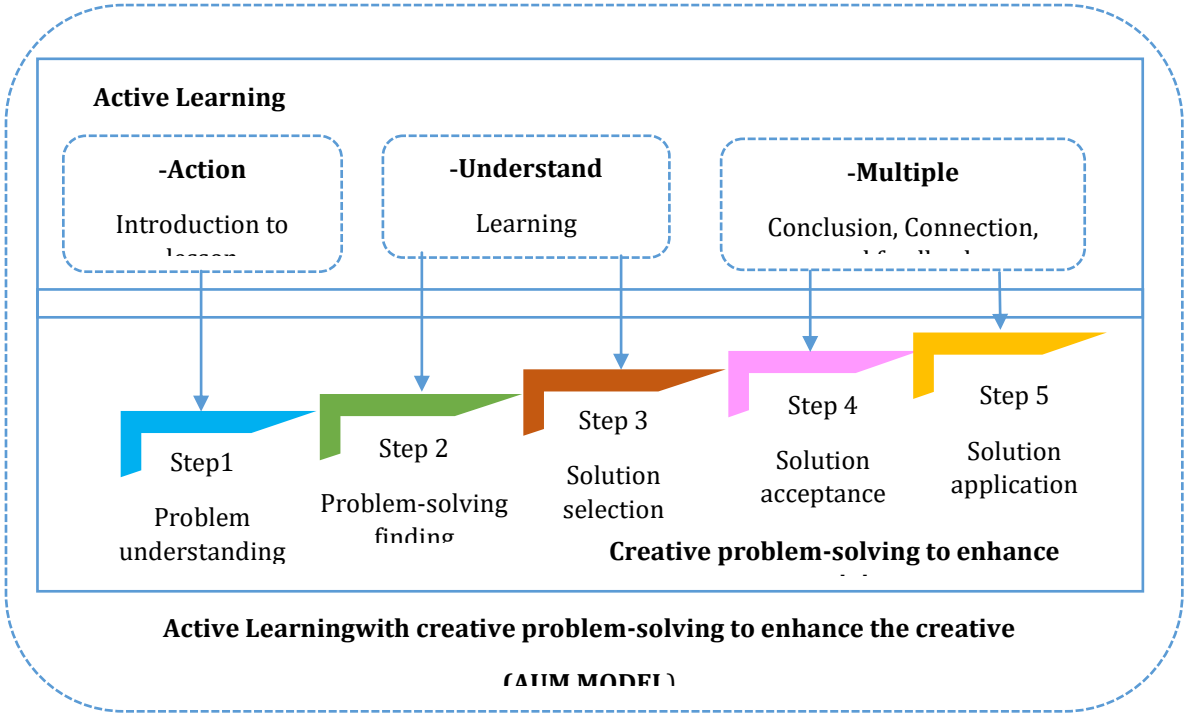

Figure 1:*(AUM MODEL)*

V. CONCLUSION AND DISCUSSION

Active learning, which is used alongside creative problem-solving to enhance creativity, is a form of learning management that focuses on organized activity and class practice. This allows teachers to understand their roles to enhance the creativity of students in higher education. However, the outcome needs to be evaluated to assess whether it can be used to solve problems creatively.

Synthesized learning can be separated into 3 steps: ***Step 1:Lesson introduction***, which is integrated with creative problem-solving in ***problem understanding***, and requires the teachers to lead the lessons. Teachers inform the students of the objective for creative problem-solving, providing students with the preparation and the environment to ensure its facilitation Isaksen, (2011). The process starts from considering the problems, context, related persons, and desirable outcomes Luan Saiyot and Angkhana Saiyot, (2000);Bloom, (1979). ***Step 2 Learning***is a solution finding process, or thinking outside the box, which addresses problems by finding new methods as guidelines or solutions. Students can classify, categorize, and connect sub-components of situations or problems Joyce, WeilandCalhoun, (2011) with an important target to create the ideas of students. Learning activities require students to use practical outcomes or activities, including games, competitions, or cooperation. This may help the student demonstrate empathy and an understanding of the difficult conditions in other's lives. The students are assigned to facing situations or incidents to enhance their decision-making process via practical experience Nesbitt,(1971); Cherisa Nantha, Jirarat Sittiworachart, and Paitoon Pimdee, (2019). This leads to the students practicing thinking, emotional expression, and responding appropriately to develop their knowledge, skills, ideas, sympathized cooperation, critical thinking, self-ability, and expression. Malakul Na Ayuthaya, (1994) suggested that efficient problem-solving should be a process which focuses on the solution using different methods depending on the conditions. ***Step3 Conclusion, knowledge integration, and reflection***is related to students selecting problem-solving solutions to connect their knowledge attained from lessons and assigned problems. In concluding ideas, students can provide their own personal reflection Somdech Boomprajak, (2008); Osborn, (1979). Components of problem-solving to enhance creativity are evaluated to demonstrate that they are practical. This is in agreement with Chaiyot Ruangsuwan, (2010), who proposed that active learning leads students to maintain learning outcomes by interacting with friends, teachers, and the environment.Moreover, students can apply knowledge to connect and provide a reflection of problem-solving. Reflection can be used in both theoretical and practical learning using different methods. It is important to note that teachers can facilitate students to reflect by initiating questioning of the problem-solving outcomes to obtain new ideas, benefiting themselves and society. This should be performed carefully and have the necessary detail to produce more in-depth creativity.And Creativity and social interaction, such as using digital for group collaboration, could be applied to help enhance the learning sothat the students would not have to be left working alone Thamasan et al.,(2019).

REFERENCES

1. Baldwin, J. & Williams, H. (1988). Active Learning : a Trainer's Guide. England : Blackwell
2. Education.
3. Bloom, B. J. Ed. (1979).*Taxonomy of Educational Objectives: Handbook/CognitiveDomain*. London:
4. Longman.
5. Bonwell, C. C., & Eison, J. A. (1991). *Active Learning: Creating excitement in the classroom*. ASHE-ERIC Higher Education Report No.1. Washington, D.C.: The George Washington University.
6. Carmeli, A., et al. (2013). Transformational leadership and creative problem-solving: The mediation role
7. of psychological safety and reflexivity. *The Journal of Creative Behavior*, 48(2), 115-135.
8. Caswell, D. (2006). *Creative problem-solving*. Society for Teaching and Learning in Higher Education.
9. Dennard, E.A. (2000). *The Influence of Psychosocial Factors on College Choice and Subsequent Student*
10. *Satisfaction with College Experiences*. Dissertation Abstract International. 40(8), 2124-A.
11. 13November, 2012Retrieved fromhttp://search.proquest.com/docview/60712231/abstract/1485221D2B021CCA123/1?accountid=12454.
12. Dewati, M., Suparmi, A., Sunarno, W. , Sukarmin, &Cari, C. (2020).Measuring Students' Problem-
13. Solving Skills on Direct Current Circuits with Multiple Representations. *Humanities & Social*

14. *Sciences Reviews*. 8(3), 725-736. https://doi.org/10.18510/hssr.2020.8378
15. Felder, R. M., & Brent, R. (1996). Navigating the Bumpy Road to Student - Centered Instruction. College
16. Teaching. 44(2), 43-47.https://doi.org/10.1080/87567555.1996.9933425
17. Funfuengfu, V. (2019). The success Of Active Learning Management. *Journal of Humanities and*
18. *Social Sciences Valaya Alongkorn*, 9(1), 135-145.
19. https://so06.tci-thaijo.org/index.php/var/article/view/186104/130758
20. Gifkins, J. (2015, October 8). *What Is 'Active Learning' and Why Is It Important?*. 24 January2019,
21. Retrieved from https://www.e-ir.info/2015/10/08/what-is-active-learning-and-why-is-it-
22. İmportant.
23. Good, C.V. (1973). *Dictionary of Education*.*3rd ed*. New York :McGraw-Hill.
24. Guilford, J.P. (1950). *Creativity*.New York :McGraw-Hill.
25. Higgins, J.(1994). *101 Creative Problem Solving Techniques: The Handbook of New Ideas for*
26. *Business*. New Management Pub. Co.
27. Isaksen, Scott G., Dorval, Brian, K.& Treffinger, Donald, J. (2011). *Creative Approaches to Problem Solving*.
28. n.p.
29. Johnson, David W.; et al. (1991). *Active Learning : Cooperation in the College Classroom*. Edina, MN :
30. Interaction Book Company.
31. Johnson, K. & Morrow, K. (1981). *Communication in the classroom*. Longman Group Ltd.
32. Joyce, Bruce, Weil, M.& Calhoun, E. (2011).*Models of Teaching*. Pearson Education.
33. Khammanee, T. (2008). *Learning and teaching model*.Bangkok: Chulalongkorn University Press.
34. Luan, S. and Angkhana, S. (2000). *Learning achievement measurement technique*. Suwiriyasan.
35. Maithri, V., & Suresh, P. (2020). Impediments Faced by Teachers in Applying Active Learning Strategies
36. in Language Classes in Enhancing Listening Skills. *Humanities & Social Sciences Reviews*, 8(1), 113-121. https://doi.org/10.18510/hssr.2020.8117
37. Malakul Na Ayuthaya, P. (1994). *The Concept of Thinking, Creative Problem Solving. Documentation of Academic Thinking & Creativity*, No 1. Textbooks Academic Papers Center, Faculty of Education, Chulalongkorn University.
38. McKinney,K. (1993). *Sociology Through Active Learning*. Pine Forge Press. Jossey-Bass.
39. Meyer, C., & Jones, T. B. (1993). *Promoting Active Learning: Strategies for the College Classroom*. Jossey-
40. Bass.
41. Moore, K.D. (1994). *Secondary Instructional Method*. New York : Wm. C. Brown Communication,
42. Inc.
43. Nantha, C., Sittiworachart, J., &Pimdee, P. (2019). New Active Learning Model with Formative
44. Assessment in Large Classroom. *International Journal of the Computer, the Internet and Management*. (27)3, 13-18. http://www.ijcim.th.org/past_editions/2019V27N3/27n3Page13.pdf
45. Nesbitt , W. A. (1971). *Simulation Games for the Social Studies Classroom*. Foreign Policy Education.
46. Office of the National Education Commission. (1999). *National Education Act. B.E. 2542 (1999)*.
47. Office of the National Education Commission.
48. Osborn, Alex F. (1963). *Applied Imagination*. New York :Shari Lane.
49. Phienchob, S. (1997). *Language Wisdom: Tools to develop thinking skills*. Bangkok: Thai Language Institute. Ministry of Education.
50. Putpan, S. (2017). Performance indication development for creative problem-solving in students.
51. *BuaBundit Journal Of Educational Administration (BUAJEAD)*. 17 (1), 125-132.
52. Reali, P. D. (2010). *H2 solve wicked problems*.North Cololina:lulu.
53. Ruangsuwan, C. (2010). *Educational technology: Theory and research*. Odean Store.
54. Souillard, A.,& Kerr, A. (1990). *Problem Solving Activities for Science and Technology Students*. English Teaching Forum. 28-32.
55. Standford Teaching Commons. (2015). *Course Design Overview*. https://teachingcommons.stanford.edu.
56. Surakarn, A., Junprasert, T., Chaiakkarakan, N., Peungposop, N., & Boonlop, R. (2020). Active Learning and
57. its Outcomes: A Case Study from the Education Reform Project in Thailand. *The Journal of Behavioral Science*, *15*(1), 34-51.
58. https://so06.tci-thaijo.org/index.php/IJBS/article/view/143725

59. Suwanroj, T., Leekitchwatana, P., Pimdee, P. Thiyaporn, K., & Thanongsak, S. (2018). Development of digital
60. Competency Domains for Undergraduate Students in Thailand. International. *Journal of the*
61. *Computer, the Internet and Management*, 27(2).http://www.ijcim.th.org/past_editions/2019V27N2/27n2Page84.pdf
62. Suwanroj, T., Leekitchwatana, P. & Pimdee, P.(2019). Confirmatory Factor Analysis of
63. the Essential Digital Competencies for Undergraduate Students in Thai Higher Education Institutions.*Journal of Technology and Science Education (JOTSE*.), 9(3), 340-356. https://doi.org/10.3926/jotse.645
64. Thipakorn, B.(2007). "Teacher development in higher education institutions". Professional teacher:
65. Concept, tool, and development. Bangkok: Chulalongkorn University Press.
66. Torrance. Palue E. (1965). *Rewarding Creative Behavior*. Engle Wood Cliffs: New Jersey Prentice-Hall.
67. Treffinger, D.J., Isaksen, S.G., and Dorvol, K.B. (2004). *Creative Problem Solving: An Introduction. 4th ed*. Waco : Prufrock Press.
68. Treffinger, D. J., Selby, E., & Isaksen, S. G. (2008). Understanding individual problem solving style: A key to learning and applying creative problem solving. *Learning and Individual Differences*, 18(4), 390-401. https://doi.org/10.1016/j.lindif.2007.11.007
69. Wuthiwan, W. (2010). *The Effect of Teaching Science by using The Active Learning Method to*
70. *Enhance Science Achievement and Problem Solving Ability for Students in Mathayomsuksa I*. Master of Education Thesis, Faculty of Education, Burapha University.