Creative Problem Solving Process Instructional Design in the Context of Blended Learning in Higher Education

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Abstract: The Creative Problem Solving (CPS) process is a conceptual model that focuses on using higher-order thinking skills in order to overcome authentic problems during learning. The CPS process offers a structured methodology to enhance every learner's solid critical, creative, and innovative thinking skill. The application of the CPS method has been growing, including its implementation in the blended learning environment in universities. However, its application still requires a strategic framework that is by the blended learning conceptual model to facilitate the CPS process. Properly organized instructional design is an important element in maintaining the success of the CPS process in blended learning to encourage and promote learner creativity to solve problems. The application of the CPS method in the context of blended learning is integrated through synchronous and asynchronous patterns facilitated by the Moodle LMS-based e-Learning facility. This research aims to produce a CPS process instructional design in a blended learning context that is valid, practical, and effective and can systematically guide instructors or lecturers in facilitating students to be skilled in critical thinking and creative thinking in problem-solving processes. This development process is based on the incorporation of ideas related to the conceptual model of blended learning with the principles of the CPS process design strategy that has been developed. Instructional design was developed by applying the Research and Development (R&D) method, which implements several stages between Analysis, Design, Development, Implementation, and Evaluation. The validity of the resulting model product was measured using a validation sheet of learning design experts, learning technology, media, materials, and linguists with the title of professor. Questionnaire responses from lecturers and students measured the product's practicality, and the product's effectiveness was measured by conducting testing of critical and creative thinking skills. The research data were analyzed using descriptive statistics to provide a quality score on the resulting instructional design. Based on the results of the study, it can be concluded that this learning design is valid, practical, and effective in improving the thinking skills of prospective teacher students. This proves that the instructional design developed has the feasibility to be used in learning, which can effectively improve the creative problem-solving process in the context of blended learning.

Keywords: Instructional design, Blended learning, Creative problem-solving process

1. Introduction

Higher-order thinking skills are very important to be developed in the learning process, especially in higher education. This is to encourage students to be able to face complex problem-solving situations in their careers. Higher-order thinking skills have been popularized for the process of achieving learning goals. One of them is as a practical solution for the problem-solving process in the learning activities of prospective teacher students. However, this thinking skill cannot be utilized optimally to influence the way of learning. Thus is due to the fact that the quality of instructional learning in higher education still prioritizes content achievement rather than choosing a problem-solving-centered learning approach as a predictive power to improve learning effectiveness (Ssemugenyi, 2022).

Under these conditions, the learning process is less in favor of the creative problem-solving process. The active role of lecturers is needed to facilitate the student learning process by providing authentic or real problems as a learning experience (Monita and Fitria, 2021). Thus, the role of creative thinking will be increasingly facilitated in the problem-solving process (Laisema and Wannapiroon, 2014). In organizing the thinking processes of student teachers who are more productive, the Creative Problem Solving (CPS) learning method can be used as a conceptual model to promote the use of thinking skills in improving students' learning in solving problems (Kashefi, Ismail and Yusof, 2012). The CPS process can help students engage in the integration of critical and creative thinking skills as well as several other metacognitive skills (Treffinger, 1995).

The application of CPS as a structured methodology for students' thinking skills has become an interesting study in this era, especially regarding its application regarding blended learning environments in universities. In the last decade, the application of blended learning in higher education institutions has been growing (Bazelais and

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Doleck, 2018). This is due to universities being at the academic levels that are most ready to implement information technology comprehensively (Prasetya *et al.*, 2020). The research results (Kashefi *et al.*, 2011; Kashefi, Ismail and Yusof, 2012; Lim and Han, 2020; Wahyuningsih *et al.*, 2020) reported that the CPS process through a blended learning context could increase active student involvement in the learning process. The results of this study illustrate that the CPS method in the context of blended learning can be a learning model that lecturers can use to promote student learning outcomes for prospective teachers.

But unfortunately, this conceptual learning model is still rarely used by lecturers in learning. Because the latest knowledge about strategic frameworks for designing blended learning that can facilitate creative problem-solving processes is still very minimal and is difficult for lecturers to build the success of the CPS process in blended learning events appropriately. In addition to that, in learning that involves technology, the attention of lecturers is often focused only on the implementation of the technology, while the contribution of the instructional model is less concerned about its function. In this regard, good instructional design is an important element in supporting the implementation of the CPS process in the context of blended learning as instructional design can produce methods that help instructors determine the best way to teach content to students both in practical and contextual conditions (Reigeluth and An, 2021). This is in line with (Kilbane and Milman, 2014), who states that instructional design is a special method that contributes to facilitating learning.

Thus, the main objective of this study is how to develop and produce the stages (syntax) of the CPS process in the context of blended learning in accordance with the context of learning for prospective teacher students, the expected learning context framework is that it can affect the high-level thinking skills of prospective teacher students such as critical and creative thinking in the problem-solving process. Critical thinking ability is a systematic and directed skill in forming and building trust to carry out activities in an organized manner (Sholikh, Sulisworo and Maruto, 2019). Meanwhile, according to (Zhuang *et al.*, 2021), the ability to think creatively is a feature of cognition in humans, which makes it possible to generate useful new ideas. The use of these two thinking skills can encourage students to be able to face problem-solving situations that are in accordance with their world of work.

Based on the description above, critical and creative thinking skills are needed by prospective teacher students to be able to face various and complex problems in the future, especially to respond to the world of work and changes in the growing educational transformation. However, this thinking ability has yet to be considered and appropriately facilitated in learning activities. Therefore, this study offers the CPS learning method in the context of blended learning as a conceptual model to improve critical and creative thinking skills in prospective teacher students. So, investigations related to these two thinking abilities need to be investigated further. Thus, the ability to think critically and creatively becomes the target of the results of developing the instructional design. The resulting learning design products can provide useful guidance for lecturers in implementing creative problem-solving processes in mixed learning contexts.

In achieving this learning context, (Lim, Park and Hong, 2010) recommend the basic principles of developing CPS process instructional design in a blended learning environment, namely; 1) the environment in which learning occurs, including the classroom environment (onsite) and virtual environment (online), 2) the learning instruction process, and 3) the components of the CPS process. Based on this principle, the blended learning approach functions as an environment that creates learning that integrates various learning resources and appropriate activities (Littlejohn and Pegler, 2007). Meanwhile, the instruction process and the components of the CPS process act as an integrated form of learning resources and activities to create a learning experience for students. Thus, the blended learning environment becomes an important determinant for shaping the CPS process. Therefore, selecting the right blended learning conceptual model can help students' learning process (Fazal, Panzano and Luk, 2020).

The application of blended learning does not only combine face-to-face (offline) with online learning but requires the most appropriate combination (Chaeruman, Wibawa and Syahrial, 2020). This mix can be managed well by deeply understanding the conceptual model and practice of effective blended learning settings. Recommendations for blended learning arrangements can be seen from the perspective of space and time (synchronicity) (Chaeruman, Wibawa and Syahrial, 2018) as well as from the source of the learning process in formal or informal conditions and individually or collaboratively (Ulfa, Surahman and Octaviani, 2020). This blended learning conceptual model aims to form a stronger community to interact, discuss, and share ideas and can stimulate the speed of independent learning of students both synchronously and asynchronously (Lin and Gao, 2020). A blended learning environment must facilitate involvement and experience and encourage student participation in learning (Armellini, Teixeira Antunes and Howe, 2021). According to (Fatawi *et al.*, 2020), engagement is one of the indicators of the success of blended learning. Meanwhile, the level of student involvement can be measured from the aspect of participation during the learning process (Hui *et al.*, 2019). Blended learning designs that are planned and facilitated by technology appropriately can change students' attitudes, behavior, and learning outcomes (Hung, Tan and Koh, 2006). On the other hand, when the blended learning environment is not managed properly, it does not guarantee the realization of the level of satisfaction for students (Taghizadeh and Hajhosseini, 2021).

Thus, the CPS process in the context of blended learning should have an instructional design that is properly organized as a guide to help the learning process for prospective teacher students. Responding to this, this research focuses on developing blended learning instructional designs from the point of view of synchronicity patterns to be able to facilitate students' higher-order thinking processes in the problem-solving process.

2. Literature Review

2.1 Blended Learning

Blended learning, in a more specific sense, combines synchronous learning strategies and asynchronous learning (Khan, 2005). The two combinations create class-based synchronous communicative activities and asynchronous communicative activities supported by conventional technology (Littlejohn and Pegler, 2007). In essence, blended learning requires the right activities to integrate synchronous and asynchronous components (Garrison and Vaughan, 2008). So, the most appropriate combination is needed in order to influence the optimal learning experience (Chaeruman, Wibawa and Syahrial, 2020). This combination can be based on the source of the learning process in formal or informal conditions, in the classroom or outside the classroom, individually or socially, digital and non-digital media, as well as the physical or virtual environment (Ulfa, Surahman and Octaviani, 2020). This is in line with (Cubric, 2007), who states that a learning activity can be developed in the classroom ("face to face") or outside the classroom ("online"), and individually or in groups.

Formal and informal learning processes are interesting learning conditions to be applied in today's digital era. Because according to (Mills, Knezek and Khaddage, 2014), formal learning is a learning activity that occurs in the classroom, but access to learning technology causes a shift in learning outside the classroom as an informal condition. (Furlong and Davies, 2012), state that the use of ICT can create informal learning practices. So this shift supports the semiotic relationship between formal and informal learning (Lai, Khaddage and Knezek, 2013) because what is learned outside the classroom can support the learning process in the classroom and vice versa. According to (Allen, 2007), informal learning can complement or assist more formal efforts.

In addition to formal and informal learning processes, blended learning environments can consider a combination of individual learning processes and collaborative learning (social learning). Individual learning can occur in one individual who can change some of the features learned based on his own experience, whereas social learning requires more individuals to change the features that one person can learn based on the experiences of others (Heinerman, Rango and Eiben, 2015). According to (Lin, Huang and Ko, 2020), social learning is an activity in order to acquire new concepts and strategies through interaction with more knowledgeable individuals, and then the individual applies what is learned to other contexts. This process can occur through software-based media interaction to support learning (Tavangarian *et al.*, 2004). Blended learning is a medium that provides comfortable learning through team collaboration activities (Lin, Huang and Ko, 2020) to be skilled in problem-solving (Lin *et al.*, 2018). This condition can occur in social contexts such as online discussions to find references and work ideas to be produced (Cheng and Chau, 2014; Hui *et al.*, 2019).

Thus, the learning process in formal and informal conditions and individual and social conditions can form a blend of learning events in a blended learning environment. Moreover, offer complementary learning experiences in a digital environment (Ubah, Spangenberg and Ramdhany, 2020). Referring to this concept, the researcher defines the blended learning model as a synchronicity learning strategy that combines various learning conditions. The conceptual structure of this blended learning model can be explained in Figure 1.

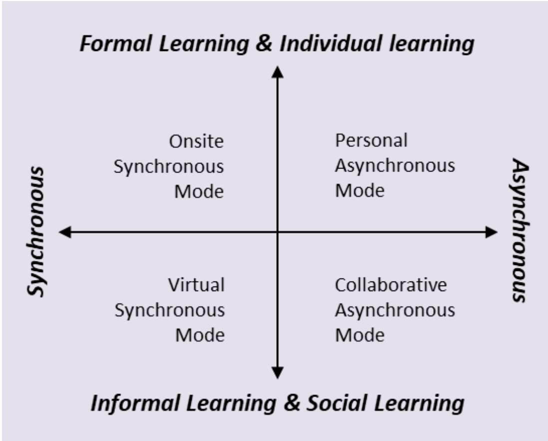

Figure 1: Conceptual Framework of Blended Learning Model

The conceptual framework of the blended learning model above forms a synchronicity pattern that places two groups of categories in the learning process, namely formal and individual conditions with informal and social conditions (Ulfa, Surahman and Octaviani, 2020). Both are in one context, which is presented through a blended learning setting blended (Chaeruman, Wibawa and Syahrial, 2020) which is modified through synchronous and asynchronous modes. As for the arrangement of the blended learning model, it can be divided into four subcategories of synchronicity patterns as follows.

- Onsite Synchronous Mode (OSM); is learning in a place that applies a formal situation in the classroom conditions between teachers and students who must be physically present. According to (Adarkwah, 2021), onsite learning occurs in school buildings with a teacher-centered teaching mode (providing comments) and student-centered (listening, taking notes, and also asking questions). Such learning conditions occur in direct synchrony between those who learn and teach at the same place and time (Chaeruman, Wibawa and Syahrial, 2018).
- Personal Asynchronous Mode (PAM); is individualized learning that allows students to learn at their own pace through online instructor direction. These learning events occur anytime and anywhere independently under their own pace and control (self-directed learning) (Chaeruman, Wibawa and Syahrial, 2020).
- Virtual Synchronous Mode (VSM); is a learning activity that occurs informally outside the classroom and simultaneously. This learning activity can occur through virtual meeting tools such as Google Meet or Zoom Cloud meetings. This mode of learning occurs in virtual synchrony at the same time but in different places (Chaeruman, Wibawa and Syahrial, 2020).
- Collaborative Asynchronous Mode (CAM); is a learning activity that applies social interaction through online learning technology. The learning experience that occurs in this mode directs the learner and learning resources to interact at any time or place and with anyone (Chaeruman, Wibawa and Syahrial, 2018).

2.2 Characteristics of *Creative Problem Solving* (CPS)

The initial idea of creative problem solving (CPS) was first initiated by (Osborn, 1953) with three main procedures: fact-finding, idea discovery, and finding solutions. CPS underwent several changes in its development, one of which was proposed by (Treffinger, Isaksen and Dorval, 2010). CPS Version 6.1™ includes a management component consisting of two stages: assessing tasks and designing processes. Assessing a task is the stage of guiding individuals or groups in examining sources, content, context, and methods to assess the suitability of the CPS for a particular task. While designing the process is the stage when CPS is considered the right choice, it then guides the selection of certain components, stages, and tools to be applied in the CPS process (Treffinger; and Isaksen;, 2013). The two stages act as an operational system for implementing the three components of the CPS process (understanding challenges, generating ideas, and preparing for action) and the six stages of implementing the CPS process, namely building opportunities, exploring data, and framing problems, generating ideas, developing solutions, and building acceptance.

The purpose of CPS is to enable students to face challenges in real life (Hajiyakhchali, 2013), which is supported by divergent and convergent thinking skills to find creative solutions (Lim and Han, 2020). The implementation of this model illustrates flexibility and creativity, which tend to function in a more cyclical pattern (Wood and

Bilsborow, 2014). This means that CPS has a gradual problem-solving pattern with the help of a systematic framework (Kapoor, Bansal and Jain, 2020). The systemic pattern (Kajzer Mitchell and Walinga, 2017) proposes that CPS can be combined with holistic problem framing and unlocks the quality of problem-solving through insight into finding solutions that are more effective. Therefore, the role of a systemic approach to CPS allows individuals or groups to recognize and act on opportunities, respond to challenges, balance creative and critical thinking, build collaboration and teamwork, and overcome problems (Treffinger and Isaksen, 2005).

2.3 Instructional Design of CPS Learning Methods in the Context of Blended Learning

Designing an effective CPS process in a blended learning context requires organized and systematic planning. According to (Kuo, Chen and Hwang, 2014), learning strategies and problem-solving instruction strategies are important issues that can be considered for designing learning performance in a digital environment. In addition, the intended strategy must be able to meet the principles of implementing the CPS process as proposed (Lim, Park and Hong, 2010), namely, the environment in which learning occurs, the learning instruction process, and the components of the CPS method.

2.3.1 Learning environment

In this study, the blended learning environment is the center of the occurrence of learning events from the point of view of the synchronous learning process. The principle of this learning refers to the alignment of indicators that affect the CPS process in the context of blended learning (Sophonhiranrak, Suwannatthachote and Ngudgratoke, 2015) with a modification of the conceptual model of blended learning synchronicity patterns (Chaeruman, Wibawa and Syahrial, 2018), which can be explained in table 1 below.

Table 1: Learning Activities in a Blended Learning Environment (Synchronicity)

Blended learning indicators for the CPS process	Blended Learning Strategy			
	Formal Learning & Individual learning		Informal Learning & Social Learning	
	OSM	PAM	VSM	CAM
Learning activities	Lectures Discussions Practice Workshops Seminars Lab practices Individual or group projects	Reading Watching (Video, webcast) Listening (audio, audio cast) Online studies Simulations or practice Exercises Roleplay Tests Journal publications	Virtual classes Audio conferences Video conferencing Web-based seminars (webinars)	Participation in discussions via online discussion forums Doing individual or group assignments through online assignments Individual or group publications
Learning resources	-	Texts Audio Visual Video Animations Simulations	Virtual Conference Zoom cloud meeting Google meeting Webex meeting	-
Feedback	Live sync face to face in class	Peer feedback via audio, Video, or text	In real-time via video call or video conference	Online discussion forum
interaction	Learning at the same time and location	Learn anytime, anywhere, about anything, without anyone	Learn at the same time but in different places	Learn anytime, anywhere, about anything, with anyone

Blended learning indicators for the CPS process	Blended Learning Strategy			
	Formal Learning & Individual learning		Informal Learning & Social Learning	
	OSM	PAM	VSM	CAM
Evaluations	Individual or group project	Online tests	Virtual presentations and seminars	Online assignments

2.3.2 Learning instruction process

The CPS method instruction process in the context of blended learning can be developed with four stages recommended by (Lim and Han, 2020), namely: a) Course preparation, b) Preparation of CPS activities, c) CPS implementation, and d) Evaluation. In this study, one of the instructional processes is added, namely the activity of deepening the material. This stage is intended to provide reinforcement of the basic concepts of the study material before students perform the creative problem-solving process.

2.3.3 CPS process components

This stage contains three main phases: understanding the problem, generating ideas, and preparing for action (Treffinger, Isaksen and Dorval, 2010). The implementation process of the three phases can be described in Figure 2 below.

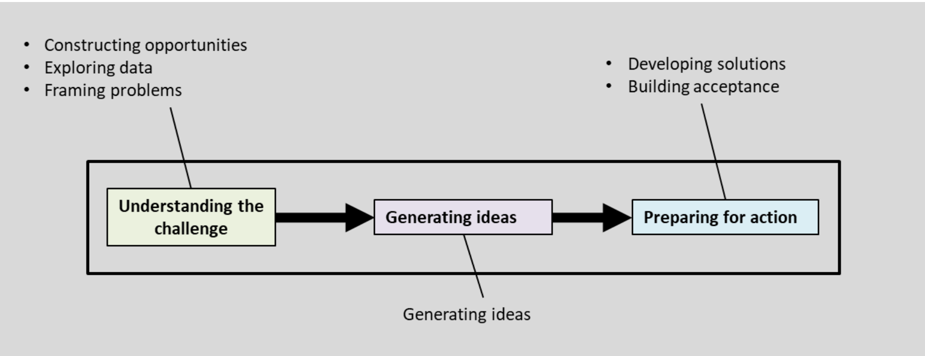

Figure 2: Stages of Implementing the Creative Problem-Solving Process

Of the three phases, (Lim and Han, 2020) outline the six steps of CPS: a) Building opportunities; identifying broad goals, challenges and opportunities; setting a direction for problem-solving; and focusing on possible opportunities and challenges. b) Explore the data, scrutinize the task carefully, and decide on the main focus of the CPS. c) Framing the problem; develop various problem statements and select specific problem statements. d) Generating ideas; generating new and diverse ideas related to the problem statement. e) Developing solutions; turning ideas into potential solutions. f) Build acceptance; explore potential solutions, and identify their supports and barriers to find workable solutions.

3. Methods

3.1 Research Design

This research is a Research and Development (R&D) which aims to produce a CPS process instructional design in a blended learning context that is valid, practical, and effective in learning strategy courses. This development research procedure refers to the ADDIE development model, which includes the Analysis, Design, Development, Implementation, and Evaluation stages. This model was considered in order to develop a learning model that is accurate, effective, efficient, and useful in developing learning for lecturers.

3.2 Research Sample

The population in this study were 6th-semester students of the Biology Education Study Program, Faculty of Mathematics and Natural Sciences, State University of Gorontalo, consisting of 64 students in learning strategies. The sample in this study was 30 students. The sampling technique used in this study was randomized sampling for limited product testing.

3.3 Data Collection Techniques and Instruments

Data collection techniques were used in this study, using instruments in the form of validation assessment sheets, product practicality assessment questionnaires, and effectiveness tests. The validation assessment sheet was used to obtain product validity data according to experts with the title of professor. The experts who validated this learning design were three validators with expertise in instructional design and learning technology experts. As for the other three experts, they were media experts, material experts, and linguists. The type of instrument used to validate the instructional design was an instrument with closed questions in the form of a 5-point Likert Scale which is based on the adaptation of a comprehensive rubric (Debattista, 2018) and (Perris and Mohee, 2020) as well as the CPS process design strategy in a blended learning environment (Lim and Han, 2020) and recommended design principles for CPS support systems by oleh (Lim, Lim and Hong, 2013). Meanwhile, the open-ended question instrument was used to explore information sourced from suggestions and input from experts regarding the design product being developed.

In a limited trial, practicality questionnaire sheets were used to obtain product practicality data according to user responses from lecturers and students. Tests of critical thinking and creative thinking were used to obtain data on the product's effectiveness in improving prospective teacher students' thinking skills. The indicators used to test the critical thinking skills of prospective teacher students adapt the critical thinking aspects proposed by (Ennis, 1989). Meanwhile, the indicators for the creative thinking ability test were adapted from (Treffinger *et al.*, 2002). All instruments were deemed valid and reliable before use.

3.4 Data Analysis Techniques

The data was collected in the form of quantitative data and analyzed descriptively, equipped with triangulation of methods and data sources. The resulting product validity data were analyzed and adjusted to the validity category based on the decision-making criteria using the conversion of score scores on a 5-point scale of the Likert Scale (from 1 = very poor and 5 = very good) (Widoyoko, 2013) as presented in table 2 below.

Table 2: Conversion of Five Actual Scale Scores

Score		Category
Formula	Average	
$X > \bar{X}_i + 1.8sd_i$	X > 4.2	Very good
$\bar{X}_i + 0.6sd_i < X \leq \bar{X}_i + 1.8sd_i$	3.4 < X ≤ 4.2	Good
$\bar{X}_i - 0.6sd_i < X \leq \bar{X}_i + 0.6sd_i$	2.6 < X ≤ 3.4	Satisfactory
$\bar{X}_i - 1.8sd_i < X \leq \bar{X}_i - 0.6sd_i$	1.8 < X ≤ 2.6	Not enough
$X > \bar{X}_i - 1.8sd_i$	X ≤ 1.8	Very poor

Where:

$\bar{X}_i$ (The mean ideal) = 1/2 (maximum score + minimum score)

sd_i (Standard deviation ideal) = 1/6 (maximum score - minimum score)

Maximum score = 5

Minimum score = 1

X = Actual Score

$\bar{X}_i$ = 1/2 (5+1) = 3

sb_i = 1/6 (5-1) = 0.67

The product's practicality is in the form of questionnaire data from lecturers and students who were analyzed quantitatively (percentage). The analysis to calculate the percentage of positive responses from lecturers and students was adapted from (Arikunto, 2010), which is very practical (84%-100%), practical (68%-83%), quite practical (52%-67%), less practical (36%-51%), and impractical (less than 35%). The instructional design of the CPS process in the context of blended learning can be declared practical if the responses of lecturers and students reach a minimum of 68% or are in the practical category. The product's effectiveness was analyzed by quantitative descriptive analysis using the N-gain test. The test results were then interpreted using a modified Normalized Gain index criterion (Hake, 1998) which is presented in Table 3 below.

Table 3: N-Gain Index Criteria

Normalized Gain Index	Classification/Category
g > 70	High / Very Effective
30 < g > 70	Moderate / Effective
g < 30	Low / Less Effective

The final conclusion of product feasibility was determined by using the criteria for the level of validity, practicality, and effectiveness adapted from (Akbar, 2013) in Table 4.

Table 4: Product Eligibility Criteria

No.	Achievement Criteria	Eligibility Level
1	81% - 100%	very valid, very practical, very effective, feasible to use without improvement
2	61% - 80%	quite valid, quite practical, quite effective, feasible to use but needs a little improvement
3	41% - 60%	less valid, less practical, less effective, needs major improvement, not feasible to use
4	21% - 40%	invalid, impractical, ineffective, should not be used
5	0% - 20%	very invalid, very impractical, very ineffective, absolutely not allowed

4. Results

4.1 Pre-Analysis

4.1.1 Characteristics analysis

Prospective teacher students in the Biology Education Study Program at the State University of Gorontalo have learning characteristics that have been facilitated by technology such as smartphones and PCs or laptops. Through this technology, students feel the ease of learning, including getting various learning information that suits their needs. Based on the results of initial observations, it is known that students' experiences, learning styles, learning preferences, and learning behaviors are highly dependent on learning activities that utilize computer-based digital media, such as interactive tools and interacting with others. Regarding the aspect of the maturity level of thinking, student teacher candidates are more fun in the form of personal activities to access and interact with widely available learning resources and are motivated in the form of collaborative social interaction activities. From this initial information, describing the source of the learning process among student teacher candidates, it was found that there really is a need for a more varied learning space, not only in formal study rooms and not individually.

4.1.2 Analysis of learning objects

The curriculum studies carried out focused on the objectives and characteristics of the learning content of the learning strategy courses in the Biology Education Study Program. The expected learning objectives are generally regarding the mastery of educational and academic competencies in the field of study and the ability to connect teaching and learning concepts. In particular, the learning strategy course has learning objectives to be able to understand, know, appreciate, animate, and have the ability to develop constructivism knowledge, problem-solving abilities, and skills, as well as critical thinking and creative thinking skills for their profession.

With such learning objectives, the ability of high creativity becomes the main goal for every student-teacher candidate because student-teacher candidates will be encouraged to be able to overcome practical problems in the real world by using higher-order thinking skills so, the ability of Creative Problem Solving (CPS) can be used as a method to influence students to use thinking skills in improving their way of learning.

4.1.3 *Analysis of the blended learning environment*

This analysis looked at the opportunities and constraints for teacher candidates implementing a student learning environment. The results of the initial analysis found that the depth of material that students must achieve had a wide scope with conceptual, procedural, and theoretical structures, as well as learning characteristics that focus on problem-solving abilities that are discovered. This consideration, of course, requires the provision of a more dynamic time to adjust learning activities. The time allotted for each course is equivalent to 170 minutes per credit each week. Thus the time is certainly not enough to be able to meet the expected learning achievements. Thus, to support the implementation of maximum learning, the State University of Gorontalo provides an infrastructure of e-learning facilities for learning in a Moodle-based LMS network. This infrastructure can provide convenience for lecturers and prospective teacher students to facilitate learning and teaching activities both synchronously and asynchronously. The use of e-learning media can facilitate the delivery and management of learning that is easier to support learning achievement. Thus, both lecturers and prospective teachers have good abilities to use e-learning media as a blended learning environment.

4.2 Design

This stage is the process of overcoming the problems encountered based on the results of the analysis that was conducted by designing a learning scenario. Activities in this process focus on developing the CPS process's learning syntax in the context of blended learning. The form of the learning steps can be explained in Figure 3 below.

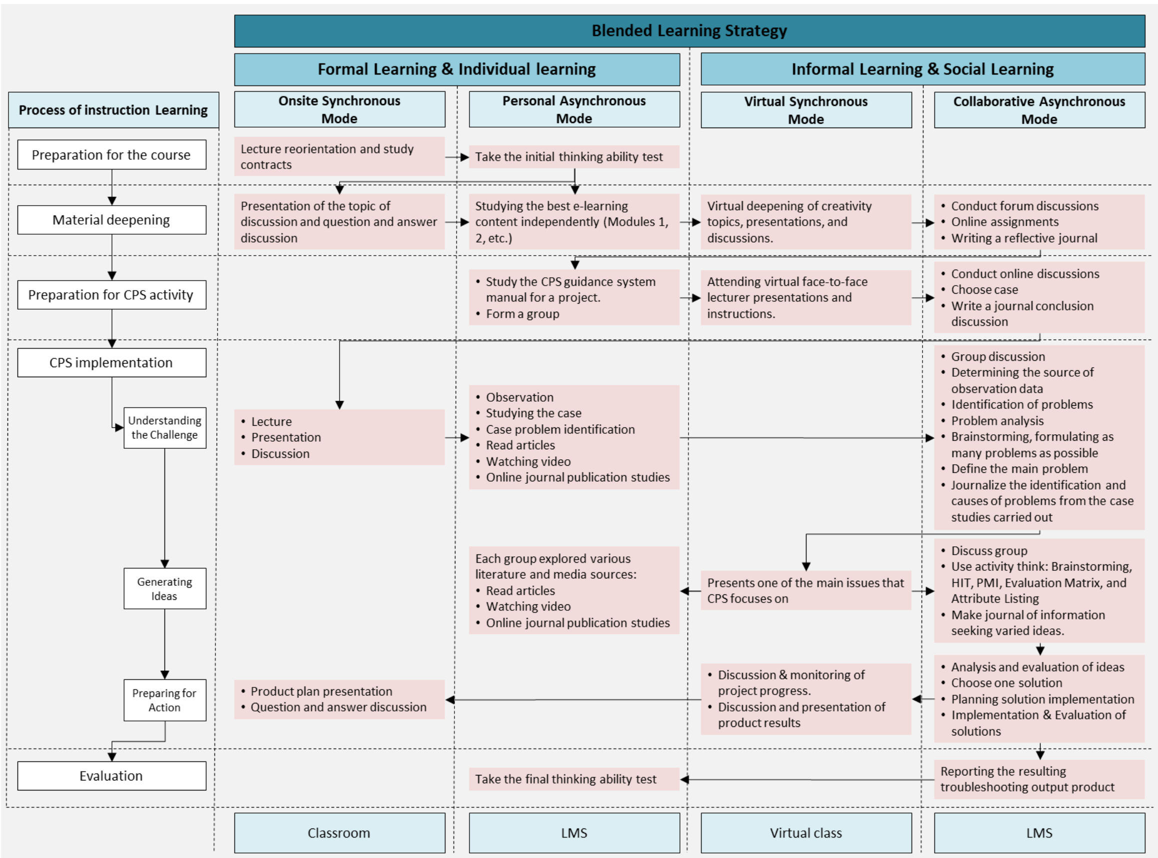

Figure 3: Design of the CPS Process Instructional Model in the Context of Blended Learning

This learning syntax can be started from;

- Preparation for early learning. Lecturers apply creative learning by introducing the study topic and explaining the focus of project problems to the team.
- The process of deepening the material. Students will study and explore the best material that has been presented by the lecturer through e-learning content independently.
- Preparation of CPS activities. Focuses on organizing the learning team and delivering the CPS process support system.

- Implementation of CPS. Students work on team projects by utilizing the CPS process stage (understanding problems, generating ideas, and preparing actions) supported by divergent and convergent thinking tools available in the Moodle-based e-learning system.
- Evaluation activities. Directing students to present the results of team projects and evaluated by lecturers and colleagues as a form of participation.

4.3 Development

The product produced in this development is the syntax of the CPS learning method in the context of blended learning and e-learning for Moodle-based learning strategy courses that can be accessed via https://spada.ung.ac.id/. The e-learning class feature in this course provides 16 blended meetings. Each week of learning is equipped with learning resources and learning activities that provide 120 minutes for independent study and 120 minutes for collaboratively structured assignments.

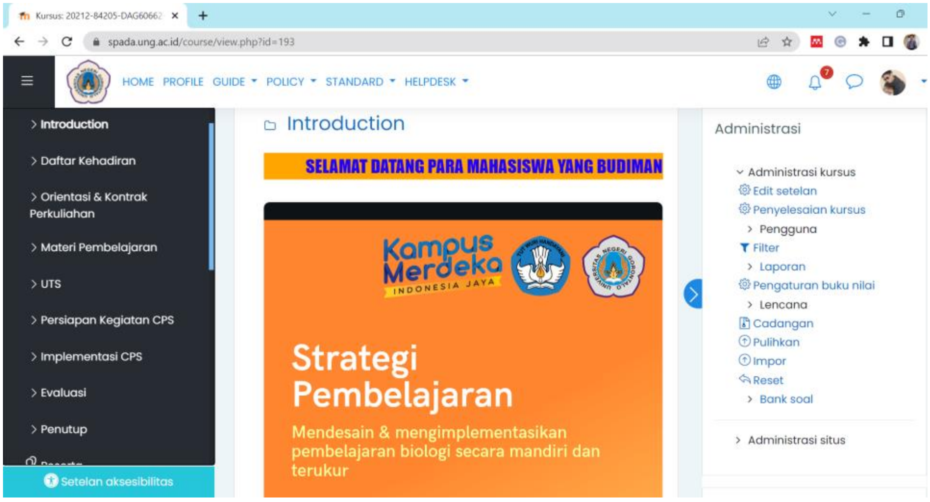

Figure 4: Integration of Learning Strategy Courses Into the Moodle Platform

Experts then validate the products that have been developed by reviewing the criteria for the resulting product indicators. The results of the assessment can be presented in table 5 below.

Table 5: The Results of the Validation of the CPS Process Instructional Design in the Context of Blended Learning

No.	Aspects assessed	Score			Average	Category
		Validator 1	Validator 2	Validator 3		
1	Instructional design	5.00	4.50	4.75	4.75	Very good
2	Learning structure	4.00	4.00	4.50	4.17	Good
3	Learning preparation	4.80	4.20	4.60	4.53	Very Good
4	Learning process	4.78	4.78	4.56	4.70	Very good
5	Learning assessment	4.67	4.50	4.67	4.61	Very good
6	Communication and interaction	4.90	4.60	4.70	4.73	Very good
7	Sources of instructional materials	4.57	4.29	4.86	4.57	Very good
8	Technology design	4.83	4.50	4.67	4.67	Very Good
9	Learning closure	4.00	4.67	4.67	4.44	Very good
Overall average					**4.58**	**Very Good**

Table 5 shows that the average value of the overall assessment aspect is 4.58, which is categorized as "Very Good". Thus the instructional design that has been developed is declared valid and can be implemented in the practicality test stage.

4.4 Implementation

This phase includes product practicality tests which are implemented through Moodle-based e-learning. The questionnaire consisted of responses from 3 lecturers who are lecturers of learning strategy courses and 30 students. The following are the results of practicality tests assessed by lecturers, which can be seen in table 6 below.

Table 6: Results of Lecturer User Responses

No.	Aspects assessed	Average	Category
1	Instructional design	95	Very practical
2	Learning structure	80	Practical
3	Learning preparation	92	Very practical
4	Learning process	87.41	Very practical
5	Learning assessment	85.56	Very practical
6	Communication and interaction	86.67	Very practical
7	Sources of instructional materials	88.57	Very practical
8	Technology design	87.78	Very practical
9	Learning closure	86.67	Very practical
10	Language appropriateness	93.33	Very practical
Overall average		**88.30**	**Very practical**

The results of student assessments of the practicality of product application in the lecture process can be seen in table 7 below.

Table 7: Student User Response Results

No.	Aspects assessed	Average	Category
1	Attractive learning environment	87.11	Very practical
2	Learning experience	82.67	Practical
3	Learning activities	82.89	Practical
4	Learning process	85.56	Very practical
5	Material relevance	89.56	Very practical
6	Language eligibility	89	Very practical
Overall average		**86.13**	**Very practical**

The results of user and student responses show that instructional design products implemented through Moodle-based e-learning facilities are very practical and do not need to be revised.

4.5 Evaluation

This stage is a limited testing process of the product that has been developed. The N-gain test measures the effectiveness of the product. The test instrument is an essay test of critical and creative thinking skills. The test results can be seen in Figure 5.

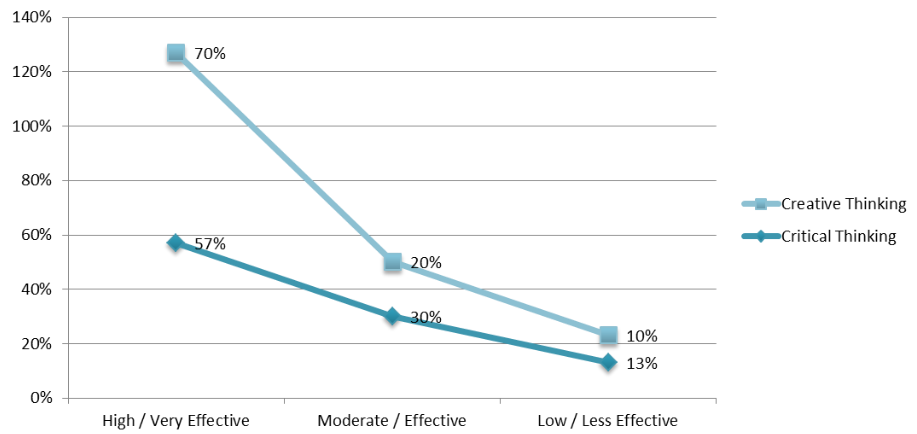

Figure 5: Diagram of N-Gain Test Results for Critical and Creative Thinking Skills

The N-gain value of the product's success is very effective; it can improve critical thinking skills by 71.20% and creative thinking by 72.04%. This success can be seen in Figure 6.

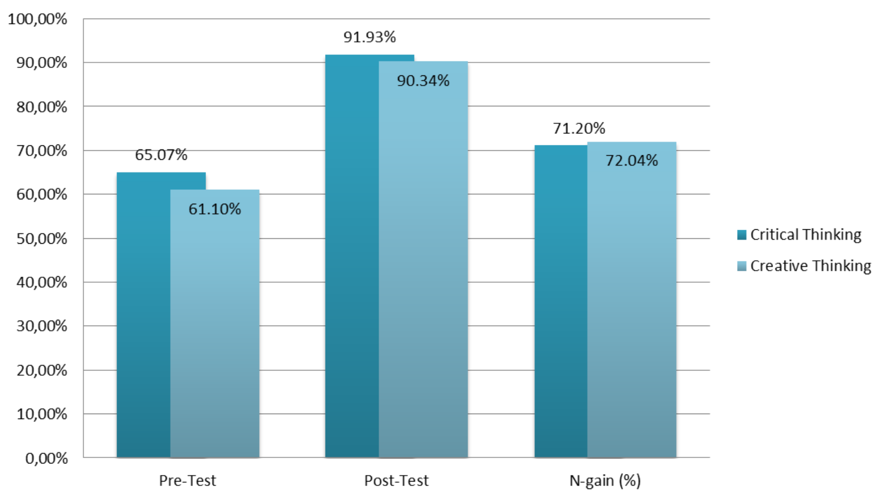

Figure 6: Diagram of the Average Product Effectiveness Test Results

In order to ensure the level of product feasibility, the researchers then carried out a Focus Group Discussion (FGD) activity which reviewed the results of the product tests that had been carried out. This activity involved media, materials, and language experts to complete the product assessment process. The results of the assessment can be seen in table 8.

Table 8: The Results of the Assessment of Media, Material, and Linguistic Experts

No.	Aspects assessed	Average Score	Category
A	Aspects of e-learning media		
1	Have a design interface display interesting to use.	3	Enough
2	Navigation on e-learning media is quite simple, easy, and very conducive.	3	Enough
3	The e-learning media provides a two-way interaction process, namely synchronous and asynchronous.	5	Very good
4	The e-learning media used can facilitate multi-way interactions.	4	Good
5	E-learning media provides various learning resources such as; audio, Video, text, graphic representations of the subject matter, etc.	4	Good

No.	Aspects assessed	Average Score	Category
6	The e-learning media used can promote the engagement of creative problem-solving process learners.	5	Very good
7	The e-learning media used can support a learner-centered learning approach.	3	Enough
8	Learners get clear and detailed instructions intuitively regarding the ease of use of e-learning media.	5	Very good
9	The e-learning media can be accessed through various software platforms, browsers, and computing devices.	5	Very good
10	The use of online e-learning media systems in learning provides time efficiency.	4	Good
	Average	4.18	Good
B	Material aspect		
1	The material is given coherently.	5	Very good
2	The suitability of the material with the expected final achievement.	4	Good
3	The material is free from conceptual errors.	3	Enough
4	Clarity of presentation of material.	5	Very good
5	The material presented is easy to understand coverage.	4	Good
6	The course content is accurate, contextual and contemporary, and relevant to the needs of the professional world of work.	4	Good
6	The presentation of the material is more practical and can be studied repeatedly.	4	Good
	Average	4.14	Good
C	Language aspect		
1	The language description is straightforward, easy to understand, and simple.	3	Enough
2	Instructions/descriptions of the description of learning materials using communicative language.	5	Very good
3	The suitability of using clear and precise sentences in communication with students.	5	Very good
	Average	4.33	Very good

Based on the results of the tests that have been carried out, it can be recommended that the level of feasibility of learning to design products is described in Figure 7 below.

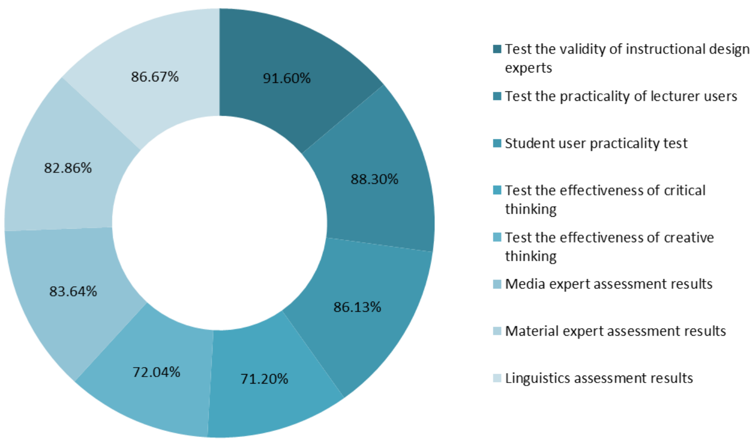

Figure 7: Recapitulation Diagram of Product Feasibility Test Results

Based on the table above, it is known that the product developed has an average product feasibility value of 81.85%, which means that the resulting product is very valid, very practical, very effective, and feasible to use without repair. In addition, the results of expert assessments in FGD activities have ensured that the products produced are more suitable for implementation in the lecture process, with several recommendations for improving the product. The suggestion is that in the implementation of the learning design that is produced, it must be obeyed according to the design and attention must be paid to the learning structure of students so that it is not excessive.

5. Discussion

This study suggests an appropriate CPS process learning syntax to be applied to blended learning. The resulting learning syntax has the flexibility to be presented in a Moodle-based e-learning manner through various software platforms, browsers, and computing devices.

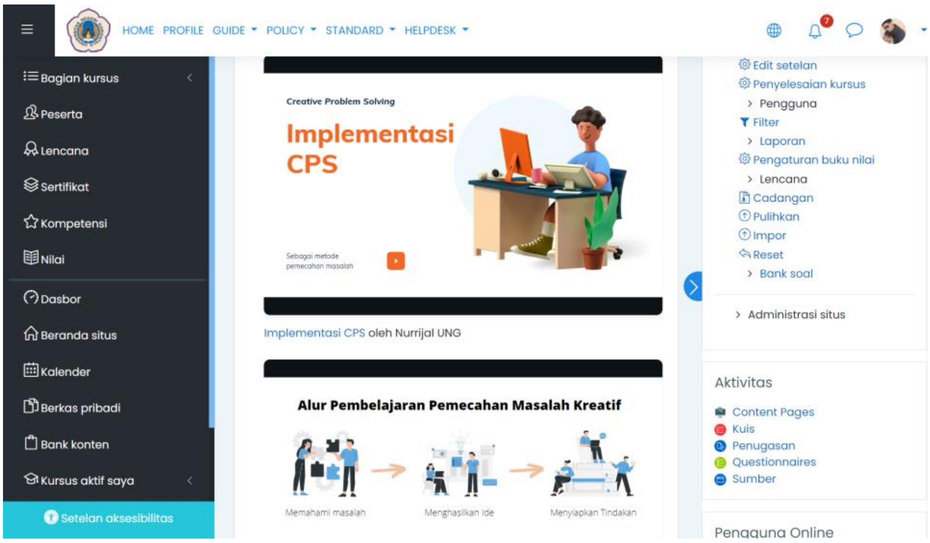

Figure 8: Integration of the CPS Process Into the Moodle Platform

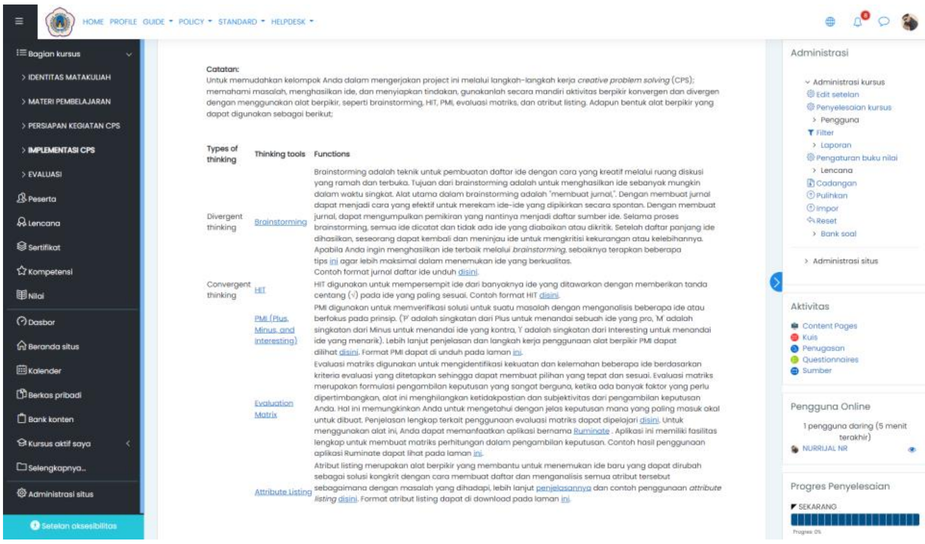

Figure 9: Online Support in the Form of Divergent and Convergent Thinking Tools

During the CPS process, e-learning facilities provide online support features in the form of divergent and convergent thinking tools. These thinking tools include; brainstorming, HIT, PMI, evaluation matrix, and attribute listing. This feature makes it easier for students to work on problem-solving projects and can balance divergent and convergent thinking throughout the CPS process.

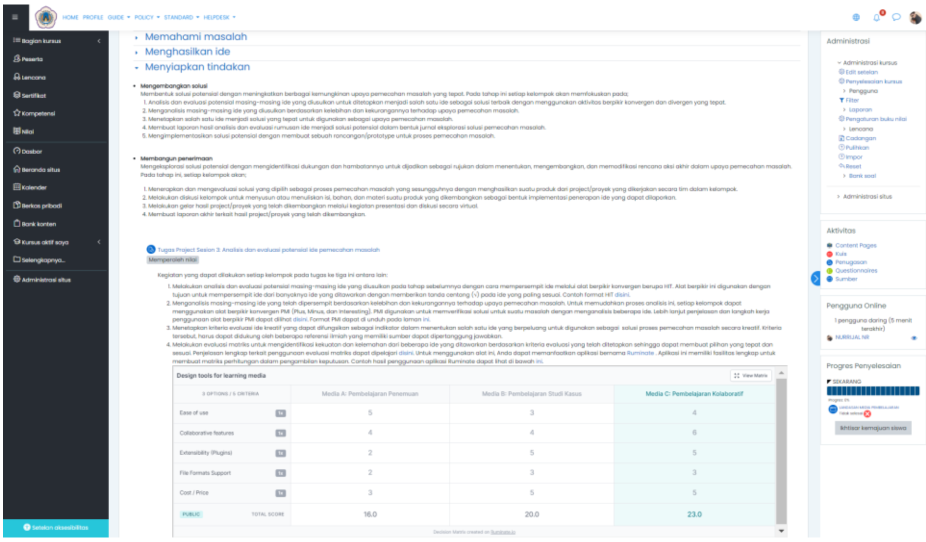

Figure 10: Examples of the Implementation of Online Thinking Tools

In addition, e-learning facilities have facilities that can present a combination of text, images, videos, and animations, as learning resources and various activities such as quizzes, chats, assignments, and discussion forums that can motivate students to be more active. This facility can support innovative learning anytime and anywhere that can be accessed and studied repeatedly.

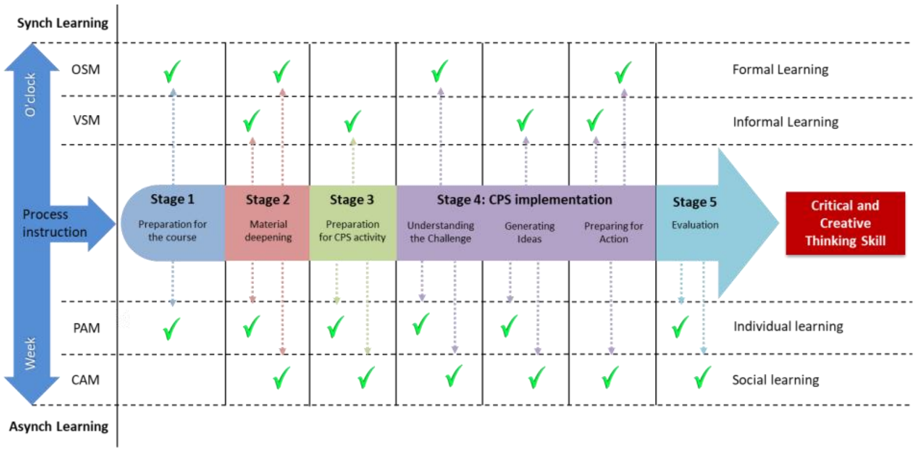

Figure 11: The Process of Implementing the CPS Method in the Context of Blended Learning

The conceptual model of blended learning built in this study offers a pattern of synchronicity as a learning environment for prospective teacher students. This conceptual form has explained the important elements of blended learning (Carman, 2002), namely; 1) Occurs synchronously, educators and all students participate at the same time informally in a "virtual classroom" or directly in a formal classroom; 2) Self-directed learning, a learning experience that is completed individually at asynchronous pace and in its own time; and 3) Collaboration (social learning), a learning experience that comes from the ability of individual students to communicate with other individuals, such as online discussions to facilitate project completion or authentic student assignments.

The expert validity test results indicate that the product developed is categorized as valid. This is in line with the practicality test, which shows a positive response from users to the implementation of very practical learning design products embedded in e-learning. A very good response means that students or lecturers support its use, and students are motivated to follow the whole series of lectures. Meanwhile, the product effectiveness test results show that prospective teacher students' critical and creative thinking skills have increased. This study's findings align with (Yustina, Syafii and Vebrianto, 2020; Bahtiar, 2021), who use an effective blended learning strategy to improve students' critical and creative thinking skills. In addition, the results of studies conducted (Kashefi *et al.*, 2011; Kashefi, Ismail and Yusof, 2012; Munafiah and Rochmad, 2021) also inform the same thing that combining blended learning strategies with e-learning assisted CPS methods can support students in critical thinking and creative thinking.

Thus the CPS process in the context of blended learning has a strong potential to help students to develop their metacognitive thinking skills. This is because the blended learning mode with the CPS method is able to increase the learning potential of students in online interactions (Kanchanachaya and Shinasharkey, 2015), this mode utilizes a combination of computer technology to support students' communication, teamwork, and problem-solving skills (Kashefi *et al.*, 2011). This pattern increasingly directs individuals to think critically and creatively in dealing with complex problems and can play a role in promoting cognitive development (Treffinger, 2016).

6. Conclusion

The instructional design product produced in this study has a more structured and systematic learning syntax to support students' critical and creative thinking skills. With good thinking skills, students can be responsible for regulating the involvement of their learning process during problem-solving. In addition, this learning design can help students become independent learners and synergize collaboratively in teams.

Based on the results of expert validation tests, practicality tests, and product effectiveness tests, as well as the results of media, material, and language expert assessments in FGD activities, it can be concluded that the development of CPS instructional design in the context of blended learning is stated to be very valid, very practical, very effective, and feasible to be implemented in learning. In this study, it was found that the CPS process learning design was very suitable to be applied through the support of Moodle-based e-learning facilities. This is due to the fact that it can optimize and facilitate the balance of divergent and convergent thinking during the problem-solving process. Thus, it can improve students' thinking skills more optimally; however, further investigation is still needed to reveal the effectiveness of its influence on the learning process and learning outcomes of prospective teacher students, as well as its effect on higher order thinking skills in larger classes. So future work should involve experimental studies using control groups to observe or examine the performance and effects extensively of the resulting instructional design products.

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References

Adarkwah, M.A. (2021) 'A strategic approach to onsite learning in the era of SARS-Cov-2', *SN Computer Science*, 2(4), pp. 1–15.

Akbar, S. (2013) *Instrumen perangkat pembelajaran*. Bandung: PT Remaja Rosdakarya.

Allen, M.W. (2007) *Designing successful e-learning*. San Francisco: Pfeiffer; John Wiley & Sons, Inc.

Arikunto, S. (2010) *Prosedur penelitian: Suatu pendekatan praktik*. Jakarta: Rineka Cipta.

Armellini, A., Teixeira Antunes, V. and Howe, R. (2021) 'Student perspectives on learning experiences in a higher education active blended learning context', *Tech Trends*, 65(4), pp. 433–443. Available at: https://doi.org/10.1007/s11528-021-00593-w

Bahtiar, B. (2021) 'The effectiveness of blended learning model to promote physics students' critical thinking skill', *Jurnal Pendidikan Indonesia*, 10(3), pp. 441–452.

Bazelais, P. and Doleck, T. (2018) 'Investigating the impact of blended learning on academic performance in a first semester college physics course', *Journal of Computers in Education*, 5(1), pp. 67–94.

Carman, J.M. (2002) *Blended learning design: Five key ingredients*, *KnowledgeNet*.

Chaeruman, U.A., Wibawa, B. and Syahrial, Z. (2018) 'Determining the appropriate blend of blended learning: A formative research in the context of SPADA-Indonesia', *American Journal of Educational Research*, 6(3), pp. 188–195.

Chaeruman, U.A., Wibawa, B. and Syahrial, Z. (2020) 'Development of an instructional system design model as a guideline for lecturers in creating a course using blended learning approach', *International Journal of Interactive Mobile Technologies*, 14(14), pp. 164–181.

Cheng, G. and Chau, J. (2014) 'Exploring the relationships between learning styles, online participation, learning achievement and course satisfaction: An empirical study of a blended learning course', *British Journal of Educational Technology*, 47(2), pp. 257–278.

Cubric, M. (2007) 'Wiki-based process framework for blended learning', in *WikiSym '07: Proceedings of the 2007 international symposium on Wikis, Montreal Quebec Canada October 21 - 25, 2007*. New York: Association for Computing Machinery, pp. 11–24.

Debattista, M. (2018) 'A comprehensive rubric for instructional design in e-learning', *The International Journal of Information and Learning Technology*, 35(2), pp. 93–104. Available at: https://doi.org/10.1108/IJILT-09-2017-0092

Ennis, R.H. (1989) 'Critical thinking and subject specificity: Clarification and needed research', *Educational Researcher*, 18(3), pp. 4–10. Available at: https://doi.org/10.3102/0013189X018003004.

Fatawi, I. *et al.* (2020) 'Effect of online-based concept map on student engagement and learning outcome', *International Journal of Distance Education Technologies*, 18(3), pp. 42–56.

Fazal, M., Panzano, B. and Luk, K. (2020) 'Evaluating the impact of blended learning: A mixed-methods study with difference-in-difference analysis', *TechTrends*, 64(1), pp. 70–78. Available at: https://doi.org/10.1007/s11528-019-00429-8.

Furlong, J. and Davies, C. (2012) 'Young people, new technologies and learning at home: Taking context seriously', *Oxford Review of Education*, 38(1), pp. 45–62. Available at: https://doi.org/10.1080/03054985.2011.577944.

Garrison, D.R. and Vaughan, N.D. (2008) *Blended learning in higher education*. San Francisco: Jossey-Bass AWiley Imprint.

Hajiyakhchali, A. (2013) 'The effects of creative problem solving process training on academic well-being of shahid chamran university students', in *Procedia - Social and Behavioral Sciences, 3rd World Conference on Psychology, Counselling and Guidance (WCPCG-2012), 9 July 2013, Cyprus*. Elsevier, pp. 549–552.

Hake, R.R. (1998) 'Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses', *American Journal of Physics*, 66(1), pp. 64–74. Available at: https://doi.org/10.1119/1.18809.

Heinerman, J., Rango, M. and Eiben, A.E. (2015) 'Evolution, individual learning, and social learning in a swarm of real robots', in *Symposium Series on Computational Intelligence, Cape Town, South Africa 07-10 December 2015*. IEEE, pp. 1055–1062.

Hui, Y.K. *et al.* (2019) 'Learning engagement via promoting situational interest in a blended learning environment', *Journal of Computing in Higher Education*, 31(2), pp. 408–425. Available at: https://doi.org/10.1007/s12528-019-09216-z.

Hung, D., Tan, S.C. and Koh, T.S. (2006) 'Engaged learning: Making learning an authentic experience', in David Hung & Myint Swe Khine (ed.) *Engaged Learning with Emerging Technologies*. Berlin/Heidelberg: Springer, Dordrecht, pp. 29–48.

Kajzer Mitchell, I. and Walinga, J. (2017) 'The creative imperative: The role of creativity, creative problem solving and insight as key drivers for sustainability', *Journal of Cleaner Production*, 140, pp. 1872–1884. Available at: https://doi.org/10.1016/j.jclepro.2016.09.162.

Kanchanachaya, N. and Shinasharkey, T. (2015) 'A study on interactions between anonymous and non-anonymous pre-service teachers in blended learning using creative problem solving technique to enhance pre-service teachers' ability in professional practices', in *Procedia - Social and Behavioral Sciences, International Conference on New Horizons in Education, INTE 2014, 25-27 June 2014, Paris, France*. Amsterdam: Elsevier Ltd, pp. 2401–2406.

Kapoor, N., Bansal, V.K. and Jain, M. (2020) 'Development of creative problem solving-based framework for site planning in hill areas', *Frontiers of Architectural Research*, 9(2), pp. 450–466.

Kashefi, H. *et al.* (2011) 'Promoting creative problem solving in engineering mathematics through blended learning', in *3rd International Congress on Engineering Education (ICEED) Kuala Lumpur, Malaysia 07-08 December 2011*. IEEE, pp. 8–13.

Kashefi, H., Ismail, Z. and Yusof, Y.M. (2012) 'Supporting engineering students' thinking and creative problem solving through blended learning', in *Procedia - Social and Behavioral Sciences, International Conference on Teaching and Learning in Higher Education in conjunction with Regional Conference on Engineering Education and Research in Higher Education, 8 October 2012, Kuala Lumpur*. Elsevier Ltd, pp. 117–125.

Khan, B.H. (2005) *Managing e-learning: Design, delivery, implementation and evaluation*. USA: Idea Group Inc.

Kilbane, C.R. and Milman, N.B. (2014) *Teaching model designing instruction for 21st century learners*. USA: Pearson Education, Inc.

Kuo, F.-R., Chen, N.-S. and Hwang, G.-J. (2014) 'A creative thinking approach to enhancing the web-based problem solving performance of university students', *Computers & Education*, 72, pp. 220–230. Available at: https://doi.org/10.1016/j.compedu.2013.11.005.

Lai, K.W., Khaddage, F. and Knezek, G. (2013) 'Blending student technology experiences in formal and informal learning', *Journal of Computer Assisted Learning*, 29(5), pp. 414–425.

Laisema, S. and Wannapiroon, P. (2014) 'Design of collaborative learning with creative problem-solving process learning activities in a ubiquitous learning environment to develop creative thinking skills', in *Procedia - Social and Behavioral Sciences, 5th World Conference on Educational Sciences, 21 February 2014, Bangkok*. Elsevier Ltd, pp. 3921–3926.

Lim, C. and Han, H. (2020) 'Development of instructional design strategies for integrating an online support system for creative problem solving into a University course', *Asia Pacific Education Review*, 21(4), pp. 539–552. Available at: https://doi.org/10.1007/s12564-020-09638-w.

Lim, C., Lim, W. and Hong, M. (2013) 'A developmental study for the design of the creative problem solving support system', in *Handbook of the design in educational technology*. Routledge, pp. 217–229.

Lim, C., Park, K. and Hong, M. (2010) 'An instructional model with an online support system for creative problem solving', *International Journal for Educational Media and Technology*, 4(1), pp. 4–12.

Lin, C.-Y., Huang, C.-K. and Ko, C.-J. (2020) 'The impact of perceived enjoyment on team effectiveness and individual learning in a blended learning business course: the mediating effect of knowledge sharing', *Australasian Journal of Educational Technology*, 36(1), pp. 126–141. Available at: https://doi.org/10.14742/ajet.4446.

Lin, K.-Y. *et al.* (2018) 'Effects of web-based versus classroom-based STEM learning environments on the development of collaborative problem-solving skills in junior high school students', *International Journal of Technology and Design Education*, 30(1), pp. 21–34. Available at: https://doi.org/10.1007/s10798-018-9488-6.

Lin, X. and Gao, L. (2020) 'Students' sense of community and perspectives of taking synchronous and asynchronous online courses', *Asian Journal of Distance Education*, 15(1), pp. 169–179.

Littlejohn, A. and Pegler, C. (2007) *Preparing for blended e-learning*. New York: Routledge Taylor & Francis Group.

Mills, L.A., Knezek, G. and Khaddage, F. (2014) 'Information seeking, information sharing, and going mobile: Three bridges to informal learning', *Computers in Human Behavior*, 32, pp. 324–334.

Monita, M. and Fitria, Y. (2021) 'Perbedaan keterampilan berpikir logis dalam pembelajaran dengan menggunakan bahan ajar sains terintegrasi matematika berbasis masalah dengan model CTL dalam pembelajaran IPA', *Jurnal Basicedu*, 5(3), pp. 1286–1393.

Munafiah, S. and Rochmad, R. (2021) 'Mathematical creative thinking ability in terms of mathematical disposition in creative problem solving learning with an open ended approach', *Unnes Journal of Mathematics Education Research*, 10(2), pp. 121–127.

Osborn, A. (1953) *Applied imagination: Principles and procedures of creative writing*. England: Read Books Ltd.

Perris, K. and Mohee, R. (2020) *Quality assurance rubric for blended learning*. Canada: Commonwealth of Learning.

Prasetya, D.D. *et al.* (2020) 'Designing rich interactive content for blended learning: A case study from Indonesia', *Electronic Journal of e-Learning*, 18(4), pp. 276–286. Available at: https://doi.org/10.34190/EJEL.20.18.4.001.

Reigeluth, C.M. and An, Y. (2021) *Merging the instructional design process with learner-centered theory*. New York: Routledge.

Sholikh, M.N., Sulisworo, D. and Maruto, G. (2019) 'Effects of cooperative blended learning using google classroom on critical thinking skills', in *Advances in Social Science, Education and Humanities Research, Proceedings of the 6th International Conference on Community Development (ICCD 2019), 24-25 July, 2019, Bandar Seri Begawan, Indonesia*. Amsterdam: Atlantis Press, pp. 326–330.

Sophonhiranrak, S., Suwannatthachote, P. and Ngudgratoke, S. (2015) 'Factors affecting creative problem solving in the blended learning environment: A review of the literature', in *Procedia - Social and Behavioral Sciences, International Conference on New Horizons in Education, INTE 2014, 25-27 June 2014, Paris, France*. Amsterdam: Elsevier Ltd, pp. 2130–2136.

Ssemugenyi, F. (2022) 'Trapped at the crossroads: Does problem-based learning make a difference? The moderating role of traditional mode of instruction', *Cogent Education*, 9(1), pp. 1–18.

Taghizadeh, M. and Hajhosseini, F. (2021) 'Investigating a blended learning environment: contribution of attitude, interaction, and quality of teaching to satisfaction of graduate students of TEFL', *The Asia-Pacific Education Researcher*, 30(5), pp. 459–469. Available at: https://doi.org/10.1007/s40299-020-00531-z.

Tavangarian, D. *et al.* (2004) 'Is e-learning the solution for individual learning?', *Electronic Journal of e-Learning*, 2(2), pp. 273–280.

Treffinger;, D.J. and Isaksen;, S.G. (2013) 'Teaching and applying creative problem solving: Implications for at-risk students', *International Journal for Talant Development and Creativity*, 1(1), pp. 87–98.

Treffinger, D.J. (1995) 'Creative problem solving: Overview and educational implications', *Educational Psychology Review 1995 7:3*, 7(3), pp. 301–312. Available at: https://doi.org/10.1007/BF02213375.

Treffinger, D.J. *et al.* (2002) *Assessing creativity: A guide for educators*. Storrs: National Research Center on the Gifted and Talented. University of Connecticut.

Treffinger, D.J. (2016) 'Creative problem solving (CPS): Powerful tools for managing change and developing talent', *Gifted and Talented International*, 22(2), pp. 8–18. Available at: https://doi.org/10.1080/15332276.2007.11673491.

Treffinger, D.J. and Isaksen, S.G. (2005) 'Creative problem solving: the history, development, and implications for gifted education and talent development', *Gifted Child Quarterly*, 49(4), pp. 342–353.

Treffinger, D.J., Isaksen, S.G. and Dorval, K.B. (2010) *Creative problem solving (CPS Version 6 . 1 TM) a contemporary framework for managing*. Center for Creative Learning, Inc. and Creative Problem Solving Group, Inc.

Ubah, I.J.A., Spangenberg, E.D. and Ramdhany, V. (2020) 'Blended learning approach to mathematics education modules: an analysis of pre-service teachers' perceptions', *International Journal of Learning, Teaching and Educational Research*, 19(7), pp. 298–319.

Ulfa, S., Surahman, E. and Octaviani, H.I. (2020) 'Mobile seamless language learning framework to improving students' speaking skills for junior high students during pandemic Convid-19: A case study in Indonesian context', in *Advances in Social Science, Education and Humanities Research, 1st International Conference on Information Technology and Education (ICITE 2020), 7 November 2020, Malang*. Amsterdam: Atlantis Press, pp. 497–500.

Wahyuningsih, S. *et al.* (2020) 'An integration of "online interactive apps" for learning application of graph theory to enhance creative problem solving of mathematics students', *International Journal of Interactive Mobile Technologies (iJIM)*, 14(12), pp. 97–109.

Widoyoko, E.P. (2013) *Evaluasi program pembelajaran*. Yogyakarta: Pustaka Pelajar.

Wood, D. and Bilsborow, C. (2014) '"I am not a person with a creative mind": Facilitating creativity in the undergraduate curriculum through a design-based research approach', *Electronic Journal of e-Learning*, 12(1), pp. 111–125.

Yustina, Syafii, W. and Vebrianto, R. (2020) 'The effects of blended learning and project-based learning on pre-service biology teacher creative thinking through online learning in the Covid-19 pandemic', *Jurnal Pendidikan IPA Indonesia*, 9(3), pp. 408–420.

Zhuang, K. *et al.* (2021) 'Connectome-based evidence for creative thinking as an emergent property of ordinary cognitive operations', *NeuroImage*, 227, p. 117632.