

Design of learning python programming for informatics education student using cloud computing technology based on google colaboratory

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Abstract: The application of technology in learning can provide many benefits, such as enriching learning methods, increasing learning motivation and facilitating access to information. The world of education greatly benefits from the existence of cloud computing technology such as google colaboratory in the Informatics Education department. Learning design that is integrated with technology requires a suitable design in conducting technology-integrated collaborative learning. In this study, researchers designed a computer support collaborative learning with a gamification approach using the Research and Development (R&D) method with the ASSURE model. The design test was conducted by content experts, design experts, media experts, and gamification experts. The series of learning designs developed by researchers received positive results by experts. The validation results assessed by content experts get a score of 100%, media experts get a score of 95%, design experts get a score of 87%, and gamification experts get a score of 88%. Based on this score, this learning design is suitable for implementation.

Keywords: Cloud computing, CSCL, gamification, google colaboratory

Abstrak: Penerapan teknologi dalam pembelajaran dapat memberikan banyak manfaat, seperti memperkaya metode pembelajaran, meningkatkan motivasi belajar dan memudahkan akses terhadap informasi. Dunia pendidikan sangat diuntungkan dengan adanya teknologi cloud computing seperti google colaboratory pada jurusan Pendidikan informatika. Desain pembelajaran yang diintegrasikan dengan teknologi memerlukan desain yang cocok dalam melakukan pembelajaran kolaborasi yang diintegrasikan teknologi. Dalam penelitian ini, peneliti mendesain pembelajaran komputer support collaborative learning dengan pendekatan gamifikasi menggunakan metode Research and Development (R&D) dengan model ASSURE. Uji coba desain dilakukan oleh para ahli isi, ahli desain, ahli media, dan ahli gamifikasi. Rangkaian desain pembelajaran yang dikembangkan oleh peneliti mendapatkan hasil positif oleh para ahli. Hasil validasi yang dinilai oleh ahli isi mendapatkan skor 100%, ahli media mendapatkan skor 95%, ahli desain mendapatkan skor 87%, dan pada ahli gamifikasi mendapatkan skor 88%. Berdasarkan skor tersebut desain pembelajaran ini layak untuk implementasikan.

Kata kunci: Cloud computing, CSCL, gamifikasi, google colaboratory

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INTRODUCTION

In this digital era, the use of technology has become inevitable in all aspects of life, including the world of education. Technological advances and their rapid evolution have had a positive impact on the industrial sector and various productive/service sectors, the service sector that has benefited the most is education (Miranda et al., 2021), the rapid development of learning technology has had a very broad impact on education in the 21st century, including education in higher education (Qonita et al., 2019). Along with the access to technology, software, and applications, more and more educators and researchers are paying attention to the integration and use of technology (Fernandes et al., 2020).

Education has been integrated with digital devices to enhance the learning and teaching process (Raja & Priya, 2021; Yomaki et al., 2023), with the development of technology in education, students, parents, and teachers face a variety of educational technologies to choose from ranging from personalized digital learning platforms to personalized digital learning tools (Escueta et al., 2020, Setyantoko et al., 2023), technology is one of the solutions to develop meaningful learning (Fuada & Soepriyanto, 2020). The application of technology in learning can provide many benefits, such as enriching learning methods, increasing learning motivation and facilitating access to information. However, according to (Kimmons et al., 2020), training teachers and students to practice technology integration is a tough challenge at the moment.

Therefore, it is necessary to have a good understanding of how to integrate technology in learning effectively, so that it can provide maximum benefits to the learning process, educators must be professionally engaged in using digital technology for communication, collaboration, and professional development (Ota et al., 2023; Štemberger & Konrad, 2021; Yunita et al., 2023), as the most effective factor for integrating technology into the classroom is the teacher themselves, it is important to recognize the importance of digital technology in the learning process (Dogan et al., 2021), technology is one of the solutions to develop meaningful learning (Adi et al., 2020). Integrating technology in learning is essential to support education reform in developing 21st-century skills (Ratih et al., 2024). One of the technologies that can be integrated with learning in Informatics Education is cloud computing technology.

Cloud computing technology has penetrated the world of education. Cloud computing technology in education is not only used as a learning medium in the classroom that helps lecturers in presenting teaching materials, cloud technology allows the use of broader forms and methods of teaching and has proven to be one of the modern ways to accelerate and optimize the learning process (Elmurzayevich, 2020). In the context of education, cloud computing technology allows students and teachers to access resources and information quickly and easily, without restrictions on time and place, cloud-based environments are organized so that students can access them anywhere, as long as they have internet access (Kim & Henke, 2021). In addition, cloud computing technology can also facilitate interaction and collaboration between students and teachers, one of which is by using google colaboratory.

Google Colaboratory is a cloud service based on Jupyter Notebooks for deploying machine learning education and research (Carneiro et al., 2018), google colaboratory provides web-based communication techniques and traditional collaboration methods adopted using the web, google colaboratory which allows users to type python code in a web browser (Kuroki, 2021), google colaboratory is a free GPU service provider that can be used as a CNN computing tool (Handayani et al., 2020), google colaboratory can allow students to study material independently, at a pace and in a way that suits them best, which can accelerate and improve their understanding of the material, Google Colaboratory can introduce students to programming concepts and can be a useful tool to help the learning process (Vallejo et al., 2022). Google colaboratory can be a very useful tool to improve student effectiveness and learning outcomes.

With cloud computing technology in the form of google colaboratory in Informatics Education, It is necessary to implement a suitable learning design such as collaborative

learning. Collaborative learning refers to learning arrangements that involve two or more learners working together to achieve a common learning goal (van Leeuwen & Janssen, 2019). It can take the form of dialogue, negotiation, debate to solve their problems. Computer-mediated cooperative learning (CSCL) is collaborative learning in which a group of students use a computer network to maximize individual and group learning outcomes and to achieve goals through discussion, CSCL which emphasizes reciprocal relationships supported by information and communication technology thus enhancing group interaction (Chengzheng et al., 2023). CSCL is built on the premise that collaborative knowledge construction and problem-solving can be effectively assisted by technology (Jeong et al., 2019).

In computer-supported collaborative learning (CSCL), there needs to be a design so that it has added value in terms of learning design itself, there needs to be innovation and appropriate support systems so that the positive impact increases in the application of computer-supported collaborative learning. The innovation that can be done is by adding the concept of gamification learning to computer-supported collaborative learning, the application of this concept by using game principles in non-game activities, especially in the world of education, gamification uses game-based mechanisms, aesthetics, and game thinking to engage people, motivate action, encourage learning, by including game elements in learning to make learning fun (Khuluq et al., 2023). Based on the explanation above, researchers want to design learning for Informatics Education students by using cloud computing technology based on google colaboratory.

METHOD

The method used in this research is research and development (R&D). The development using the ASSURE model model. The steps instructed in the ASSURE model are as follows.



Fig. 1. ASSURE model

Analyze learner In this initial step, the researcher analyzes the learning situation and the general characteristics of the learners. At this stage, researchers conduct analyses in order to find out and collect the data needed to carry out activities. State Objectives, the next step is to determine specific learning objectives, in this goal formulate statements to describe the competencies obtained by learners after learning. Select methods, media, and materials, in choosing methods based on the objectives that have been formulated in the previous step, as well as in choosing teaching materials to be delivered based on learning

objectives, and in selecting media in conducting learning also based on previously formulated objectives.

Utilize media and materials after determining the selected methods, media, and teaching materials, then utilize them in learning activities. After the product is developed, researchers test whether the methods, media, and teaching materials in the form of a computer-supported collaborative learning (CSCL) learning design product with a gamification approach are appropriate. In conducting trials, researchers carry out activities (a) Preview the materials (review teaching materials) (b) Prepare the materials (prepare teaching materials) (c) Prepare the environment (prepare the learning environment) (d) Prepare the learners (prepare the learners) (e) Provide the learning experience (determine the experience in learning).

Require learner participation (develop learner participation) In this stage, learning is done by involving learners in the learning process. Evaluate and revise (assess and improve) in this stage evaluate the model and assess the effectiveness in the development of learning design. Evaluation of all learning components is carried out in order to obtain quality development products.

The product to be developed is first validated by experts, who aim to determine the feasibility of the product being made. Validation is carried out by content experts, media experts, and design experts, and gamification experts. This research was conducted to test the level of validation. The product was tested using an assessment instrument with a four-option Likert scale.

Table 1. Scoring provisions

Score	Criteria
4	Agreed
3	Agree
2	Disagree
1	Disagree

Assessment to determine the quality and validation, calculated in the form of a percentage. The results of data processing will be calculated through the following formula:

$$X = \frac{\sum \text{score result}}{\sum \text{maximum score}} \times 100\% \quad (1)$$

Furthermore, the value of X is referred to as the interval determining the validation of learning design development. In quantitative analysis, the percentage techniques are used (Arikunto, 2002). The design developed is declared feasible if at least the feasible level is more than equal to 60%.

Table 2. Validation criteria table

No.	Formula	Category
1.	81% X 100%	Very Decent
2.	61% X 80%	Worth
3.	41% ≤ X 60%	Less Feasible
4.	21% ≤ X ≤ 40%	Not Feasible

RESULTS AND DISCUSSION

This chapter presents the results of development, validation by four competent experts, as for experts who conduct validation, namely: content experts, media experts, design experts, and gamification experts. The results of the development of computer-supported collaborative learning (CSCL) learning design with a gamification approach can be seen in the learning activities in the table below.

Table 3. Learning activities

Activities	Activity Description	Educator Activities	Learner Activity
Initial (15)	<ul style="list-style-type: none"> The educator opens the lesson, then conveys the learning outcomes and rules for learning activities in the class. 	<ul style="list-style-type: none"> Educators open the learning by saying greetings. Educator checks the attendance of learners. Educators convey learning outcomes and convey the rules of classroom learning activities. 	<ul style="list-style-type: none"> Learners listen to explanations regarding the rules of learning rules in class. learners ask questions if there is confusion related to the rules of learning activities in class.
Core (120)	<ul style="list-style-type: none"> Read out the lecture content and rules in the lecture. Forming learners into groups for collaboration. Point aim to determine the ranking in a class. Providing material and problems then learners in groups solve the problem Educators facilitate collaboration with online platforms There will be a reward for the group that gets the highest point. 	<ul style="list-style-type: none"> The educator forms the learners into groups according to the number of learners in the class. Educators read out the gamification rules in the form of rules, point, leaderboard, and reward mechanisms. The educator explains the material to the learners and gives examples of problems for the learners to solve in groups in class. Educators give rewards to the group that gets the highest point that week. 	<ul style="list-style-type: none"> Learners gather with their groups and decide who will be the team captain. Learners solve cases given by the educator in groups by discussing through google colaboratory.
End (15)	The educator closes the learning activity.	<ul style="list-style-type: none"> Educators display the leaderboard regarding 	<ul style="list-style-type: none"> Learners ask questions related

	the results of the standings of each meeting.	to things that are not understood to the educator.
	<ul style="list-style-type: none"> • Educators close learning activities. 	

After the learning design has been developed, it will be validated by experts who are following their competence. The testing carried out by this severe expert aims to determine the serviceability of the results that have been developed in the form of computer support collaborative learning (CSCL) learning design with a gamification approach.

Table 4. Results of the four Validators

Validator	Aspects assessed	Results
Content Expert	<ul style="list-style-type: none"> • Material suitability • Appropriateness of the material • Use of language 	100%
Media Expert	<ul style="list-style-type: none"> • Ease • Attractiveness • Quality • Motivation 	95%
Design Expert	<ul style="list-style-type: none"> • Identity • Systematics • Semester lesson plan substance • Time 	87%
Gamification Expert	<ul style="list-style-type: none"> • Gamification elements 	88%

Collaborative learning is one of the most critical concepts in distance education as the diversity of learners is often seen as an important indicator to enhance comprehensive interaction within the group and ensure the effectiveness of the learning process (Karaoglan Yilmaz & Yilmaz, 2019), collaborative learning can train individuals in problem-solving, sharing knowledge and skills (Setiawan et al., 2020), collaborative learning provides convenience in learning, motivates students in learning and displays media that are attractive to students (Praherdhiono et al., 2021).

The computer-supported collaborative learning is a learning approach that prioritizes cooperation and collaboration between learners with the support of computer technology. Computer-supported collaborative learning (CSCL) is considered an important skill today (Hsu et al., 2021). In computer-supported collaborative learning, learning is carried out with technology, which forms groups in learning that are later faced with interactions to solve complex unstructured problems or asked to design a project, well-structured collaborative enhances individual learning and has a significant influence on learner satisfaction (Hernández-Sellés et al., 2019).

Gamification is an approach to learning that integrates game elements into the learning environment, gamification in education has become increasingly prominent in the last decade (Ramansyah et al., 2024). This approach uses game elements to enhance non-

entertainment applications to drive behavior change, engagement, motivation, and solicit participation in activities (Bassanelli et al., 2022), gamification is an activity using game elements but applied to non-game systems. In learning, gamification applies game elements to non-game applications with the aim of increasing learner motivation in solving a problem.

The first stage is the educator conveys the learning outcomes and the rules of classroom learning activities; the educator reads out the gamification rules in the form of rules, points, leaderboards, and reward mechanisms, when gamification is applied, learners will be taken to a game-like learning atmosphere (Rumianda et al., 2020). These rules include classroom learning activities. Educators form learners into groups according to the number of learners in the class, then educators provide explanations related to the material to learners and examples of problems for learners to solve in groups in class; learners have the opportunity to get points when successfully solving problems (successful coding), the first group to solve the problem every meeting is given 25 points, with points can motivate learners and learning activities become better (Azman et al., 2023). Educators give points to find out the ranking in standings in the class, and then there will be a reward for the group that gets the highest point. The educator displays a leaderboard regarding the results of the standings at each meeting. Based on the validation results that experts have carried out, the learning design is suitable for use in the informatics education department of Citra Bangsa University, Kupang City, East Nusa Tenggara.

CONCLUSION

In this digital era, the use of technology has become inevitable in all aspects of life including in the world of education. The application of technology in learning can provide many benefits, such as enriching learning methods, one of which is the use of cloud computing technology in the form of google colaboratory. Developing a learning design that is integrated with technology requires the right learning design and is in accordance with the field conditions in the Informatics Education Department of Citra Bangsa University. Computer-mediated cooperative learning is collaborative learning in which a group of students use a computer network to maximize individual and group learning outcomes and to achieve goals through discussion, the model in cooperative/collaborative emphasizes the role of teachers and students. CSCL emphasizes reciprocal relationships supported by information and communication technology to enhance group interaction.

In computer-supported collaborative learning (CSCL) needs to be designed so that it has added value in terms of learning design, the innovation that can be done is by adding the concept of gamification learning to computer-supported collaborative learning, the application of this concept by using game principles in non-game activities, especially in the world of education, gamification uses game-based mechanisms, aesthetics, and game thinking to engage people, motivate action, encourage learning. The series of learning designs developed by researchers received positive results from experts. Based on the results of the validation that experts have carried out, the learning design results are suitable for use in the Department of Informatics Education, Citra Bangsa University, Kupang City, and East Nusa Tenggara.

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