

Development of the CPOL design to improve the ability to develop teaching materials

Muhammad Yunus^{a*}, Syiah Kuala University, Department of Civic Education, Banda Aceh, 23111, Indonesia
<https://orcid.org/0000-0002-6503-0708>

Amirullah Amirullah^b, Syiah Kuala University, Department of Civic Education, Banda Aceh, 23111, Indonesia,
<https://orcid.org/0000-0001-9129-1218>

Intan Safiah^c Syiah Kuala University, Department of primary school teacher education, Banda Aceh, 23111,
Indonesia <https://orcid.org/0000-0003-1090-6941>

Syahrul Ridha^d Syiah Kuala University, Department of Geography Education, Banda Aceh, 23111, Indonesia
<https://orcid.org/0000-0003-3882-4729>

I Kadek Suartama^e, Universitas Pendidikan Ganesha, Department of Instructional technology, Singaraja, 81116,
Indonesia, <https://orcid.org/00000002-4881-3233>

Suggested Citation:

Yunus, M., Amirullah, A., Safiah, I., Ridha, S. & Suartama, I.K (2022). Development of the CPOL design to improve the ability to develop teaching materials. *Cypriot Journal of Educational Science*. 17(5), 1655-1670.
<https://doi.org/10.18844/cjes.v17i5.7257>

Received from January 15, 2022; revised from April 20, 2022; accepted from May 05, 2022.

©2022 Birlesik Dünya Yenilik Arastırma ve Yayıncılık Merkezi. All rights reserved.

Abstract

This study aims to develop an online-based collaborative project learning model design that can improve students' abilities in developing teaching materials. The method used is research and development. Data collection instruments are questionnaires and rubrics. Data analysis used descriptive statistics. The validation test used the individual content validity index and the overall content validity index. The Collaborative Project Online Learning (CPOL) model developed consists of six stages in learning: (1) orientation, (2) understanding project concepts and tasks, (3) designing and determining project themes, (4) working on project assignments, (5) presenting project assignments, and (6) evaluating project assignments. The results show that the content validity index shows a good category. Students are also good at developing teaching materials. Thus, the design of the CPOL model can be used in the course of developing teaching materials in higher education.

Keywords: Designing, collaborative project, online learning, ability to develop, teaching materials.

* ADDRESS FOR CORRESPONDENCE: Muhammad Yunus, Universitas Syiah Kuala, Department of Civic Education, Darussalam, Banda Aceh, 23111, Indonesia,
E-mail address: yunus.msalem@unsyiah.ac.id / Tel.: +62-813-6039-9572

1. Introduction

The problems of implementing face-to-face learning due to COVID-19 have caused experts in higher education to find solutions to online learning (Chen & Swan, 2020). Online learning is one choice in education today, especially when there are barriers to face-to-face learning (Dhull & Arora, 2019). Currently, lecturers in universities carry out online learning using e-learning applications facilitated by university institutions, but the majority of teachers experience obstacles such as ineffective learning (Suartama et al., 2019; Vezne, 2020). The current COVID-19 pandemic period requires new, innovative methods to improve students' communication skills and reduce tension in online learning (AlKhamaiseh, 2022). On the other hand, the application of online learning, such as using expository learning and assignments carried out through Google Meet or Zoom meeting, has become a separate problem in the current COVID-19 pandemic situation.

Online learning during the pandemic has raised many problems for both lecturers and students (Wargadinata et al., 2020). Some lecturers and students are not ready to apply online learning, since they are not familiar with the technology and strategies used in online learning (Simamora, 2020). Several research results show that the challenges faced by lecturers in carrying out online learning include limitations in presenting material in the sense that the material presented is monotonous and uninteresting and the difficulties of building activeness, creating interaction between lecturers and students, as well as between students (Salehudin et al., 2021; Suartama et al., 2021). Online learning is likely more stressful than studying in a regular classroom because students are forced to study alone. The absence of challenging and collaborative activities makes students unmotivated and difficult to focus on learning (Oliveira et al., 2021). Mediocre online activities and content are also a major problem (Dhawan, 2020). Distance learning with collaborative technology can be prioritised (Masalimova et al., 2021). This condition requires the development of an online-based learning model in the course of developing teaching materials. The importance of model development is because the course of developing teaching materials requires a learning model that can accommodate students working on collaborative teaching materials' development projects. For this reason, the researchers tried to design and implement a model called Collaborative Project Online Learning (CPOL) model.

The developed CPOL model currently is inseparable from online collaborative project learning models that are currently the focus of educational research. This is in line with the results of the research, revealing that project and collaborative learning becomes innovative learning, followed by the demands of the 21st century (Lee et al., 2015; Magen-Nagar & Shonfeld, 2018). In addition, online-based collaborative learning is also a solution for improving learning activities and outcomes (Ardiasih et al., 2019). Research similar to this study has revealed that learning collaborative-based online projects are learning models that are useful to enhance communicative, meaningful and effective activities and to improve English skills (Al Rawahi & Al-Mekhlafi, 2015).

Web-based project learning models to improve collaborative team communities are pursued through group reflection (Wang, 2022). Online collaborative learning can also improve student performance, learning experiences, motivation and is considered a fun and rewarding experience (Farrah, 2015; Sarwar et al., 2019). Project-based learning is a learning strategy that can increase participation, is interesting for students because they learn by collecting data, solving problems, discussing and presenting results as reports (Huysken et al., 2019; Kricsfalusy et al., 2018). The development of the learner project-based learning model contributes to the ability of higher-order thinking and creativity (Pinho-Lopes & Macedo, 2014). The results of the study suggest that collaborative reflection on online journal writing can increase knowledge and improve teaching performance (Elhussain & Khoja, 2020).

Based on several literature studies obtained at the current time, the design of an online project-based collaborative learning model has not been found. This research tries to focus on developing the design and implementation of an online-based collaborative learning model to increase participation; understanding of concepts; and the ability to develop teaching materials for students. This model was developed based on the results of previous research on collaborative learning design, project learning and online learning. This research is important in order to find solutions for students lacking activities during online meetings.

This research can be useful for learning design developers and can be used in implementing online project-based learning. In particular, it can produce an online project-based collaborative learning model design to increase student participation and their ability to develop teaching materials. The project learning model design combined with online-based collaborative learning is called CPOL model. This study developed the CPOL model to help students to be more participative and creative in producing learning design products. Based on the background described, this research's problem is whether the design of the CPOL model can be used to obtain learning outcomes in developing teaching materials for students.

1.1 Theoretical Framework and Related Research

1.1.1 Collaborative project online learning

The CPOL model was developed by integrating collaborative learning, project learning and online learning. Collaborative project learning is an effort to combine collaborative learning and project learning, in which students interact in a project learning environment by developing practical skills that are integrated in technology and carried out collaboratively (Baser et al., 2017). Collaborative learning facilitates interaction between students which has the potential to improve the quality of knowledge construction and development of the necessary skills (Saqr et al., 2018). Therefore, combining the concept of collaborative learning and project learning further enhances learning with the principle of helping each other in togetherness for the completion of learning tasks.

The online collaborative project learning design is designed based on the results of previous research, especially on the results of research on project learning, collaborative learning and online collaborative learning. The project's collaborative learning structure is designed to be dynamic in accordance with the needs and characteristics of students and the conditions of the learning environment. The use of a collaborative learning structure is built on four main elements, namely simultaneous interaction, positive interdependence, individual accountability and equal participation (Lin, 2015). This online-based project collaborative learning is implemented with various presentation strategies in group formation.

The design of collaborative online learning is also associated with the collaboration techniques presented from the results of other studies (Davidson & Major, 2014), which revealed that the implementation of collaborative learning can be carried out in conjunction with other models, namely cooperative learning and problem-based learning. To increase student involvement, collaborative learning requires interaction between peers and lecturers or teachers (Blasco-Arcas et al., 2013). The technique used for assessment in collaborative learning is peer assessment (Mora et al., 2020). Assessment can also be carried out in other forms as explained by Wicks et al. (2015) where in collaborative learning, students' differences are measured using student scores through peer evaluation, pre-test and post-test, and community inquiry surveys. In addition, quantitative content analysis and social network analysis were used to assess collaboration by examining the presence of learning in groups.

Currently, there are many web-based applications that can be used which include supporting features to support implementing CPOL (Alkhataba et al., 2018). Among the media that are often used are Wiki and Google Docs. The positive experience of using media tools such as Wiki and Google Docs for online collaboration in projects as an effective management tool, as well as many students highlighting the features of Google Docs, shows they are user-friendly (Seifert, 2020). Higher education institutions have developed e-learning based on a learning management system (LMS) in the context of implementing online learning.

1.1.2 The ability to develop teaching materials

The ability to develop teaching materials is a competency that prospective teacher students must develop for the preparation of teaching materials. The development of these teaching materials is included in the category of creative ability in producing a final product (Cowdroy & de Graaff, 2005). The development of teaching materials for students aims to enable students to produce their own teaching materials in accordance with the demands of the curriculum. Teacher candidates must have professional abilities to develop their own teaching materials rather than only using teaching materials that have been developed by others (Park & Jongwon, 2012). The results of the study also recommend that creativity in developing student thinking is very good in developing teaching materials (Tsai et al., 2017). Based on this, the development of teaching materials referred to in this study is the ability of students to be creative in developing teaching materials in the subjects of Pancasila Education and Citizenship for secondary-level education.

1.2 Purpose of the Study

The purpose of this research is to develop an online-based collaborative project learning model design in improving students' ability to develop teaching materials. Specifically, the objectives of this research are (1) to prove the expert validation test on the CPOL design in improving students' ability to develop teaching materials and (2) to prove whether the CPOL design can improve students' ability to develop teaching materials.

2. Method and Materials

2.1. Types of research

This research uses the research and development (R&D) method. The R&D method was carried out to develop the design of the CPOL model and to test students' ability to develop teaching materials by collaborating online in working on project assignments. The development research procedure basically consists of two main objectives: (1) developing a product and (2) testing the effectiveness of the product by measuring the ability of students to develop teaching materials as learning objectives (Gall et al., 2003). The developmental function is the first goal and the validation function is the second goal. This research was conducted to develop an online-based project collaborative learning design and validation, then to test it through the implementation of the model in the implementation of the Pancasila and citizenship education teaching material development course.

2.2. Research location

This research was conducted with students of the Department of Citizenship Education, Faculty of Teacher Training and Education, Universitas Syiah Kuala. Expert validation tests were carried out on the CPOL model design and then a model trial was carried out on a limited scale adapted to the civics teaching material development course. The location selection is based on the ease of access to research, as well as being adjusted to the characteristics of the project tasks carried out.

3.3. Research model and stages

Conceptually, the research and development approach includes eight steps (Figure 1).

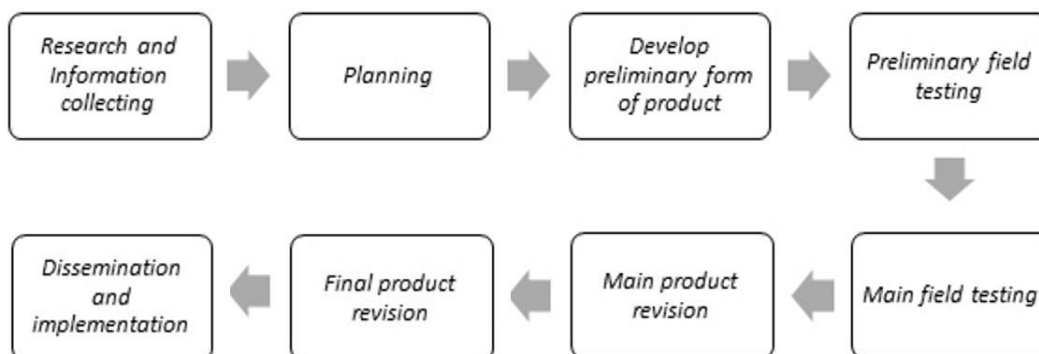


Figure 1. Research and development model (adapted by Borg and Gall, 2003)

The stages of this research were adapted from the instructional design of Borg and Gall (2003), which consists of eight stages, modified into four stages, namely (1) preliminary study, (2) planning and developing products, (3) testing the validity of experts and (4) field trials on a limited scale. The stages of the research are described in detail in Table 1.

Table 1. Stages and research activities

No	Stages	Activities
1	Preliminary research	Study of literature related to research problems Needs analysis Formulating a framework
2	Planning and developing products	Determining goals Designing CPOL model Products developing initial products
3	Expert validity test	Validating the results of the design to the learning model design experts
4	Limited field trials	Preparing instruments Preparing guidelines for field trials Analysing data.

3.4. Research instruments

The research instrument used to obtain data on the feasibility of the CPOL model was a questionnaire, while data collection on the ability to develop teaching materials used a rubric. A questionnaire to measure the feasibility of the CPOL model was developed by researchers with a focus on four indicators, namely online learning activities, independent learning, collaboration and completing projects. It was developed by adapting to the instrument developed by Safiah et al. (2020) and adapting the collaboration aspect of Farrah (2015), while using the adaptation project steps of Jalinus et al. (2017). The rubric used to measure the ability to develop teaching materials was also developed by researchers. Before being used, a validation test for the rubric was carried out.

3.5. Data collection and analysis

Data collection on the feasibility of the model design was carried out by sending the questionnaire and the developed model design to the validator to be assessed. Meanwhile, the rubric as well as the product of teaching materials developed by each student, was also sent to the assessors of teaching materials. The data were analysed using descriptive statistics, i.e., both the feasibility of the design and the ability of students to develop teaching materials. Before analysing the design data, expert validation was carried out which involved design experts who provided input on the design aspects of the CPOL model. The qualification of the CPOL model was carried out by expert testing of the product model developed using the content validity index (CVI) formula (Hendryadi, 2017). This analysis calculates the content validity of individual items (i-CVI) and the content validity of the overall scale (o-CVI). The measurement used a Likert scale of 4, which ranged as follows: 1 = not relevant; 2 = somewhat relevant; 3 = quite relevant; and 4 = very relevant. Then, each i-CVI item was calculated by the number of experts who gave an assessment that was irrelevant, namely 1 and 2, and relevant is 3 or 4, so that the separation of the ordinal scale becomes irrelevant = 0 and relevant = 1, divided by the number of experts, measured by descriptive statistics with the conditions shown in Table 2.

Table 2. Students' ability to develop teaching materials using the CPOL model

Achievement	Qualification
80.1%–100%	Very Good
70.1%–80%	Good
60.1%–70%	Fairly Good
50.1%–60%	Poor
1%–50%	Not Good

3. Results

Exposure to the results of the research on the design of the CPOL model, of both product design and results of the test validation model, is explained in this section.

3.1. CPOL design product results

The results of the design development carried out in three stages, namely the initial development stage, the expert validation result stage and the trial results stage, as well as the final design of the CPOL model, are shown in Figure 2.

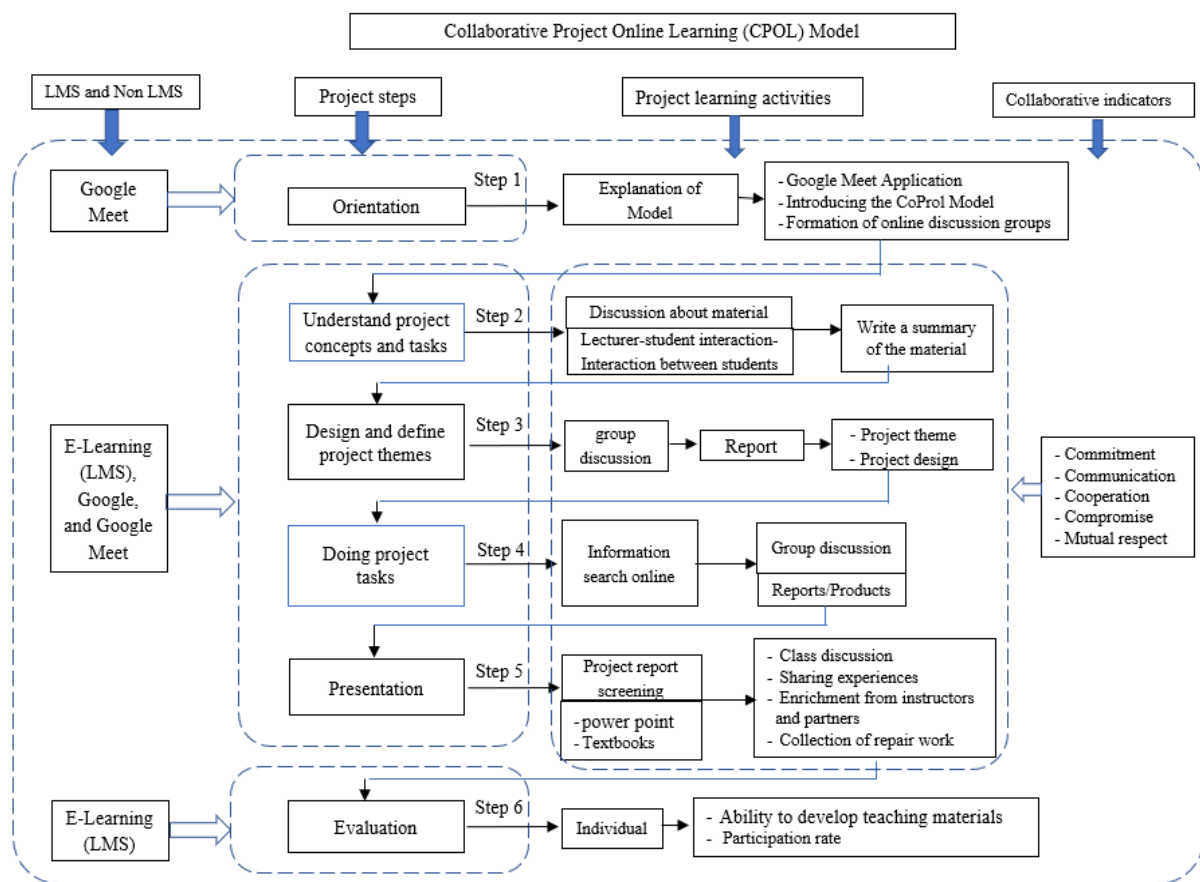


Figure 2. Design of the CPOL model

Based on Figure 2, the learning steps of the CPOL model can be explained as follows:

1. **Orientation.** In the first stage, the teacher or lecturer explains the implementation of learning using the CPOL model. The lecturer explains in detail the learning steps and activities carried out from step 1 to step 6. Each step is explained in detail with the activities carried out. At this stage, the projects carried out by students are also explained, together with the collaborative activities carried out online by emphasising discussions conducted online through LMS and non-LMS applications. Then, the lecturer and students form a collaborative group for the purpose of online discussion entering the second stage at the second meeting.
2. **Understanding the concepts and project assignments.** In the second stage, the lecturer begins to open free discussions in large groups through the Google Meet application, to equalise perceptions between collaborative groups and before determining the project assignments to be worked on. Then, the students continue the discussion in the form of chatting online in collaborative groups through the LMS application, namely the university's e-learning and also the WhatsApp application. The results of this discussion are written in the form of a summary as a basis for designing project assignments in the third stage in the next meeting.

3. **Designing and determining the theme of the project.** In the third stage, the lecturer also starts with a free discussion in large groups through the Google Meet application, in order to guide how to design and determine the project tasks to be carried out. After all groups have determined the project tasks to be carried out, then the students are directed to discuss intensively in collaborative groups how to design projects, as well as the division of individual tasks that will be carried out by each student. Individual assignments on students are part of group assignments so that they are directed to collaborate with five collaboration principles, namely commitment, communication, cooperation, compromise and respect, so as to produce perfect project assignments. The results of the group discussion at this stage would result in a report in the form of certainty of the project being carried out and already having designed a clear project to be carried out at the next stage.
4. **Working on project assignments.** In this stage, lecturers and students interact in collaborative group discussions; lecturers direct students through discussions on LMS and WhatsApp to find a number of references that supports both online and offline-sourced material. All resources can be used to complete projects based online. Students are given 2 weeks to complete project assignments before being presented with the next stage. At the end of this stage, students are expected to have collected reports or project work products.
5. **Presenting project assignments.** In the fifth stage, students in each group are given the opportunity to present the product of the project work in front of the course lecturers, as well as experts from partner schools, and academics from universities. A week before the presentation, students should have sent the product materials to reviewers. The activity begins with presentations from students, then input from reviewers and course lecturers, followed by discussions related to the material presented and the results of reviews from reviewers. The final activity of this stage is the submission of the results of a joint review of the aspects that need to be improved for writing the final product and collecting for product evaluation.
6. **Evaluation of project assignments.** The sixth stage is the assessment stage of the final product of the student's project. At this stage, students are given a questionnaire to obtain information about the level of participation or involvement in collaborating and to obtain a response to the level of student satisfaction while working on project assignments through the CPOL model. Student responses are taken with the aim of knowing the effectiveness of implementing the CPOL model in working on project assignments online.

3.2. *Validity model test results*

Validation of the CPOL model is carried out by experts who have a reputation for learning and language design. Expert validation is carried out to ensure that the model developed is recognised as a model that is worthy of being used as a learning model. The validation team consisted of three people from Syiah Kuala University, one person from the Education University Ganesha Bali and one person from the State Islamic University of Samarinda. All of these validators have educational qualifications with a doctoral degree.

Data analysis of expert validation tests on model design products was developed using the CVI formula (Hendryadi, 2017). This formula is used with consideration of the use of this analysis of i-CVI and analysis content validity of the o-CVI. The measurement scale used is a scale of 4; this is to avoid bias caused by a neutral answer factor. The measurement scale used was in the range of 1 = strongly disagree, 2 = disagree, 3 = agree and 4 = strongly agree. Then, the item i-CVI calculation using the provisions on the number of experts who gave an assessment for strongly disagree (1) and disagree (2) categories showed that the model cannot be used. Meanwhile, the alternative assessment for agree

(3) and strongly agree (4) categories showed that the model can be used. The ordinal scale was dichotomised into two, namely not usable = 0 and usable = 1, divided by the number of experts who gave an assessment of the feasibility of the learning model design.

Table 3. i-CVI calculation results

No.	Statement	Expert validator					Total	o-CVI
		1	2	3	4	5		
1	Steps for collaborative learning online projects	1	1	1	1	1	5	5/5= 1
2	The learning design clearly shows independent learning activities	1	1	1	1	0	4	4/5= 0.80
3	The learning design clearly shows group learning activities carried out collaboratively	1	1	1	1	1	5	5/5= 1
4	The learning design shows the project steps	1	1	1	1	1	5	5/5= 1
5	The design shows that there is a continuous and sustained learning activity.	1	1	1	1	1	5	5/5= 1
6	The design shows online activities both in e-learning and non-e-learning	1	1	1	0	1	4	4/5= 0.80
7	The learning design shows the flow of completing online project tasks carried out individually	1	1	1	1	1	5	5/5= 1
8	Learning design can provide an overview of the learning flow to complete project tasks	1	1	1	1	1	5	5/5= 1
9	Learning design shows students' freedom to access learning resources from all lines of online facilities for completion of project tasks	1	1	1	1	1	5	5/5= 1
10	Learning design shows learning steps that support increased creativity in developing teaching material projects	1	1	1	1	1	5	5/5= 1
11	Learning design shows increased student engagement in learning collaboratively online in completing project assignments	1	1	1	1	1	5	5/5= 1
12	Learning activities can support increased commitment in students to complete project assignments	1	1	1	1	0	4	4/5= 0.80
13	Development learning activities can support increased cooperation on students to complete project tasks	1	1	1	1	1	5	5/5= 1
14	The learning activities can support the increased ability to complete project tasks	1	1	1	1	1	5	5/5= 1
15	The learning activities can support increasing awareness to share by compromising when completing project tasks	1	1	1	1	1	5	5/5= 1
16	The learning activities can support the improvement of mutual respect to complete project tasks	1	1	1	1	1	5	5/5= 1
	Σ	16	16	16	15	14	Mean o-CVI	0.96
	Eligibility level	1.00	1.00	1.00	0.94	0.88	0.96	

Information: 1 = Validator 1; 2 = Validator 2; 3 = Validator 3; 4 = Validator 4; and 5 = Validator 5.

Table 3 shows that the results of expert validation of the CPOL model design can be used with a feasible proposition. Of the 16 assessment items examined by experts, some items required improvement, including items 2, 6 and 12, while the other 13 items did not need any change. The average results of the assessments of all validators concluded that the model design could be used. The results of the analysis concluded that it can be used because all assessment items from all validators have an o-CVI value and an i-CVI value greater than 0.78 (Hendryadi, 2017).

3.3. Students' ability to develop textbooks

Students' ability to develop teaching materials was measured by analysing the results of the score documentation given by 5 assessors, 2 researchers and 3 reviewers to 24 students who developed junior high school textbooks. Data on student learning outcomes regarding the ability to develop teaching materials is shown in Table 4.

Table 4. Assessment of the ability to develop teaching materials

Student number	Assessment team					Average
	1	2	3	4	5	
1	81	86	78	84	90	83.8
2	86	90	90	90	95	90.2
3	83	88	81	86	88	85.2
4	81	86	78	84	90	83.8
5	83	87	80	86	88	84.8
6	76	86	78	85	86	82.2
7	82	90	88	90	92	88.4
8	81	86	78	84	90	83.8
9	84	87	81	86	88	85.2
10	82	90	88	90	92	88.4
11	83	88	81	86	88	85.2
12	83	87	80	86	88	84.8
13	75	80	75	84	85	79.8
14	83	86	81	86	88	84.8
15	83	87	70	86	88	82.8
16	81	86	78	84	90	83.8
17	82	90	88	90	92	88.4
18	81	86	78	84	90	83.8
19	82	90	90	90	92	88.8
20	82	90	88	90	92	88.4
21	83	87	82	86	88	85.2
22	85	90	92	90	95	90.4
23	81	86	78	84	90	83.8
24	82	90	88	90	92	88.4
	Rata-Rata					85.6

Based on the results of the assessment determined by the five assessors of the teaching material products developed by students by collaborating to work on online teaching material writing projects,

it is good. This is evidenced by the students' lowest average score (79.8) given by the five reviewers, while the highest average score reached 90.4. The overall average score of students given by the five assessors of teaching materials reached 85.6. Writing teaching materials by students can be described as follows: 8 students (33.33%) were at a very good level, while 12 students (66.67%) were at a good level. In general, the teaching materials written by students in developing teaching civics materials for secondary school students can be categorised as good. This means that the use of the CPOL model for developing teaching materials can be used.

4. Discussion

The CPOL model combines online project activities by collaborating and completing individual and group assignments. This learning project was carried out for 8 weeks. In working on individual assignments and group assignments, students collaborate with five main principles, namely (1) commitment, (2) communication, (3) cooperation, (4) compromise and (5) respect. The project given to students is to develop teaching materials. References used in developing teaching materials are offline and online sources.

The development of the learning model design, which is abbreviated as CPOL, is supported by the results of other studies using collaborative designs. Research using a collaborative design has been proven by Kim et al. (2021), who provide an explanation that collaborative independent learning can produce activities produced by children and the delivery of material can be accepted by students. This CPOL design is also in line with the concept of designing collaborative production of digital media developed by Kalaitzidis (in Reigeluth et al., 2017), who revealed the importance of collaboration in digital production and media. Another supporting source is collaborative design for embedded systems by Fitzgerald et al. (2014), who explained the importance of embedded systems and collaborative design in order to have maximum power in producing maximum work results.

A number of other research results support the development of the CPOL model. Zain (2017) describes the efforts to visualise 21st-century learning through the collaborative instructional design system (CIDS), exploring and involving students' caring and communication elements in developing online collaborative teaching materials (Robinson et al., 2017); online collaborative learning (Ellis & Bliuc, 2019); student attitudes towards online learning (McCarthy, 2017); and online study and exams web (Myry & Joutsenvirta, 2015). Behavioural competence in clinical reasoning can be realised by web-based collaborative learning (Gherib & Bouhadada, 2021). The five principles of collaboration are communication, commitment, cooperation, compromise and rewards supported by prior research studies (Penuel et al., 2020).

Another result of the research on project learning also supports the learning design of this CPOL model where they conclude that collaborative project-based learning is effective in integrative science and technology education projects (Baser et al., 2017). The results of other studies are also the development of learning modules using the ICARE model based on the LMS which can be used for online learning media development projects (Suartama et al., 2022). Projects that students work with on online can also be carried out via Instagram (Salehudin, Hamid, et al., 2020; Salehudin, Sarimin, et al., 2020). Thus, the CPOL model can be used in certain subjects that require project assignments that students must do online, although not during the COVID-19 pandemic.

This study also proves the results of the trials on the implementation of the CPOL design by measuring the ability of individual students to develop teaching materials. The results of the study prove that students have the ability to develop teaching materials, with the lowest score of 79.8, the highest score reaching 90.4 and an average score of 85.6. This finding is in line with the results of

other studies which reveal that collaborative learning can improve problem-solving abilities, such as the opinion of Kamil et al. (2020), which states that students who study collaboratively can complete projects well so as to improve learning outcomes. In addition, Nouri et al. (2017) also explain that collaborative learning can effectively solve problems and improve students' ability to complete projects. Collaborative learning also requires project competence, meaning that students have special knowledge, skills and abilities to solve problems based on hypotheses, set activity goals, plan activities, collect and analyse required information, conduct experiments and present research results (Levanova et al., 2020).

The CPOL model aims to create creative and innovative learning in completing projects. Student innovation and creativity are enhanced through interaction and collaboration with other students to find and solve problems. Project-based learning also aims to improve fieldwork skills, laboratories and the ability to analyse, organise data and make presentations of problems and solutions found (Ridha & Kamil, 2021). In addition, online project-based collaborative learning strategies and motivation to get achievement can interact in influencing students' civic problem-solving abilities (Yunus et al., 2021).

5. Conclusion

The design of an online-based collaborative project learning model, or the so-called CPOL model, can be regarded as a learning model. Recognition of CPOL as a learning model is due to the results of expert validation tests. The validation results show that the developed model can be used in learning. Based on the results of the analysis using the provisions of the o-CVI and i-CVI values, the 5 validators who scored the 16 items obtained a content validity index score above 0.78. Proof of the design is also proven by model testing in the implementation of learning where student learning outcomes in the development of teaching materials are categorised as good and very good. Thus, the CPOL model can be used as a learning model. This study recommends that the CPOL model can be used in courses that require project work.

6. Recommendations

The development of the CPOL model can be said to be good in the aspect of the project development of teaching materials by students. Researchers recommend that teachers use the CPOL model to improve student competence in developing teaching materials. This model still needs to be tested continuously on a number of other variables, so that its advantages and limitations can be found.

References

- Al Rawahi, L. S., & Al-Mekhlafi, A. M. (2015). The effect of online collaborative project-based learning on EFL learners' language performance and attitudes. *Learning and Teaching in Higher Education: Gulf Perspectives*, 12(2). <https://doi.org/10.18538/lthe.v12.n2.186>
- AlKhamaiseh, O. S. (2022). Communication skills and its role in decreasing tension in online learning during covid 19 pandemic: Case study of public schools. *Cypriot Journal of Educational Sciences*, 17(2), 357–371. <https://doi.org/10.18844/cjes.v17i2.6812>
- Alkhataba, E. H. A., Abdul-Hamid, S., & Ibrahim, B. (2018). Technology-Supported Online Writing: An Overview of Six Major Web 2.0 Tools for Collaborative-Online Writing. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3151131>

- Yunus, M., Amirullah, A., Safiah, I., Ridha, S. & Suartama, I.K (2022). Development of the CPOL design to improve the ability to develop teaching materials. *Cypriot Journal of Educational Science*. 17(5), 1655-1670. <https://doi.org/10.18844/cjes.v17i5.7257>
- Ardiasih, L. S., Emzir, E., & Rasyid, Y. (2019). Online Collaborative Writing Technique Using Wiki: How Effective is It to Enhance Learners' Essay Writing? *The Journal of AsiaTEFL*, 16(2), 531–546. <https://doi.org/10.18823/asiatefl.2019.16.2.6.531>
- Baser, D., Ozden, M. Y., & Karaarslan, H. (2017). Collaborative project-based learning: An integrative science and technological education project. *Research in Science & Technological Education*, 35(2), 131–148. <https://doi.org/10.1080/02635143.2016.1274723>
- Bell, S. (2010). Project-Based Learning for the 21st Century: Skills for the Future. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, 83(2), 39–43. <https://doi.org/10.1080/00098650903505415>
- Blasco-Arcas, L., Buil, I., Hernández-Ortega, B., & Sese, F. J. (2013). Using clickers in class. The role of interactivity, active collaborative learning and engagement in learning performance. *Computers & Education*, 62, 102–110. <https://doi.org/10.1016/j.compedu.2012.10.019>
- Chen, C.-C. (Brian), & Swan, K. (2020). Using Innovative and Scientifically-Based Debate to Build e-Learning Community. *Online Learning*, 24(3), 68–80. <https://doi.org/10.24059/olj.v24i3.2345>
- Cowdroy, R., & de Graaff, E. (2005). Assessing highly-creative ability1. *Assessment & Evaluation in Higher Education*, 30(5), 507–518. <https://doi.org/10.1080/02602930500187113>
- Davidson, N., & Major, C. H. (2014). Boundary crossings: Cooperative learning, collaborative learning, and problem-based learning. *Journal on Excellence in College Teaching*, 25(3–4), 7–55.
- Dhawan, S. (2020). Online Learning: A Panacea in the Time of COVID-19 Crisis. *Journal of Educational Technology Systems*, 49(1), 5–22. <https://doi.org/10.1177/0047239520934018>
- Dhull, I., & Arora, S. (2019). *Online Learning*. 3, 32–34.
- Elhussain, S. W., & Khoja, A. Y. (2020). Collaborative reflection on shared journal writing to foster EFL teacher CPD. *Cypriot Journal of Educational Sciences*, 15(2), 271–281. <https://doi.org/10.18844/cjes.v15i2.4598>
- Ellis, R. A., & Bliuc, A.-M. (2019). Exploring new elements of the student approaches to learning framework: The role of online learning technologies in student learning. *Active Learning in Higher Education*, 20(1), 11–24. <https://doi.org/10.1177/1469787417721384>
- Farrah, M. A. H. (2015). Online Collaborative Writing: Students' Perception. *Journal of Creative Practices in Language Learning and Teaching*, 3(2), 17–32.
- Fitzgerald, J., Larsen, P. G., & Verhoef, M. (Eds.). (2014). *Collaborative Design for Embedded Systems: Co-modelling and Co-simulation* (1st ed. 2014). Springer Berlin Heidelberg: Imprint: Springer. <https://doi.org/10.1007/978-3-642-54118-6>
- Gall, Meredith D., Borg, Walter R., Gall, J. P. (2003). *Educational Research: An Introduction* (7th Editio). Allyn & Bacon.
- Gherib, T., & Bouhadada, T. (2021). Towards a New Platform Based on Web 2.0 Technologies Supporting Collaborative Clinical Reasoning Behavior Skills. *International Journal of Emerging Technologies in Learning (IJET)*, 16(08), 106. <https://doi.org/10.3991/ijet.v16i08.19471>
- Hendryadi, H. (2017). VALIDITAS ISI: TAHAP AWAL PENGEMBANGAN KUESIONER. *Jurnal Riset Manajemen Dan Bisnis (JRMB) Fakultas Ekonomi UNIAT*, 2(2), 169–178. <https://doi.org/10.36226/jrmb.v2i2.47>
- Huysken, K., Olivey, H., McElmurry, K., Gao, M., & Avis, P. (2019). Assessing Collaborative, Project-based Learning Models in Introductory Science Courses. *Journal of the Scholarship of Teaching and Learning*, 19(1). <https://doi.org/10.14434/josotl.v19i1.26777>
- Jalinus, N., Nabawi, R. A., & Mardin, A. (2017). The Seven Steps of Project Based Learning Model to Enhance Productive Competences of Vocational Students. *Proceedings of the International Conference on*

Yunus, M., Amirullah, A., Safiah, I., Ridha, S. & Suartama, I.K (2022). Development of the CPOL design to improve the ability to develop teaching materials. *Cypriot Journal of Educational Science*. 17(5), 1655-1670. <https://doi.org/10.18844/cjes.v17i5.7257>

Technology and Vocational Teachers (ICTVT 2017). International Conference on Technology and Vocational Teachers (ICTVT 2017), Yogyakarta, Indonesia. <https://doi.org/10.2991/ictvt-17.2017.43>

Kamil, P. A., Putri, E., Ridha, S., Utaya, S., Sumarmi, & Utomo, D. H. (2020). Promoting environmental literacy through a green project: A case study at adiwiyata school in Banda Aceh City. *IOP Conference Series: Earth and Environmental Science*, 485(1), 1–8. <https://doi.org/10.1088/1755-1315/485/1/012035>

Kim, J., Wee, S. J., & Meacham, S. (2021). What Is Missing In Our Teacher Education Practices: A Collaborative Self-Study Of Teacher Educators With Children During The Covid-19 Pandemic. *Studying Teacher Education*, 17(1), 22–37. <https://doi.org/10.1080/17425964.2021.1895102>

Kricsfalusy, V., George, C., & Reed, M. G. (2018). Integrating problem- and project-based learning opportunities: Assessing outcomes of a field course in environment and sustainability. *Environmental Education Research*, 24(4), 593–610. <https://doi.org/10.1080/13504622.2016.1269874>

Lee, D., Huh, Y., & Reigeluth, C. M. (2015). Collaboration, intragroup conflict, and social skills in project-based learning. *Instructional Science*, 43(5), 561–590. <https://doi.org/10.1007/s11251-015-9348-7>

Levanova, E. A., Galustyan, O. V., Seryakova, S. B., Pushkareva, T. V., Serykh, A. B., & Yezhov, A. V. (2020). Students' Project Competency within the Framework of STEM Education. *International Journal of Emerging Technologies in Learning (IJET)*, 15(21), 268. <https://doi.org/10.3991/ijet.v15i21.15933>

Lin, L. (2015). *Investigating Chinese HE EFL Classrooms: Using Collaborative Learning to Enhance Learning*. Springer.

Magen-Nagar, N., & Shonfeld, M. (2018). The impact of an online collaborative learning program on students' attitude towards technology. *Interactive Learning Environments*, 26(5), 621–637. <https://doi.org/10.1080/10494820.2017.1376336>

Masalimova, A. R., Ryazanova, E. L., Tararina, L. I., Sokolova, E. G., Ikrennikova, Y. B., Efimushkina, S. V., & Shulga, T. I. (2021). Distance learning hybrid format for university students in post-pandemic perspective: Collaborative technologies aspect. *Cypriot Journal of Educational Sciences*, 16(1), 389–395. <https://doi.org/10.18844/cjes.v16i1.5536>

McCarthy, J. (2017). Enhancing feedback in higher education: Students' attitudes towards online and in-class formative assessment feedback models. *Active Learning in Higher Education*, 18(2), 127–141. <https://doi.org/10.1177/1469787417707615>

Mora, H., Signes-Pont, M. T., Fuster-Guilló, A., & Pertegal-Felices, M. L. (2020). A collaborative working model for enhancing the learning process of science & engineering students. *Computers in Human Behavior*, 103, 140–150. <https://doi.org/10.1016/j.chb.2019.09.008>

Myry, L., & Joutsenvirta, T. (2015). Open-book, open-web online examinations: Developing examination practices to support university students' learning and self-efficacy. *Active Learning in Higher Education*, 16(2), 119–132. <https://doi.org/10.1177/1469787415574053>

Nouri, J., Åkerfeldt, A., Fors, U., & Selander, S. (2017). Assessing Collaborative Problem Solving Skills in Technology-Enhanced Learning Environments – The PISA Framework and Modes of Communication. *International Journal of Emerging Technologies in Learning (IJET)*, 12(04), 163. <https://doi.org/10.3991/ijet.v12i04.6737>

Oliveira, G., Grenha Teixeira, J., Torres, A., & Morais, C. (2021). An exploratory study on the emergency remote education experience of higher education students and teachers during the COVID-19 pandemic. *British Journal of Educational Technology*, 52(4), 1357–1376. <https://doi.org/10.1111/bjet.13112>

Park, Jongwon. (2012). Developing the Format and Samples of Teaching Materials for Scientific Creativity in the Ordinary Science Curriculum -Including Teachers' Practice and Reflection-. *한국과학교육학회지*, 32(3), 446–466. <https://doi.org/10.14697/JKASE.2012.32.3.446>

- Yunus, M., Amirullah, A., Safiah, I., Ridha, S. & Suartama, I.K (2022). Development of the CPOL design to improve the ability to develop teaching materials. *Cypriot Journal of Educational Science*. 17(5), 1655-1670. <https://doi.org/10.18844/cjes.v17i5.7257>
- Penuel, W. R., Riedy, R., Barber, M. S., Peurach, D. J., LeBouef, W. A., & Clark, T. (2020). Principles of Collaborative Education Research With Stakeholders: Toward Requirements for a New Research and Development Infrastructure. *Review of Educational Research*, 90(5), 627–674. <https://doi.org/10.3102/0034654320938126>
- Pinho-Lopes, M., & Macedo, J. (2014). Project-Based Learning to Promote High Order Thinking and Problem Solving Skills in Geotechnical Courses. *International Journal of Engineering Pedagogy (IJEP)*, 4(5), 20. <https://doi.org/10.3991/ijep.v4i5.3535>
- Reigeluth, C. M., Beatty, B. J., & Myers, R. D. (2017). *Instructional-design theories and models. Volume IV, Volume IV, : Vol. IV*. Routledge.
- Ridha, S., & Kamil, P. A. (2021). The Problems of Teaching Geospatial Technology in Developing Countries: Concepts, Curriculum, and Implementation in Indonesia. *Journal of Geography*, 120(2), 72–82. <https://doi.org/10.1080/00221341.2021.1872681>
- Robinson, H. A., Kilgore, W., & Warren, S. J. (2017). Care, Communication, Support: Core for Designing Meaningful Online Collaborative Learning. *Online Learning*, 21(4), 29–51. <https://doi.org/10.24059/olj.v21i4.1240>
- Safiah, I., Degeng, I. N. S., Setyosari, P., & Ulfa, S. (2020). Design and development of seamless learning to improving learning outcome of Islamic economic course: A case study in Indonesia. *Journal of E-Learning and Knowledge Society*, 16(3), 60-67 Pages. <https://doi.org/10.20368/1971-8829/1135249>
- Salehudin, M., Hamid, A., Zakaria, Z., Rorimpandey, W. H. F., & Yunus, M. (2020). Instagram User Experience in Learning Graphic Design. *International Journal of Interactive Mobile Technologies (IJIM)*, 14(11), 183. <https://doi.org/10.3991/ijim.v14i11.13453>
- Salehudin, M., Nasir, M., Hawib, S., Toba, R., Hayati, N., & Safiah, I. (2021). The Users' Experiences in Processing Visual Media for Creative and Online Learning Using Instagram. *European Journal of Educational Research*, 10(4), 1669–1682. <https://doi.org/10.12973/eu-jer.10.4.1669>
- Salehudin, M., Sarimin, D. S., Steven, R. H., Yunus, M., & Safiah, I. (2020). Using Instagram to Support Creative Learning and Project Based Learning. *International Journal of Advanced Science and Technology*, 29(5), 11.
- Saqr, M., Fors, U., & Tedre, M. (2018). How the study of online collaborative learning can guide teachers and predict students' performance in a medical course. *BMC Medical Education*, 18(1), 24. <https://doi.org/10.1186/s12909-018-1126-1>
- Sarwar, B., Zulfiqar, S., Aziz, S., & Ejaz Chandia, K. (2019). Usage of Social Media Tools for Collaborative Learning: The Effect on Learning Success With the Moderating Role of Cyberbullying. *Journal of Educational Computing Research*, 57(1), 246–279. <https://doi.org/10.1177/0735633117748415>
- Seifert, T. (2020). Harnessing collaborative pedagogies to promote writing skills in a Web 2.0 environment. *International Journal of Learning Technology*, 15(3), 255. <https://doi.org/10.1504/IJLT.2020.112171>
- Simamora, R. M. (2020). The Challenges of Online Learning during the COVID-19 Pandemic: An Essay Analysis of Performing Arts Education Students. *Studies in Learning and Teaching*, 1(2), 86–103. <https://doi.org/10.46627/silet.v1i2.38>
- Suartama, I. K., Mahadewi, L. P. P., Divayana, D. G. H., & Yunus, M. (2022). ICARE Approach for Designing Online Learning Module Based on LMS. *International Journal of Information and Education Technology*, 12(4), 305–312. <https://doi.org/10.18178/ijiet.2022.12.4.1619>
- Suartama, I. K., Setyosari, P., Sulthoni, S., & Ulfa, S. (2019). Development of an Instructional Design Model for Mobile Blended Learning in Higher Education. *International Journal of Emerging Technologies in Learning (IJET)*, 14(16), 4. <https://doi.org/10.3991/ijet.v14i16.10633>

- Yunus, M., Amirullah, A., Safiah, I., Ridha, S. & Suartama, I.K (2022). Development of the CPOL design to improve the ability to develop teaching materials. *Cypriot Journal of Educational Science*. 17(5), 1655-1670. <https://doi.org/10.18844/cjes.v17i5.7257>
- Suartama, I. K., Setyosari, P., Sulthoni, S., Ulfa, S., Yunus, M., & Sugiani, K. A. (2021). Ubiquitous Learning vs. Electronic Learning: A Comparative Study on Learning Activeness and Learning Achievement of Students with Different Self-Regulated Learning. *International Journal of Emerging Technologies in Learning (IJET)*, 16(03), 36. <https://doi.org/10.3991/ijet.v16i03.14953>
- Tsai, H., Jou, M., Wang, J., & Huang, C.-C. (2017). An empirical study on the incorporation of APP and progressive reasoning teaching materials for improving technical creativity amongst students in the subject of automatic control. *Computers in Human Behavior*, 75(1), 997–1007. <https://doi.org/10.1016/j.chb.2016.10.031>
- Vezne, R. (2020). Teacher candidates' satisfaction with massive open online courses in Turkey. *Cypriot Journal of Educational Sciences*, 15(3), 479–491. <https://doi.org/10.18844/cjes.v15i3.4914>
- Wang, L. (2022). Effects of regulation on interaction pattern in web-based collaborative writing activity. *Computer Assisted Language Learning*, 35(1–2), 1–35. <https://doi.org/10.1080/09588221.2019.1667831>
- Wargadinata, W., Maimunah, I., Dewi, E., & Rofiq, Z. (2020). Student's Responses on Learning in the Early COVID-19 Pandemic. *Tadris: Jurnal Keguruan Dan Ilmu Tarbiyah*, 5(1), 141–153. <https://doi.org/10.24042/tadris.v5i1.6153>
- Wicks, D., Craft, B. B., Lee, D. (Don), Lumpe, A., Henrikson, R., Baliram, N., Bian, X., Mehlberg, S., & Wicks, K. (2015). An Evaluation of Low Versus High-Collaboration in Online Learning. *Online Learning*, 19(4). <https://doi.org/10.24059/olj.v19i4.552>
- Yunus, M., Setyosari, P., Utaya, S., & Kuswandi, D. (2021). The Influence of Online Project Collaborative Learning and Achievement Motivation on Problem-Solving Ability. *European Journal of Educational Research*, 10(2), 813–823. <https://doi.org/10.12973/eu-jer.10.2.813>
- Zain, I. Md. (2017). The Collaborative Instructional Design System (CIDS): Visualizing the 21st Century Learning. *Universal Journal of Educational Research*, 5(12), 2259–2266. <https://doi.org/10.13189/ujer.2017.051216>