Tersedia secara online
http://journal.um.ac.id/index.php/jptpp/
EISSN: 2502-471X
DOAJ-SHERPA/RoMEO-Google Scholar-IPI

Jurnal Pendidikan:
Teori, Penelitian, dan Pengembangan
Volume: 7 Nomor: 12 Bulan Desember Tahun 2022
Halaman: 586—594

Development of *A Self-Assessment-Based Collaboration Assessment* Instrument on Construction and Housing Planning

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ARTICLE INFORMATION

Article History:

Received: 10-10-2022
Approved: 12-12-2022

Keywords:

self-assessment;
assessment instruments;
vocational high schools;
collaboration skills

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ABSTRACT

Abstract: It developed a collaborative assessment tool aimed at providing students with the opportunity to evaluate their abilities. This research is a research and development (R&D) using the ADDIE stage approach. The development of the laboratory instrument is made in the form of a non-test self-assessment sheet. The validity of the data is assessed by the experiential team in the fields of materials, construction, and language. The Aiken equation with the coefficient V Aiken is used as a decision rule in determining the validity of the instrument. This study involved 5 experts and 34 vocational high school students in Surakarta as respondents to the study. The results showed that the self-assessment-based assessment instrument was valid and reliable so it was suitable for vocational students.

Education is an important means of knowledge that is interrelated with human feelings or attitudes to live in a society (Letiche et al., 2022). Current education is expected to be able to follow developments in the field of science and technology that are increasingly developing in 21st-century society (Afriyenni, 2020). These competencies include critical and creative thinking, communication, and cooperation as well as analytical and problem-solving skills (collaboration).

One type of secondary education level in Indonesia is vocational high school. In fact, in the middle class, many are not absorbed in the world of work, thus increasing the number of unemployed (Vinandita & Sugandi, 2017). To support learners entering the workforce, they also need hands-on practice (Cornelius & Stevenson, 2019). Quoted on the website of the Ministry of Education and Culture (Kemendikbud), in 2021 it issued the eighth episode of the Merdeka Belajar policy: SMK Center of Excellence which aims to realize graduates who will be absorbed in the world of work and the learning process using project-based learning, which is based on actual projects from the workplace (project-based learning) which is expected to be able to ensure the strong character of students, hard skills, and soft skills. One of its applications is in the subjects of planning construction and home planning with the aim that SMK students, especially those majoring in construction and housing at SMK Suarakarta, can plan and design construction and can make construction and housing planning projects (CPL, 2022). The creation of projects in learning with groups further improves the achievement of learning outcomes and shows that they collaborate and communicate positively when working on group projects (Greetham & Ippolito, 2018; Lin, 2018; You, 2021).

Collaborative-based project learning will involve students working in project teams to complete authentically complex projects (Nicol & MacLeod, 2005). The collaboration will support the regulation of a person's ability to assess the difficulty of a problem that positively affects student interaction related to team planning and forms of knowledge (Kim & Lim, 2018). Collaboration is the act of doing what is asked or necessary when working together to achieve a common goal. On the other hand, collaboration involves the mutual involvement of group members in a coordinated effort to solve joint project problems (Ofstedal & Dahlberg, 2009). This collaborative learning environment can result in active learning between students and teachers. Students must also be involved during the learning process, starting from the initial stage of planning and implementation to the last stage of their assessment (Hariyanto, 2017). During the learning process, many SMK students experience difficulties in their ability to collaborate, making it difficult to use the material provided by the teacher effectively, both in group and individual form (Hafiluddin, 2016).

This statement is reinforced by research by (Noviana et al., 2019) which states that the assessment of student skills when collaborating and communicating is only limited to the opinion of the teacher so that the determination of the assessment of the achievement of student learning outcomes is less objective. This is because the assessment of student skills when collaborating has not used instruments specifically for several reasons, including (1) the lack of examples of student collaboration skills

assessment instruments; (2) the existing skills assessment instruments have not been specifically able to measure aspects of collaboration skills as a whole; (3) the assessment instruments used are only observation techniques so that teachers are less than optimal in assessing student learning outcomes. Collaborative assessment is an essential learning process in education and collaborative assessment has a dual function, namely as a record and assessment of student learning outcomes. Collaborative assessments should be aligned with the knowledge, skills, and competencies required in the assessment (Searle & Poth, 2021). The assessment envy instrument in collaboration is an educational Rubik used as a tool to develop an awareness of one's collaboration skills (Ofstedal & Dahlberg, 2009; Hinyard et al., 2019).

Self-assessment of students which is the evaluation of their work and learning, self-assessment is beneficial because it demands that students be able to maintain a strong practice of reflection on themselves and provides opportunities for students to assess themselves and reflect on their learning methods to be more collaborative (Berdrow & Evers, 2010; Flournoy & Bauman, 2021). Self-assessment at the intermediate level makes students who detect errors and subsequently formulate and complete self-assessment activities achieve better performance (Zamora et al., 2018). Refleksi of one's own accord focuses on increasing general knowledge about the learning process and there will be a change in student knowledge between self-reflective thinking induced in self-assessment and general knowledge of the learning process (Van Velzen, 2017).

Self-assessment-based assessment instruments are tools not only for error detection tasks, but also to encourage learning from assessments. The introduction of this assessment in the educational process allows students to use the entered criteria as goals, gives them greater and more accurate insight into the progress they have made in working on the task, stimulates them to activate appropriate learning strategies, and helps them to assess the final result and improve it to reach the level that they have set themselves (Ofstedal & Dahlberg, 2009; Zamora et al., 2018).

To create appropriate learning situations and achieve educational goals and effectively improve student performance, it is important to determine the student's self-assessment needs for behavior change (Shirazi et al., 2018). The assessment process requires an instrument that will be used as an assessment instrument (Hafiluddin, 2016). During the observations, the researchers found that the assessment process carried out at SMK Surakarta showed that there was no collaboration assessment instrument in the subjects of planning construction and home planning considering the importance of collaboration skills needed by vocational secondary students. Based on these problems, it is necessary to develop an assessment instrument to support the quality of learning as a form of students being able to assess themselves and as an assessment instrument for student collaboration. The purpose of this development research is to design, produce and determine the feasibility of a self-assessment-based collaboration assessment instrument based on validity and reliability.

METHOD

This research uses the development method and the strategy used in this study is the ADDIE development model (Walter Dick et al., 2015). ADDIE stands for Analysis, Design, Development, Implementation, and Evaluation as follows:

Analysis

The analysis stage is the first step for researchers in identifying literature sources that are relevant to the competence of research and observations carried out in needs analysis.

Design

At the design stage, researchers make instruments by reviewing literature and writing indicators as a standard for the instrument to be developed, in the form of conceptual frameworks in measuring collaboration ability.

Development

At the development stage, researchers design instruments based on prepared indicators. The items are then validated by experts consisting of material, construction, and language using a Likert scale of 1 to 5 i.e. from highly irrelevant to highly relevant (Vagias & Wade M, 2006), and then analyzed using the formula of equation Aiken (Aiken, 1980) (Sumarni et al., 2022).

Furthermore, revisions were made to the improvement of the assessment instrument. After revising the instrument, it then conducted a limited trial to determine the readability of the development of assessment instruments by providing the results of the development of assessment instruments (Lian Kusumaningrum et al., 2015; Sudibyo et al., 2017).

Implementation

At the implementation stage, researchers test the instruments that have been prepared. The sampling used in this study is sampling purposive (Acharya et al., 2013). The research samples that will be used as product trials are the entire class XI construction and housing engineering students at SMK Surakarta with a total of 34 students.

Evaluation

At the evaluation stage, the researcher conducts each stage of the analysis, from the design stage to the development stage to achieve the objectives of developing the assessment instrument. The evaluation consists of expert validation and field tests.

The implementation of this expert validation uses an instrument in the form of a questionnaire. The questionnaire consists of a validation sheet against the assessment instrument, a comment and suggestion column, and the conclusion of the validation. Assessment aspects of the material, construction, and Bahasa. To assess each aspect of a statement, the Likert scale is used (Vagias & Wade M, 2006). For the statement, 1 is very not relevant, 2 is not relevant, 3 is simply relevant, 4 is relevant, and 5 is very relevant. The results of the values by the expert are analyzed using the formula of the equation A Aiken (Aiken, 1980) as follows:

$V : \sum s / [n(C-1)]$ .... (1)

S: r – lo

Where

lo: numbers in the lowest assessment (1)

c: numbers in the highest assessment (5)

r: numbers given by experts

The implementation of the Uji was limited to 10 construction and housing engineering students. Siswa was asked to fill out a sheet on the collaboration assessment instrument that had been developed. The test was carried out to look at the readability of the developed instrument. If the readability results of the instrument are good, a large group test can be carried out. Readability results will then be analyzed quantitatively using construct validity tests with person product moment correlation with SPSS Statistics 2 0 software and reliability with Cronbach's alpha.

Large-scale trials will be conducted on all 34 students of class XI construction and housing engineering. At this time, students were asked to fill out a self-assessment-based collaboration assessment sheet. After large-scale trials are carried out, the results are then analyzed quantitatively to determine the coefficient of reliability and validity of the developed assessment instrument.

RESULT

The product developed is the development of a self-assessment-based collaborative assessment instrument on construction and housing planning subjects in the Surakarta Vocational Secondary Ecolab.

Analysis

The initial analysis was carried out by conducting several sources of literature studies related to the collaboration skills of vocational students. According to (Hafiluddin, 2016) collaboration is a benchmark for improving student learning outcomes in vocational secondary schools. (Ofstedal & Dahlberg, 2009) states collaboration with prospective teachers in understanding skills is necessary to know the form of collaboration within the group to achieve a successful goal. Meanwhile, (Vance & Smith, 2019) states that collaboration skills are professional skills that can increase the effectiveness of attitudes in groups.

Based on observations, researchers also found that the assessment during the learning process is the assessment of the results of student assignments/projects. Assessments are felt to be lacking to measure collaboration and communication skills in groups during the project creation process. Therefore, an assessment instrument is needed that can measure students' awareness attitudes in the form of self-assessment to find out the level of collaboration itself as a form of student awareness when studying in groups during the project creation process.

Design

After conducting a needs analysis and literature study. Instrument grids to facilitate product development in the assessment. Elaboration results in measuring the success of collaboration in several studies. Maka, the development of this instrument will be designed in a conceptual framework which will later be developed into an assessment instrument capable of measuring the level of student collaboration based on self-assessment in construction and housing planning subjects. The conceptual framework that has been developed gets 5 aspects of collaboration and 10 indicators that can later be used as a measure of student collaboration ability. Here is the concept of l that has been developed:

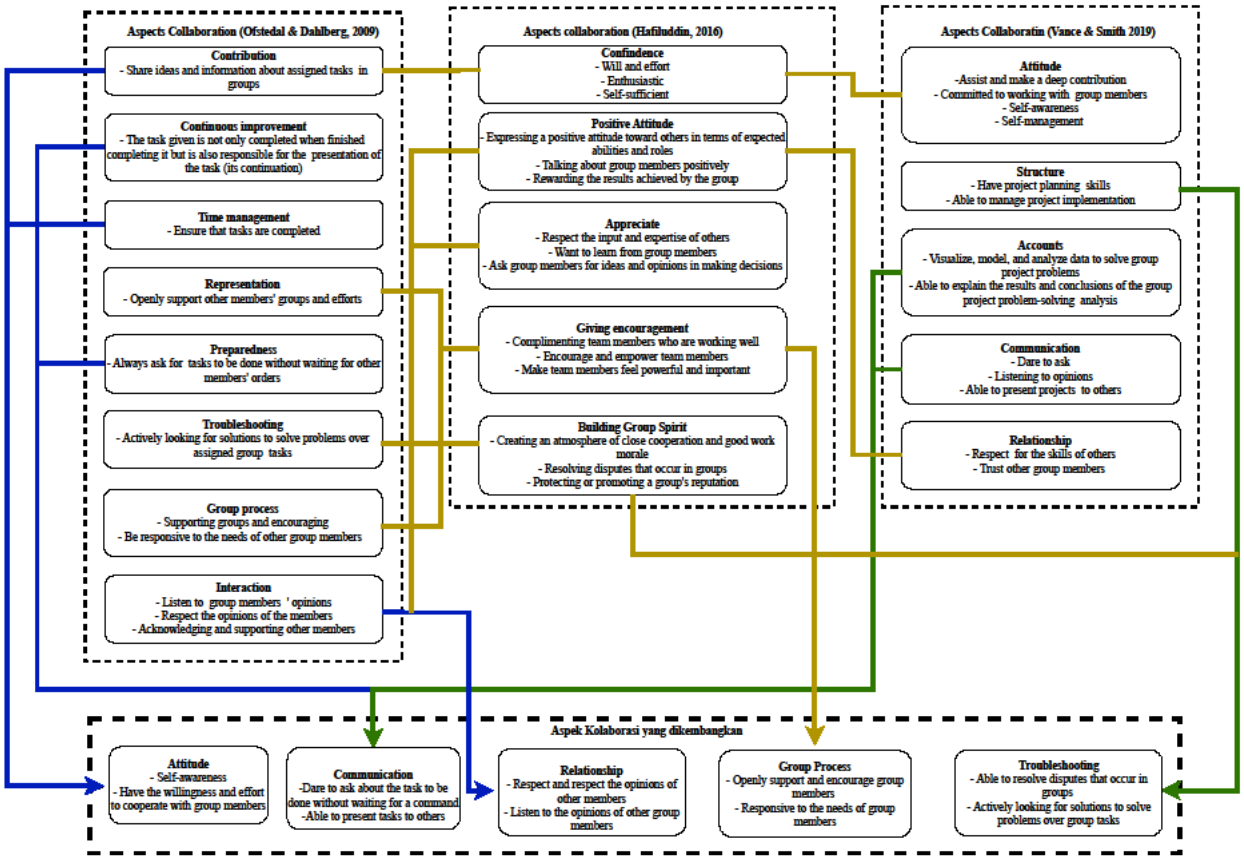

Figure 1. Conceptual Framework

This instrument grid section consists of indicators that are capable of measuring collaboration skills based on conceptual methods that have been developed based on table 1.

Table 1. Collaboration Assessment Grid

Aspects of Collaboration	Indicator	Positive Statement	negative Statement
Attitude	Self-awareness	1,2	3
	Have the willingness and effort to cooperate with group members	4,5	6
Komuniasi	Dare to ask about the task to be done without waiting for a command	7,8	9
	Able to present tasks to others	10,11	12
Relationship	Respect and respect the opinions of other members	13,14	15
	Listen to the opinions of other group members	16,18	17
Group Process	Openly support and encourage group members	19,20	21
	Responsive to the needs of group members	22,24	23
Troubleshooting	Able to resolve disputes that occur in groups	25,27	26
	Actively looking for solutions to solve problems over group tasks	28,29	30

The indicators that have been prepared will be used as instruments for self-assessment-based collaboration assessment in construction and housing planning subjects. The assessment instrument amounts to 30 items of statements consisting of 20 positive statements and 10 negative statements f attached to table 2.

Table 2. Self-Assessment Based Collaboration Assessment Instrument Statement

Item No.	Statement
	Attitude
1.	I tried to do the project task of creating a group portfolio promptly
2.	I have a sense of responsibility in the group project task of creating a portfolio
3.	I can't actively contribute to a group project assignment to create a portfolio

4.	I am committed to always assisting in the completion of group project tasks to create a portfolio
5.	I work on group project tasks without being commanded by other group members
6.	In working on the task of creating a portfolio, I was unable to commit to completing the task properly
	Communication
7.	I asked group members when I was having trouble working on portfolio project assignments
8.	I asked other members about the progress of project work on creating a portfolio
9.	I cheated on the work of another group while working on a project assignment to create a portfolio
10.	I was able to explain the stages of group project task work to others
11.	I was able to explain the results of the work of group project tasks in a wider environment
12.	I feel scared when presenting the work of a portfolio project task
	Relationship
13.	In working on the task of a group project creating a portfolio, I don't feel my opinion is the most correct
14.	In working on portfolio group project assignments, I always accept the dissent of other group members
15.	During a group project assignment, I always refute the ideas of other members if they are not to my liking
16.	During the process of creating portfolio project tasks, I was able to make other members feel needed
17.	I often overlook other members' ideas during the process of creating a portfolio project task
18.	I always pay attention if other members express their opinions during the project task of creating a portfolio
	Group Process
19.	I always use positive words when interacting with groups during group project assignments to create a portfolio
20.	Openly I can give credit to members of the group who worked well
21.	I always criticize group members during group project assignments to create a portfolio
22.	I always ask about the difficulties other members face in working on portfolio project tasks
23.	I never noticed other group members during portfolio project assignments
24.	I was able to provide solutions to the difficulties other members encountered during the creation of portfolio project tasks
	Troubleshooting
25.	In completing the task of creating a portfolio group project, I was able to provide solutions in case of conflicts
26.	I always ignore if there is a problem during the project task of creating a portfolio
27.	I was able to choose the right opinion in completing the task of creating a portfolio group project
28.	I was able to divide tasks equally in the creation of portfolio projects
29.	I was able to convey ideas during the portfolio project creation process
30.	I'm not trying to help other group members who are struggling during project assignments to create a portfolio

Development

There is a stage of development of this research validated by experts and the readability test aims to determine the response of students to the development of assessment instruments before large-scale trials are carried out.

Validation is carried out by 5 experts who are lecturers of Building Engineering Education in the fields of material education, construction, and language. The assessment aspects are material, construction, and Bahasa. To assess each aspect of the statement, the Likert scale is used. For the statement, 1 is very not relevant, 2 is not relevant, 3 is simply relevant, 4 is relevant, and 5 is very relevant. Furthermore, the expert validity is analyzed based on the formula of the validity equation Aiken.

The results of expert validity at the development stage are results in the form of an average score on the calculation of the Aiken formula with a value of V from 5 experts of 0,80. The average score of the validation results shows that the development of a collaboration assessment instrument based on self-assessment states that it is valid from the material, construction, and language aspects.

After the expert validity test is carried out, a limited u ji try will be carried out to 10 students of class XI construction and property engineering students SMK Surakarta with the help of a google form to fill out a statement of the assessment instrument that has been developed. The limited trial aims to determine the readability of the developed instrument. The analysis used is that the average score is calculated quantifiably using the correlation of product-moment and Cronbach's alpha to determine its validity and reliability. Based on product moment and Cronbach alpha data stated that there are several invalid question items, namely items number 2, 8, 13, 16, 17, 19, and 21.

Implementation

At this stage, a large-scale trial was carried out on respondents of class XI construction and housing engineering with a total of 34 students. The number of question items tested on respondents was 23 questions based on the results of the readability test. Large-scale trials were carried out with the help of google forms (Regmi et al., 2016) which were distributed to students of class XI construction and property engineering students. The results of filling out the google form questionnaire obtained the number of respondents as many as 34 students.

Evaluation

At the end of each stage of the study, the instrument is analyzed at the evaluation stage. The data obtained are checked at the evaluation stage to see if the resulting product can be considered feasible, valid, and reliable. The evaluation is carried out in three stages, namely the expert validation stage, the limited trial stage, and the extensive trial.

The implementation of the expert validation process in the preparation of the stage, which is based on the number V on Aiken of 5 experts is 0,80 (Lewis R. Aiken, 1985). Based on the results of the values given by 5 experts and the calculation of the value of V. This assessment instrument is valid and feasible to use in measuring the collaborative ability of vocational students. The results of the evaluation of the analysis of the calculation of the value of V are as follows table 3.

Table 3. Average Calculation Score of Aiken Value (V) Instrument Preparation

No	Aspects studied	Average score	Information
1.	Material	0,83	Valid
2.	Construction	0,91	Valid
3.	Language	0,85	Valid

After an expert validity test is carried out and it is stated that the assessment instrument is declared valid, then a limited u ji trial will be carried out to10 students of class XI construction and property engineering SMK Surakarta with the help of a google form to fill out the statement of the assessment instrument that has been developed. The analysis used is that the average score is calculated quantifiably using the correlation of person product moment with the r-value of the table is 0.632 and Cronbach's alpha to determine the validity and reliability of the table value according to V. Wiratna Sujarweni (2014) an instrument is declared reliability if the alpha value > 0.60 in the question item. Based on the evaluation of the product moment data calculation analysis, it is stated that there are several invalid question items, namely items number 2, 8, 13, 16, 17, 19, and 21.

Table 4. Product Moment Calculation Score and Cronbach's Alpha Readability Test

Item No.	*Product Moment*	Information
1.	0,714	Valid
2.	0,340	Not Valid
3.	0,881	Valid
4.	0,821	Valid
5.	0,900	Valid
6.	0,900	Valid
7.	0,726	Valid
8.	0,580	Not Valid
9.	0,716	Valid
10.	0,788	Valid
11.	0,703	Valid
12.	0,830	Valid
13.	0,489	Not Valid
14.	0,907	Valid
15.	0,745	Valid
16.	0,549	Not Valid
17.	0,589	Not Valid
18.	0,796	Valid
19.	0,593	Not Valid
20.	0,655	Valid
21.	0,605	Not Valid
22.	0,761	Valid
23.	0,696	Valid
24.	0,761	Valid
25.	0,640	Valid
26.	0,829	Valid
27.	0,673	Valid
28.	0,650	Valid
29.	0,650	Valid
30.	0,634	Valid

Furthermore, valid statement items are carried out with reliability tests to determine the reliability of the data generated in these limited trials. The reliability test was calculated using Cronbach's Alpha equation. Based on the analysis of Cronbach's Alpha calculation of 0.964 and it can be concluded that from the results of the reliability test, it is shown that each item of the

statement has excellent reliability. Thus, a broad trial stage can be carried out using a collaboration assessment instrument that has a total of 23 question items. The results of the reliability analysis evaluation can be seen in table 5.

Table 5. Limited Test Reliability Analysis

Reliability	
Cronbach's Alpha	*N of Items*
0,964	23

Large-scale trials were conducted on respondents of class XI construction and property engineering with a total of 34 students. The number of question items tested on respondents was 23 questions based on the results of the readability test. Large-scale trials were carried out with the help of google forms (Regmi et al., 2016) The results of filling out the google form questionnaire obtained the number of respondents as many as 34 students. The analysis used was that the average score was calculated quantifiably using the correlation of product-moment and Cronbach's alpha to determine its validity and reliability with a table r value of 0.339. Based on the evaluation of the calculation analysis, this assessment instrument is valid and reliable as in table 6.

Table 6. Results of Large-Scale Trials

Item	Statement	Product Momen	Cronbach's Alfa	Information
1.	I tried to do the project task of creating a group portfolio promptly	0,590	0,946	Valid
2.	I can't actively contribute to a group project assignment to create a portfolio	0,611	0,947	Valid
3.	I am committed to always assisting in the completion of group project tasks to create a portfolio	0,728	0,945	Valid
4.	I work on group project tasks without being commanded by other group members	0,636	0,946	Valid
5.	In working on the task of creating a portfolio, I was unable to commit to completing the task properly	0,492	0,948	Valid
6.	I asked group members when I was having trouble working on portfolio project assignments	0,765	0,944	Valid
7.	I cheated on the work of another group while working on a project assignment to create a portfolio	0,765	0,944	Valid
8.	I was able to explain the stages of group project task work to others	0,737	0,945	Valid
9.	I was able to explain the results of the work of group project tasks in a wider environment	0,607	0,946	Valid
10.	I feel scared when presenting the work of a portfolio project task	0,705	0,946	Valid
11.	In working on portfolio group project assignments, I always accept the dissent of other group members	0,775	0,944	Valid
12.	During a group project assignment, I always refute the ideas of other members if they are not to my liking	0,637	0,946	Valid
13.	I always pay attention if other members express their opinions during the project task of creating a portfolio	0,677	0,945	Valid
14.	I am openly able to give credit to group members who work well	0,670	0,945	Valid
15.	I always ask about the difficulties other members face in working on portfolio project tasks	0,689	0,945	Valid
16.	I never noticed other group members during portfolio project assignments	0,652	0,946	Valid
17.	I was able to provide solutions to the difficulties other members encountered during the creation of portfolio project tasks	0,768	0,944	Valid
18.	In completing the task of creating a portfolio group project, I was able to provide solutions in case of conflicts	0,723	0,945	Valid
19.	I always ignore if there is a problem during the project task of creating a portfolio	0,701	0,945	Valid
20.	I was able to choose the right opinion in completing the task of creating a portfolio group project	0,735	0,945	Valid
21.	I was able to divide tasks equally in the creation of portfolio projects	0,739	0,945	Valid
22.	I was able to convey ideas during the portfolio project creation process	0,763	0,944	Valid
23.	I'm not trying to help other group members who are struggling during project assignments to create a portfolio	0,703	0,945	Valid

DISCUSSION

Based on expert validation analysis using the Aiken equation formula. The average score obtained is 0.83 in the material aspect. 0.91 in the aspect of construction, and 0.85 in the aspect of language. This means the assessment instrument is in the category of valid and feasible to try out. Results The readability test was carried out with a limited trial to obtain the validity of the readability of the instrument (Kusumaningrum, et al., 2015) before conducting large-scale trials related to the product development that has been implemented. Limited trials were conducted on 10 students by providing the results of the instruments that had been developed, with the results of the product moment analysis there were 7 invalid statement items.

Based on the results of the large-scale trial, the product moment value (table r) was obtained from 34 respondents in class XI construction and housing engineering, namely 0.339 for a total rating scale of 5. Meanwhile, the results of all statements obtained from the calculation results gave a product moment value greater than 0.339, so everything is declared valid. While the Cronbach's alpha value of all research competency indicators obtained is greater than 0.60 indicating that all statements obtained from calculations are reliable.

The aspects developed are the results of the elaboration of studies on the success of measuring collaboration abilities. These aspects are attitudes, communication, relationships, group processes, and problem-solving (Ofstedal & Dahlberg, 2009; Hafiluddin, 2016; Vance & Smith, 2019). The collaboration will support the regulation of one's ability to assess the difficulty of a problem that positively influences student interaction regarding team planning and forms of knowledge (Kim & Lim, 2018) because tasks must be completed together (Valdes-Vasquez & Clevenger, 2015). On the other hand, collaboration involves the mutual involvement of group members in coordinated efforts to solve joint project problems (Ofstedal & Dahlberg, 2009) and builds one's self-confidence, and becomes a forum for communicating ideas for sparking ideas in solving problems (Ning et al., 2017). This collaborative assessment instrument also has instructions or guides for filling out the steps, and instructions that students must follow during the self-assessment process. The results of this instrument's development research are to measure students' collaboration skills, which focus specifically on construction and housing planning subjects in the field of project making and can be adopted as a tool in evaluating students' collaborative abilities.

CONCLUSION

In this study, a tool was developed that can measure the ability of student collaboration related to construction planning and housing subjects in the construction and housing engineering study program at one of the vocational schools in Indonesia. Based on a review of the literature, it was established that the main factors influencing success in measuring collaboration ability are (1) attitude; (2) communication; (3) relationship; (4) group concerns; (5) troubleshooting.

This collaboration measuring instrument was developed and sufficient evidence was collected regarding the validity and reliability of its contents. The tools developed in this study can be used to evaluate process learning and can be adapted to the context of other areas, in addition to construction and housing planning subjects in the field of construction and housing engineering. The limitations of this study refer to the selection of only one vocational school. However, subsequent research could include more vocational schools to create a more balanced sample in one country.

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