Developing instrument for assessing student collaboration in vocational high schools

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Abstract. Assessment of the student collaboration of Vocational High School (VHS) in practical learning does not yet have special instruments. This study aims to develop instruments on the assessment of student collaboration VHS. This study used the Research and Development theoretical research method which has the 7 steps of development, (1) conducting a theoretical study on indicators of student collaboration; (2) arranging blue print; (3) validating by expert; (4) testing the instrument; (5) analysing the data; (6) revising the instrument; (7) compile the final instrument. Instrument review was carried out by 9 expert. Based on the results by the expert it was found that all items were valid and could be carried out for testing. The instrument test was conducted on 211 student respondents at level X, XI, and XII VHS from various skill programs in several cities in Indonesia. The distribution of questionnaires was carried out by online using the Google form application. The student’s collaboration instrument was experienced three analyses. The results showed that there are 29 good items where showed the KMO value is 0.859, the Cronbach Alpha reliability value is 0.870, the total variance explained is 65.553%, and the instrument indicator becomes 7 new indicators.

1. Introduction

The 21st century world is characterized by the use of information and communication technology in all aspects of life, including in the learning process. The world of work demands changes in competence. UNESCO said that in the 21st century education era must have four main pillars. The four pillars include learning to know, learning to do, learning to be, and together in peace. The importance of these four pillars is expected to be the basis for learning to prepare generations that are able to compete globally in the 21st century [8]. The 21st century education is also applied in Indonesia. This can be seen from the implementation of the 2013 Curriculum (K13). K13 curriculum that is implemented in schools aim to change the approach to learning in the classroom which is initially teacher-centered (student centered learning) to learner-centered learning. In the K13 Curriculum there are several competencies that students must possess, including the ability to think critically, solve problems, and collaborate. These four competencies become important competencies in entering the life of the 21st century. Schools are required to be able to prepare students to enter the 21st century. One of the important competencies in 21st century education is the competence to collaborate. Students must be able to demonstrate ability in group collaboration, be able to adapt in various roles, be responsible, work productively with other friends, have empathy and can respect others. Teamwork can be developed through the learning experience at school. Students can work together on group assignments. The interaction that is created between students will improve the attitude of cooperation
with each individual in the group. The skills to work together are very useful when students enter the workforce to create good and even global/international cooperation relationships [6].

Bruce Tuckman [1] explained that a team/group that stays together in a period of time will change and develop. There are three characteristics according to Tuckman which shows how well the team is performing, namely content, process, and feelings. Simply stated, content refers to what the team does, the process refers to how the team works in achieving shared goals, and feelings are used to connect each team member. By working together, group members can overcome various problems, act independently with full responsibility, rely on the talents and abilities of each member, trust each other in opinion and decision making [7]. Classroom learning activities with a student centered learning approach will be more focused on students. Teachers give more group assignments than individual assignments. This is in line with the 21st century education paradigm which is also contained in the K13 Curriculum, where students are able to collaborate and work together to achieve learning success.

Learning success can be measured by conducting learning outcomes of practical activities. In the guide to the implementation of the K13 Curriculum by the Directorate General of Primary and Secondary Education, evaluation activities can take the form of problem solving problems related to the subject matter. In addition, the government has also made observative reference rubric for student which is conducted by the teacher [8]. The assessment system that has been designed by the government is good enough. Teachers can assess in detail starting from the quality of character, competence, literacy skills, and high-level thinking skills. However, this assessment is limited to a one-way assessment, that is, from the teacher to students. There is no assessment from students of themselves, more specifically about the cooperative attitudes of students.

According to Black & William [3] students need to assess themselves. The importance of self-assessment is that students can know the extent of their ability to master a competency. Self-assessment is a dynamic assessment process, where students can monitor themselves, evaluate themselves, make choices that are appropriate to themselves so that they can increase their motivation and study achievements. Correctly implemented, student self-assessment can promote intrinsic motivation, internally controlled effort, a mastery goal orientation, and more meaningful learning [13]. Millands points [13] the practice of self-assessment involves students because they actively participate in the learning process and become more connected and committed to learning outcomes. According to Sharma [14] self-assessment can increase the student’s interest and motivation to enhanced learning and better academic performance. The need for the development of self-assessment instruments about the attitude of cooperation of students can help teachers in evaluating learning that has a group model inside or outside the classroom. In addition, self-assessment can also help students in knowing how sensitive they are to group friends in completing tasks from the teacher.

2. Method

2.1. Research Model

This research uses Research and Development research with theoretical methods. According to Hidayati [5], the method of theoretical development is a method that describes a framework that is based on relevant theory and supported by empirical data. The steps that need to be done in the theoretical development among: (1) conducting a theoretical study on aspects and indicators of the attitude of cooperation; (2) arranging blueprint; (3) validating by expert; (4) testing the instrument; (5) analysing the data; (6) revising the instrument; (7) compile the final [5]. The instrument development research was carried out in March to May 2018. The research location was in the PEP Laboratory, 2nd Floor Graduate School Building, Yogyakarta State University, Jalan Colombo No.1, Depok, Sleman, Yogyakarta. The subject of the trial in the study was taken by purposive sampling technique where the subject are Vocational High School students at the X, XI, and XII grade. Subjects in this study amounted to 211 people who were VHS students at the level X, XI, and XII from various
skill programs spread across several cities in Indonesia. Determination of the number of samples is 5 to 10 times the number of items (Gable, 1986). In this study there are 29 items, so the number of samples needed was 145 to 290 samples. Retrieval of trial data is carried out by distributing instruments in the form of questionnaires through online media Google form. Determination of the number of samples is 5 to 10 times the number of items [2]. In this study the number of items is 29, so the number of samples needed is 145 to 290 samples.

2.2. Validity and Reliability
In this instrument development study, validation is needed to measure the feasibility of the instruments made. The feasibility of this study was tested with two validities, first content validity and second construct validity. Content validity is an estimation of the test of the feasibility and relevance of the contents of the instrument with variables measured through rational analysis by experts [12]. Experts who are also called by the rater assess the instrument through discussion group forums. After obtaining the data from the discussion group forum then the instrument was revised and the rater assessment data was processed using the Content Validity Ratio (CVR) analysis before the instrument was tested. The range of CVR values ranges from -1 to 1. The closer to the value of 1 the instrument is more valid.

![CVR Formula]

The next test is to test the construct validity of the instrument. This validity test is carried out after obtaining data on the instrument testing results for students. To determine the construct validity in this study, data analysis was used with SPSS software. The technique of analysing construct validity data with SPSS has several indicators. These indicators are (1) KMO value (Kaiser-Meter Olkin) which is more than 0.5 [11]; (2) The value of anti-image correlation is more than 0.5; (3) The value of Communalities is more than 0.5; and (4) the value of Rotated Component Matrix is more than 0.3. If the results of the SPSS analysis have fulfilled these conditions, then the data can be interpreted. Instrument reliability calculation also utilizes existing facilities in the SPSS program. Reliability analysis used is Alpha Cronbach. The range of reliability values is from 0 to 1. The more the alpha value approaches 1, the more reliable the instrument. The terms of the instrument are said to be reliable if the alpha value is more than 0.7 [9].
3. Result and Discussion

3.1. Conducting Theoretical Studies and Compiling Instrument Item
The preparation of the development of student’s collaboration instruments is carried out by using theoretical development methods that can explain the mind set of theories that are in accordance with the attitude of cooperation. Development activities begin with conducting theoretical studies of collaboration on students from Tuckman [1]. From the results of the study, six indicators of collaboration were formulated, namely (1) having the same goal; (2) achieving certain targets; (3) work integration; (4) effectiveness of working between group members; (5) establishing cooperative relationships; and (6) providing opportunities for other friends to work.

Table 1. Blue-print of Student Collaboration Instrument.

| No. | Indicator                                      | Item Number        |
|-----|-----------------------------------------------|--------------------|
| 1   | Having the same goal                         | 1, 12*, 14         |
| 2   | Achieving certain targets                    | 2, 3, 13, 15, 19   |
| 3   | Work integration                              | 4, 5, 20, 21       |
| 4   | Effectiveness of working between group members| 6, 7*, 16*, 22*, 26, 27, 29 |
| 5   | Establishing cooperative relationship         | 8*, 9, 23, 24, 25, 28* |
| 6   | Providing opportunities for other friends to work | 10, 11, 17, 18*     |

*) negative statement

3.2. Validating by Experts
Based on the indicators that have been compiled as in Table 1, then the items from each indicator are arranged. This research has 29 items of statements with each of them having 4 answer choices namely Very often (V), Often (O), Sometimes (S), and Never (N). The draft of the instrument analysed by 9
experts. The activity was carried out by creating a discussion group forum to qualitatively assess the content of the instrument whether it was in accordance with the aspect being measured. In addition the experts which are also referred to as rater is given a validation sheet in order to measure content validity ratio through CVR calculation. After doing the expert judgments validation then the instrument was revised based on the suggestions given by rater in the discussion group forum. The items to be tested are considered on the basis of advice from rater and the results of the CVR calculation for each item. In this study all items have a CVR value > 0 so that all items are valid.

3.3. Testing the Instrument

Testing activities are carried out by distributing questionnaires by online through Google form application. This method is considered to be more effective and modern because it can take advantage of existing technology so as to lure students to keep abreast of technological developments. In addition to online distribution, it can save costs and time and not be separated by distance. So as to enable researchers to obtain respondents from various regions and in a time that does not have to be together. Respondents obtained in this trial were 211 VHS students from various skill programs in several cities in Indonesia. This amount can meet the sample requirements based on the theory developed by Gable [2].

3.4. Analysing the Data

Testing data that has been collected, then a recapitulation and scoring are carried out on the response. Data that has changed to numbers is then analysed using the SPSS program. Analysis activities must be repeated until the requirements are met. In this study, analysis of construct validity was carried out three times.

3.4.1. First Analysis. In the first analysis phase, a good KMO value of 0.862 was obtained. The significance value of 0.000 has also fulfilled the requirements for further analysis. In the anti-image
section items 1 through 29 all meet the requirements > 0.5. However, in the communalities section, there are 6 items that do not meet the requirements > 0.5, namely points 4, 12, 14, 16, 21 and 23 so that the items must be aborted and the data must be re-analysed.

![Figure 4. KMO value on the first analysis](image)

![Figure 5. Communalities value on the first analysis](image)

3.4.2 Second Analysis. In the second analysis phase, 6 items have been aborted, the KMO value is decreased, which is equal to 0.857. The anti-image section items 1 through 29 all meet the requirements > 0.5. However, in the communalities section, there is 1 item that does not meet the requirements > 0.5, that is item 18, so that the item must be aborted and the data must be re-analysed.

![Figure 6. KMO value on the second analysis](image)
3.4.3 Third Analysis. In the third analysis phase, item 18 has been aborted, obtained by the KMO value increasing by 0.02 that is equal to 0.859. In the anti-image section items 1 through 29 all meet the requirements > 0.5. Communalities section, all items meet the requirements > 0.5, so that the remaining items are valid items and can be used as a measure of self-assessment of students' cooperation attitude.
Based on the final analysis of the 29 items, those have passed 7 items, namely points 4, 12, 14, 16, 18, 21 and 23. The items that are analysed are those that have fairly good construct validity. This can be seen from the Total Variance Explained value of 65.533%. This shows that the instrument can describe the aspects of student collaboration as much as 65.553%.

**Figure 9. Communalities value on the third analysis**

**Figure 10. Total Variance Explained value on the third analysis**
Figure 11. The new component matrix

Figure 11 shows the component matrix that is formed there are 7. These seven components are new factors that are formed from the results of the testing and the items experienced grouping based on the results of the trial. Therefore, the indicator which was originally only 6, was constructed into 7 and needs to name factors according to their respective groups. The new indicators that are formed are (1) having a goal to achieve a common target; (2) helping friends; (3) carry out duties full of responsibility; (4) appreciate friends; (5) managing time in group assignments; (6) giving opportunities to friends; (7) compact. Figure 12 shows that from the results of the instrument testing and data analysis shows the value of Cronbach's alpha reliability is quite good at 0.870. This instrument can be said to be reliable or has a consistent good enough because it has fulfilled the requirements of Cronbach's alpha reliability > 0.7.

Figure 12. Reliability value on the third analysis

Based on the final analysis, the instrument of student collaboration can be formulated into 7 factors with 22 items. Although this instrument of student collaboration is considered valid and reliable, it still needs to be reviewed. The drawback in this research is that the trial is only done once, and it needs to be retested to obtain instruments that are truly standard and suitable for use. In addition, the analysis of this instrument has not used modern methods such as item response theory because in the more recent analysis, researchers can find out more deeply the characteristics of each statement item in this instrument of student collaboration.
4. Conclusion

Based on the results of the research and discussion, it can be concluded that: (1) the instrument of student collaboration is compiled and developed with theoretical methods with the following steps, (a) conducting a theoretical study of aspects and indicators of student collaboration, (b) arranging blueprint, (c) validating by expert, (d) conducting trials, (e) analysing the data, (f) revising the instrument, (g) compiling the final instrument; (2) from the results of testing the validity using SPSS factor analysis, this instrument is a valid instrument and the results of instrument reliability testing show that Cronbach's alpha reliability is quite high.

5. References

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