

## Development of Peer-Based Interaction Skills Assessment Instruments in Mathematics Learning Process in Class

Indah Nur'aena<sup>1</sup>, Budi Manfaat<sup>2</sup>, Arif Muchyidin<sup>2</sup>

<sup>1</sup>SD Islam Mumtaz Kuningan, Indonesia

<sup>2</sup>IAIN Syekh Nurjati Cirebon, Indonesia

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### Article Info

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### ABSTRACT

Interaction skills between students are needed during the learning process. If a student does not interact with the teacher or between students during the learning process in the classroom, they will have difficulty achieving maximum learning success. The purpose of this research and development is to develop an instrument for assessing interaction skills among students in the mathematics learning process in the classroom. This development method was adapted from the steps developed by Saefuddin Azwar, which started with the identification of measurement objectives, operationalization of aspects, item writing, language testing, field tests, item selection, and final compilation. The subject of the experiment was carried out on class VIII-C students of SMPN 3 Luragung. Based on the results of research and development at SMPN 3 Luragung to produce a peer-based interaction skill assessment product during the mathematics learning process in class, the researcher can conclude that the assessment of interaction skills between students can objectively assess interaction skills between students when learning mathematics so that the results of the assessment are more accurate. In addition, the validity and reliability of the test results of the instrument for assessing interaction skills between students in the learning process of mathematics in the classroom that has been developed indicate that this instrument is suitable for use in learning mathematics. With minimum validity of 1 of three authors, the reliability of the instrument is said to be very high, with a result of 0.91, and the item discrimination power is greater than the item-total correlation coefficient of 0.2

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#### Corresponding Author:

Indah Nur'aena  
SD Islam Mumtaz Kuningan, Indonesia  
Email: wak\_badjra@yahoo.com

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## 1. INTRODUCTION

Education is a learning process carried out by each individual during his life by interacting with other individuals and with the natural surroundings aimed at developing his potential, changing behavior towards a better direction under the values prevailing in

society. The application of the educational process is the teaching and learning process which is then known as learning. Sukiyasa and Sukoco [1] stated that the teaching and learning process in the classroom aims to achieve changes in students' intellectual, moral and social behavior.

The learning experienced by a student is closely related to the learning effort undertaken by the teacher. According to Wardhani [2], learning activities are mainly done to make decisions about the "appearance" of students after learning and the accuracy of the learning strategies used. Meanwhile, according to Octaviani [3], learning is a planned process to create learning conditions for students, which are interactive and communicative between students and teachers asking the device, between students and learning resources in a learning environment marked by changes in behavior. Sure, students to master the competencies that have been determined.

In the implementation of learning, assessment is one of the essential components that must be carried out by the teacher, aiming to determine the progress of individual student learning in achieving learning objectives. This follows Budiman and Jailani [4] stating that assessment is an important activity in learning. Assessment can provide feedback for teachers and students. The results of the assessment can also motivate students to achieve even better in the academic field. Learning assessment must be done comprehensively and continuously, including assessing the learning process and learning outcomes. This is by the assessment in the 2013 curriculum, which emphasizes authentic assessment.

According to Sunarti and Rahmawati [5], the term authentic is an assessment carried out comprehensively to assess input, process, and learning outcomes. Following Permendikbud Number 65 of 2013 concerning Standards for Primary and Secondary Education Processes, the learning objectives include the development of the domains of attitudes, knowledge, and skills that are elaborated for each academic unit. Zulhisra and Khabibah [6] argue that one indication of improving the quality of education can be seen from an increase in the potential or overall student learning outcomes, which include three cognitive aspects in the form of educational development, including memory and intelligence functions. Affective, in the form of attitude formation, includes the function of feelings and attitudes. Psychomotor, in the form of skills, including the functions of will, will, and behavior.

The teacher usually assesses students in the cognitive domain (academic achievement) through written tests in the form of multiple choice, descriptions, short answers, true-false, and matchmaking. According to Kunandar [6], the teacher conducts an attitude competency assessment through (1) observation or behavioral observation with an observation sheet or observation tool, (2) self-assessment, (3) peer evaluation by students, (4) journals, and (5) interviews with guide tools or interview guides (questions) straight away. The instrument used for observation, self-assessment, and assessment among students is a checklist or rating scale accompanied by a rubric, while in the journal, it is in the form of educator notes, and in the interview, it is a list of questions.

In general, the assessment carried out by the teacher focuses on the realm of knowledge (cognitive) to the exclusion of attitude assessment and skill assessment. It is essential to conduct an attitude assessment because attitude can determine a person's learning

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success. According to Kunandar [6], in the 2013 curriculum, attitudes are divided into two: spiritual and social. Spiritual and social attitudes must appear in the actual actions of students in everyday life, so the achievement of these attitude competencies must be assessed by the teacher on an ongoing basis using specific instruments.

One aspect of attitude in the learning process is student interaction skills. Yamin [7] states that learning interaction is a communication activity carried out reciprocally between students, students, and teachers, lecturers in understanding, discussing, asking questions, demonstrating, practicing subject matter in class. In the learning process, there is a reciprocal relationship (interaction) between teachers and students, students with students, and students with learning media. This is in line with the opinion of Fauzi [8] that learning is a process of interaction between students and educators and learning resources in a learning environment.

The process of learning mathematics in the classroom must be carried out systematically and continuously so that students can master and apply mathematics in everyday life. In the 2013 curriculum, students are no longer objects of education but are subjects in developing existing themes and materials. Following this, students are required to be active in the learning process in the classroom. One factor influencing active classroom learning is the achievement of good interaction skills between students during the learning process [9]–[13].

Interaction skills between students are essential during the learning process. A student, if there is less interaction with the teacher or between students during the learning process in the classroom, will have difficulty achieving maximum learning success. Conversely, if students often interact with teachers or between students during the learning process in the classroom, it will be easier to achieve maximum learning success. This is supported by research conducted by Fernanda [14]. The study results show a close relationship between the ability to interact socially with learning outcomes. This means that the better the ability to interact socially with students, the better the learning outcomes tend to be. On the contrary, the poorer the social interaction skills in students, the less good the learning outcomes tend to be.

According to observations in the world of education by conducting interviews with one of the mathematics teachers at SMPN 3 Luragung that when the learning process takes place, students interact with other friends, but the interactions that students carry out are still general and are still not felt to lead. On the mathematical problems being faced, the interactions between students that have been carried out significantly influence learning outcomes and assessment of student attitudes. Likewise, the attitude assessment process applied in mathematics learning is not optimal because the teacher only carries out an existing attitude assessment [15]–[19]. Attitude assessment is carried out only once a semester. In contrast, attitude assessment aims to determine the development of student attitudes when the learning process occurs. The aspects of attitude assessment are spiritual, honest, responsible, disciplined, tolerant, cooperative, and polite.

Assessment of interaction skills between students in the learning process in the classroom is critical to do. However, because teachers only conduct attitude assessments following existing rules and are still limited, on this basis, the development of peer-based interaction skills assessment instruments in the mathematics learning process is carried out in

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the classroom. The instrument is expected to be used to assess the interaction skills between students in the mathematics learning process in the classroom. Based on the above background, the main problem in this study is whether the interactions between students that have been carried out during the mathematics learning process in the classroom have been directed at the mathematical problems being faced.

## 2. METHOD

The research used is a type of Research and Development. The research and development method is a way for researchers to produce new products that have been tested for effectiveness of their products, whether new products or improving existing products. There are several research and development steps, including, as stated by Sugiyono [20], which consist of potential and problems, information collection, product design, design validation, design revision, product testing, product revision, usage trial, final product revision, and mass production. Meanwhile, according to Azwar [21], the steps for compiling a psychological scale are as follows: Identification of measuring objectives (Determining theoretical constructs), limitation of measuring domains (formulating behavioral aspects), operationalizing aspects (collecting behavioral indicators), writing item (review item), language testing (qualitative evaluation), field-test (quantitative evaluation), item selection (reliability estimation), construct validation, final compilation.

Steps The research and development of interaction skills among students were adapted from the model Saefudin Azwar by not carrying out the construct validation stage. In the research and development of interaction skills, students do not carry out construct validation according to scales that will only be used on a limited basis; in general, content validation is carried out through an item review process by a panel of experts (expert judgment). The steps of research and development of peer-based interaction skills among students in the mathematics learning process in the classroom are as follows:

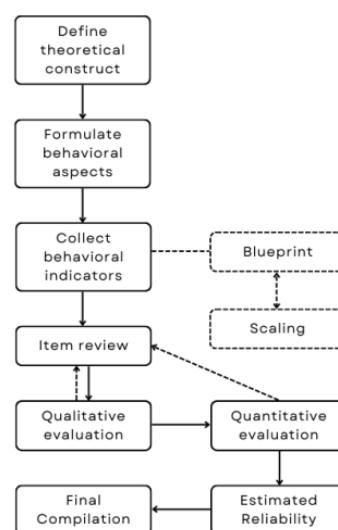


Figure 1. The steps of research and development of peer-based interaction skills among students in the mathematics learning process in the classroom

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The following is an explanation of figure 1 about the steps of research and development of an interaction skill assessment instrument between students, which has been adapted from the model developed by Saefudin Azwar [21] by not carrying out the construct validation stage:

1. Identification of Measure Objectives (Defining theoretical constructs)

Identification of the measurement objectives, namely choosing a definition, recognizing and understanding carefully the theory that underlies the psychological construct of the attribute to be measured. In this study, the identification of the measurement objective was to determine and estimate the interaction skills between students during the mathematics learning process in the classroom.

2. Measuring Domain Restriction (Formulating behavioral aspects)

The domain limitation outlines the theoretical construct of interaction skills between students into several formulations of dimensions or behavioral aspects whose behavioral concepts are more straightforward. In this stage, the writer makes a conceptual and operational definition related to interaction skills between students so that researchers can determine the dimensions or aspects of interaction skills between students that will be researched and developed.

3. Operationalization of Aspects (Collecting behavioral indicators)

The dimensions of interaction skills between students, which are still conceptual, need to be operationalized into a more concrete form of interaction skills between students. This operationalization is formulated in the form of an indicator of interaction skills between students. The indicators of interaction skills between students and the dimensions that represent them are then outlined in a grid or blueprint equipped with a scale specification. The scale designer needs to determine the form or format of the stimulus to be used. The format of this stimulus is closely related to the method of scaling.

The scale used in the research and development of the interaction skill assessment instrument among students is the Likert scale. According to Sunarti and Rahmawati [5], the Likert scale measures attitudes, opinions, and perceptions of a person or group of people about social phenomena with a range/continuum from very positive to very negative.

4. Item Writing (item review)

They were making a statement item on the interaction skills between students in the mathematics learning process in the classroom based on a predetermined grid of positive and negative statements. After writing the item, the next step is to review the item. The item writer himself carries out the first item review by always re-checking each item that has just been written. When all items have been written, the review is carried out by several competent people (as a panel). The competencies needed in this case include mastery of scale construction and measured attribute problems; besides, mastery of standard written language is very much needed.

The review process will be carried out by experts and then used to test the validity of the content on the items that have been compiled. All items that are thought to be inconsistent with the writing rules must be corrected or rewritten. The provision for

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passing items in the qualitative evaluation stage by the panel of experts is their agreement (expert judgment) that the content of the item in question is logical to reveal its indicators (logical validity).

5. Readability or Language Trial (qualitative evaluation)

The collection of items that have successfully passed the review process must then be evaluated qualitatively further, namely by being tested on a small group of respondents to find out whether the sentences used in the items are easy and can be understood correctly by the respondents as desired by the item writers. The language test was carried out on 6 grade VIII students at the school that will be used as research sites.

6. Field Test (quantitative evaluation)

After the improvement of language and sentences has been done, the next step is to evaluate the item's function quantitatively, based on the score of respondents' answers. The item score data of the respondents was obtained from the field-test results. The field test will be conducted in class VIII-C with a total of 32 students that will be used as research sites. The data from the field-test results will be tested for item discrimination power, reliability, and interpretation of the scoring results later.

7. Item Selection (Estimated reliability)

In this stage, the term item analysis is the quantitative testing of items to determine whether items meet the psychometric requirements to be included as part of the scale. The parameters tested are at least the item discriminatory power or item discrimination power, namely the item's ability to distinguish between subjects with the measured attribute and those who do not. More sharply, item discrepancy shows the item's ability to distinguish individuals into various levels of qualitative attributes as measured by quantitative scores.

In the complete classical item analysis, an analysis of the validity and item reliability indexes was also carried out. Items that do not meet the psychometric requirements will be removed or corrected before becoming part of the scale. In addition to paying attention to item parameters, scale compilation must be carried out by considering the proportionality of aspects of interaction skills between students as described by the grid.

Internal and external estimates measured the reliability of the interaction skill assessment instrument between students. Internal estimates are calculated using the interrater reliability formula or inter-observer reliability, and external estimates are calculated using the Cronbach alpha formula or alpha coefficients. This research and development need a total item correlation coefficient to determine which items have discriminatory power. The Pearson Product-Moment correlation coefficient formula is used to find the total item coefficient.

8. Final Compilation

After carrying out several stages in the preparation, the statement items for assessing the interaction skills between students during the mathematics learning process in the classroom have met the validity and reliability requirements so that the assessment of interaction skills between students during the mathematics learning process in the classroom can be used as the final product or the final format of the assessment of

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interaction skills between students during the mathematics learning process in the classroom.

### **3. RESULTS AND DISCUSSION**

#### **3.1. Result**

This research and development aim to produce an instrument product for assessing interaction skills between students. In the process, it takes several stages that researchers must carry out. The stages that researchers have carried out in producing the production of interaction skills instruments between students in this study will be explained as follows:

##### **1. Identification of Measure Objectives (Defining theoretical constructs)**

Based on the results of an interview with one of the mathematics teachers at SMPN 3 Luragung stating that the interaction skills between students when learning mathematics in class are still low, it can be seen during the mathematics learning process and the results of the attitude assessment that the teacher has carried out. Attitude assessment is only carried out once a year. One semester even though the teacher needs to know the development of student attitudes during learning. Thus, an effective interaction skill assessment instrument is needed. The measurement objective in this research and development is the interaction skills between students in the mathematics learning process in the classroom. Interaction skills between students are a person's ability to interact effectively by covering aspects of self-disclosure (self-disclosure), trust, communication skills, and conflict resolution.

##### **2. Measuring Domain Restriction (Formulating behavioral aspects)**

The measurement domain's limitation is outlined by the theoretical construct of interaction skills between students into several dimensions or behavioral aspects formulations whose behavioral concepts are more straightforward. The dimensions or aspects of interaction skills between students in the mathematics learning process in the classroom are as follows:

###### **a. Self-disclosure**

Self-disclosure is revealing personal information about ourselves that others are unlikely to discover in other ways. This information touches on topics one would not even consider discussing with particular people; therefore, we keep our thoughts and feelings to ourselves [22]. Self-disclosure has both advantages and disadvantages. About its merit, it allows us to open up and disclose more with people who disclose, too [23]. Secondly, it is a reciprocal process where the more one discloses to others, the more they will be willing to do the same [23]. Thirdly, disclosure leads to trust that develops the relationship. However, talking too much about ourselves early in a relationship may not facilitate friendship development because too much disclosure might be viewed as insecure. As a result, self-disclosure can lead to rejection because of not being liked or accepted [23]. Nevertheless, self-disclosure is subject to various issues and factors. Several factors influence when to disclose and when not to disclose.

The first factor is cultural differences between the partners, especially strangers. Culture has rules and sanctions that inhibit high levels of self-disclosure between strangers [24], [25]. Secondly, individual traits or differences in interpersonal skills

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influence how and when to disclose. Those with secure attachments to people have high levels of self-disclosure, while high openers encourage others to self-disclose. Thirdly, gender differences affect self-disclosure because men feel more awkward disclosing than women; therefore, women are more likely to reciprocate the level of intimacy than men [24], [25].

b. Trust

Trust is a factor that determines the effectiveness of the relationship because, with trust, individuals will open up more. Trust consists of two parts: being trusting and being trustworthy. Specifically, trusting or trusting involves openness (sharing information, ideas, thoughts, feelings, and reactions to something), opening up, and sharing. Individuals are trusted or trustworthy when the individual expresses acceptance, support, and cooperation with others, as long as the individual reciprocates the self-disclosure of others.

c. Communication Skills

the skills that students have when interacting in the learning process in the classroom, including having a sense of empathy and showing students' positive attitudes (expressive) and eye gaze.

d. Solve conflicts

Conflict is a situation of action in which one party obstructs, hinders, or interferes with the other party's actions. One way to solve problems is to negotiate. Johnson & Johnson [26] states that negotiation is when individuals try to solve a problem with friends who share or have different views.

3. Operationalization of Aspects (Collecting behavioral indicators)

After determining the dimensions or aspects of interaction skills between students, the next step is to make indicators of the assessment instrument for interaction skills between students, outlined in a grid or blueprint. Based on the advice given by the expert validator, three indicators must be improved, including the indicator "showing the attitude that is being experienced during learning" on the aspect or dimension of self-disclosure, the indicator "Mutual motivation between the two parties" on aspects or dimensions of self-disclosure. Dimensions of communication skills, the indicator "Receiving comments and ideas submitted" on the aspect or dimension of trust. Then one indicator that must be discarded is the indicator "Showing body movements when interacting with friends" on aspects or dimensions of communication skills.

The form an assessment instrument for interaction skills between students is the form of peer assessment sheets. The reason for choosing the form of peer assessment sheets is because, in the learning process in class, students interact more often with their peers so that peers know the ability of interaction skills between students. To avoid subjective assessments, this assessment was carried out by two students who assess. As the assessment signs between friends have been described in the theoretical description by Kunandar in point 4, namely determining the assessor for each student - one student should be assessed by several other friends. The items will be made using four alternative answers, namely Always (A), Often (O), Sometimes (S), and Never (N).

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The scoring moves from a range of 4 (A) to 1 (N) for positive items, while for negative items, the scoring moves from 1 (A) to 4 (N).

4. Item Writing (item review)

After making a grid or blueprint of the interaction skill assessment instrument between students, the next stage is item writing (item review). Item writing follows the grid that has been made. From each grid, at most minuscule 1 statement is made. In writing the item, the writer must use excellent and correct Indonesian, and the language style must be adjusted to the respondent so that the respondent has no difficulty in answering the scale. In the early stages, the author made 41 items consisting of 23 positive items and 18 negative items, and this is intended so that later the writer does not run out of items due to the loss of items that do not meet the requirements.

In writing items, the author continually reviews items by re-checking each item written to determine whether the items made following the indicators of student interaction skills to be measured. After the author reviews the items that have been made, the following review is carried out by experts or item validation by experts (expert judgment).

5. Readability or Language Test (qualitative evaluation)

The language test was carried out on six students with the provision that two students assessed one. The language test was carried out on the VIII grade students. This language test aims to determine whether the items are easy to understand and can be understood by the respondents as desired by the compiler or not. The results of this language test show that the respondents did not experience difficulties responding to the statements. So it can be concluded that the assessment instrument for interaction skills between students in terms of language (readability) can be said to be good so that the assessment instrument for interaction skills between students can be tested in the field (field test).

6. Field Test (quantitative evaluation)

After the assessment instrument for interaction skills between students was validated by experts and tested for language by 6 class VIII students, the next stage was the field test. This field trial was carried out in class VIII C, totaling 32 students, which was carried out after the mathematics learning took place. The field trial aims to determine items' reliability, discriminatory power, and interpretation of scores from the field-test results.

7. Item Selection (Estimated reliability)

After getting data from the field-test results, the next step is item selection. The term item analysis is quantitatively testing items to determine whether items meet the psychometric requirements for inclusion as part of a scale. The parameters tested are item discrimination power and item reliability.

Table 1. Results of Discrimination Power of Interaction Skills Items

Item number	$r_{ix}$	Item number	$r_{ix}$
1	0,74	1	0,49
2	0,59	2	0,59
3	0,72	3	0,47

Item number	$r_{ix}$	Item number	$r_{ix}$
4	0,24	4	0,05
5	0,01	5	0,28
6	0,43	6	0,29
7	0,28	7	0,54
8	0,61	8	0,83
9	0,42	9	0,6
10	0,39	10	0,54
11	0,57	11	0,1
12	0,6	12	0,6
13	0,4	13	0,15
14	0,55	14	0,64
15	0,51	15	0,64
16	0,54	16	0,59
17	0,37	17	0,61
18	0,35	18	

From the results of the discriminatory power of items in table 1, it is found that items no. 5, 22, 29, and 31 have lower discrimination power than the item selection criteria based on total item correlation, which can be interpreted as items with low discriminating power. If the value is less than 0.20, the item should be discarded. In this case, the researcher will discard items with less discriminatory power than the total item correlation of 4 items.

After removing items with low discriminatory power, the next step is to look at the instrument's reliability. The data obtained from the field-test results were analyzed with internal consistency (internal consistency) using Cronbach's alpha with the help of SPSS and external consistency (external consistency) using the interrater reliability formula. The results of internal consistency using Cronbach's alpha with the help of SPSS can be seen in the following table:

Table 2. Results Internal consistency using Cronbach's alpha

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.910	.913	31

The reliability statistics table above shows that Cronbach's alpha value of the test is 0.910 (greater than 0.70), so the reliability or reliability of this test is very high so that this product can be used further as an evaluation tool.

## 8. Final Compilation

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The last stage of the steps of the peer-based interaction skill assessment instrument in the mathematics learning process in the classroom is the final compilation stage. The final product of this research and development is a peer-based interaction skill assessment instrument sheet that has passed the research and development stages above. The instrument for assessing the interaction skills between students consists of 4 aspects/dimensions to be examined, namely Self-disclosure or self-disclosure, Trust, Communication Skills, and Conflict Resolution. The instrument for assessing the interaction skills between students is 31 statements, with 23 positive and eight negative statements.

### **3.2. Discussion**

From the data processing done through testing using the peer assessment sheet instrument, it can be concluded that the ability of interaction skills among students of class VIII-C SMPN 3 Luragung is in the high category. Based on the research findings, it can be seen that the interaction skills of class VIII C students of SMPN 3 Luragung are in the high category. Students with interaction skills are in the excellent category, which means that these students already know how good interaction skills between students are during the learning process in class. Interactions between students that are well established will affect student learning outcomes to the maximum. This is reinforced by Sefiyah [26], who says that the better the interactions made by students, the better their learning outcomes will be. As stated by Purwanto [27], learning outcomes are changes in student behavior due to the process of teaching and learning activities in the form of cognitive, affective, and psychomotor aspects.

Meanwhile, students who have interaction skills with students in the low category do not have good knowledge and skills about interaction skills between students in the learning process in the classroom, and students are not able to adapt well to interacting with their peers in learning, so students are afraid and feel inferior. Themselves towards their friends who are more intelligent than themselves, until, in the end, the student cannot carry out his role in social interaction with his peers, especially during the learning process in class. Ali and Asrori [18] state that people who are considered to have good self-adjustment are individuals who have learned to react to themselves and their environment in mature, efficient, satisfying, and healthy ways and can overcome mental conflicts, frustrations, and difficulties.

Based on the quote above, adjustment for a student to peers in the learning process in the classroom is essential, so that interaction skills between students can be well established and the learning process in class can run as expected. Ali and Asrori [28] state that interaction is a reciprocal relationship between two or more people, and each person involved plays an active role.

The results of this research and development are reinforced by research conducted by Mistio Mesa Fernanda et al. [14], which generally aims to examine the relationship between social interaction skills and learning outcomes. In this study, it was shown that the students' social contact was classified as very good. In contrast, student learning outcomes are in a suitable category. So the results of this study indicate a significant relationship between the ability to interact socially with learning outcomes. Research conducted by

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Nurul Khabibah also reinforces the positive and significant influence of social interaction between students on the mathematics learning achievement of 0.531, classified as moderate. One of the efforts that can be made to improve the interaction skills between students in the process of learning mathematics in the classroom is necessary for the teacher of the subject in question. In addition, assessment is a critical component in the learning process in the classroom; not only assessment in the cognitive domain but assessment in the affective domain, especially the assessment of interaction skills between students, can help teachers to know the development of student interactions when the learning process takes place.

### 3.3. Research Limitations

In this research and development, the full results of the products that have been developed can be said to be far from perfect, but researchers have tried various things to produce products for peer-based interaction skills assessment instruments during the mathematics learning process in class. The products produced by researchers have not been widely used. This is due to the limited resources and time that the researcher has.

Thus, researchers are aware of the shortcomings and weaknesses in this research and development, and it is hoped that the resulting product does not stop here, but there is a continuation to be completed and refined so that it becomes a good product and can be used in the longer term.

## 4. CONCLUSION

Based on the results of research and development at SMPN 3 Luragung to produce a peer-based interaction skill assessment product during the mathematics learning process in class, the researcher can conclude that the assessment of interaction skills between students can objectively assess interaction skills between students when learning mathematics so that the results of the assessment are more accurate.

In addition, the validity and reliability of the test results of the instrument for assessing interaction skills between students in the learning process of mathematics in the classroom that has been developed indicate that this instrument is suitable for use in learning mathematics. With minimum validity of 1 of three authors, the reliability of the instrument is said to be very high, with a result of 0.91, and the item discrimination power is greater than the item-total correlation coefficient of 0.2

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