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Independence learning and problem solving ability in elementary school students' fraction materials through online learning

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Abstract

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The purpose of this study was to determine the relationship between independence learning and problem-solving skills, especially in fractional material in online learning in fifth grade elementary school. This ¹⁸ search is included in quantitative research with correlational type. The samples contained in this study were fifth grade students from one of the elementary schools in Depok City with a sample of 122 students obtained using non-probability sampling technique. The data collection technique was carried out through the distribution of an independence learning questionnaire instrument with a total of 29 statements and a problem-solving ability test instrument as many as 8 questions. Furthermore, the data that has been obtained is measured and analyzed using Rasch modeling and ¹ assisted by Winstep software so as to obtain data on validity, reliability, logit measure, up to the quality of persons and items. After the data is obtained, a correlation test is carried out using logit measure data to determine whether or not there is a ²² relationship between independence learning and problem solving abilities. Furthermore, the Effect ² Size test was conducted to determine the effect between variables. In this study, the results showed that there was a significant and interrelated relationship between independence learning and problem ability.

Keywords: Fractions; Independent Learning; Online Learning; Problem Solving Skills

Introduction

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Indonesia is one of the countries hit by the COVID-19 pandemic with a period of more than 12 months. The COVID-19 pandemic has changed the education learning system in Indonesia from offline learning to online learning. Online learning can be interpreted as a means to be able to obtain a teaching and learning process that prioritizes student activity, is innovative, and flexible because it can carry out learning activities from anywhere and anytime (Dhawan, 2020). Online learning requires a high degree ²³ independence when studying, because the independence that is carried out while studying has a positive effect on students to carry out learning (Syelitar & Putra, 2021). In addition, online learning is expected to focus more on the independence of students' learning in receiving, processing, and implementing the explanations received (Kusumaningrum et al., 2020). Independence learning is the ability that is in students to carry out learning activities independently. In other

words, independence learning is part of one of the efforts and abilities that students need to have to carry out learning activities, so they try to be independent in seeking explanations and become motivated to understand learning material without coercion from any party. (Nuritha & Tsurayya, 2021).

Independent learning has a big impact on students' ability to solve problems. This happens because it is able to improve habits and behavior while studying which is the hallmark of independent learning (Sulistiyani et al., 2020). Problem solving ability has the meaning of a skill that encourages students to take the initiative in systematic thinking when solving problems that are being experienced and to train to recognize problems which can later be implemented in solving complex everyday problems using problem solving indicators from Polya (Nurdalilah et al., 2013; Ramadhani, 2018). Elementary school students get more than one lesson, there is one learning process that gets special attention about the ability to solve problems, namely the process of learning mathematics (Yandhari et al., 2019). That way, elementary school students must be able to master the ability to solve problems after doing the math learning process (Mulyati, 2016). In addition to problem solving abilities, independence learning is also a demand for students when carrying out mathematics learning (Nurhayati, 2017).

From the point of view of mathematics, fractions are one part of mathematics which is a difficult topic to teach to elementary school students (Tanjung & Nababan, 2016). Fractions material is defined as a field of mathematics that has a relationship with other materials and has a very close relationship in everyday life (Malikha & Amir, 2018). There are many students who find it difficult when doing fractional arithmetic operations, it can be seen in the research results of Arry Safitri et al. (2018) which shows that students who are the sample get an average score in the very low category, namely 43.86% which means that students have difficulty. This fraction material has been studied by elementary school students since grade III, but students still find it difficult in the learning process because they do not understand the concept of fraction material. (Indriani, 2018).

Sulistiyani et al. (2020) which concluded that the ability in solving mathematical problems of elementary school students was in the high category from high learning independence, and conversely, elementary school students who had problem solving abilities in mathematics were in the low category due to low learning independence. In addition, Ilham Kristanto et al. (2020) investigated the relationship between independence in learning and the results obtained in learning mathematics in grade V Elementary School, the results of the study found a significant and positive relationship between the two. With the various circumstances that have been described, this study aims to find out whether or not there is a relationship between independence while studying and the ability to solve problems with fractions in online learning in elementary schools.

Methods

The type of research carried out using the type of quantitative research with the type of correlational research. This study also aims to find out in depth about the relationship between independence learning and students' problem-solving abilities, especially in

fractional material in an online learning situation in class V, one of the elementary schools in Depok City. The population was 857 which was taken from students in first up to sixth grade at an elementary school in Depok, West Java. The non-probability sampling technique was chosen as the sampling technique in the study, so that a sample of 122 students came from all fifth graders of an elementary school in Depok, West Java.

The instrument used in this study was an ² independence learning questionnaire and a test of problem solving abilities. The questionnaire instrument for independence learning in online learning is 29 statements, 15 statements that show a positive attitude and 14 statements that show a negative attitude. To answer the questions, alternative answers are provided that are based on a Likert scale such as SL (Always), SR (Often), KD (Sometimes), and TP (Never) (Muhammad, 2020). The indicators of the independence learning questionnaire are presented in the following table:

Table 1. Independence Learning Indicators

Independence learning Indicator	Statement
Responsibility	Completing assignments from the teacher Doing homework
Inisiative	Learn whithout being ordered
Self confident	Do not have dependence on other during the learning process Believe in your own abilities
Velue time	Using free time to study
Independent	Doing assignments from the teacher without the help of other

(Sa'diyah, 2017; Suleang et al., 2021)

The test instrument on the ability to solve this problem consists of description questions on the subject of fractional material, namely calculating addition, subtraction, multiplication, division, mixed operations, and comparisons which are packaged in the form of 8 questions. The types ¹² of instruments in this study were arranged using the steps in problem solving indicators according to Polya:

Table 2. Indicators of Problem Solving Ability

No	Indicator	Definition of Indicator
1	Understand the Problem	The ability to use questions to make decisions about what is known and needed.
2	Develop a settlement plan	The ability to use all the information contained in the question to create a plan or procedure to resolve the issue raised.
3	Solve problems according to plan	The ability to solve existing questions and answer them accurately according to the steps taken from the beginning.

- 4 Check back the result that have been obtained The ability to validate the answers received by using methods or procedures that are accurate and believe the truth of the answers given.

(Widyastuti, 2015)

Testing the validity and reliability of the questionnaire instrument for independence learning and the test instrument for problem solving skills using Rasch Modeling assisted by Winsteps software. Aspects of validity using Rasch modeling using criteria such as the outfit mean square value received ($0.5 < \text{Outfit} - \text{mean square} < 1.5$), the outfit z-standard value received ($-2.0 < z\text{-standard} < +2.0$), and the received Point Measure Correlation value ($0.4 < \text{Point Measure Corr} < 0.85$) (Sumintono & Widhiarso, 2015). Meanwhile, to see the categories in deciding the value of Item Reliability and Person Reliability, use the following criteria: (Sumintono & Widhiarso, 2015)

Table 3. Reliability Criteria in Rasch Model

Reliability value (Person/Item)	Interpretation
> 0,94	Spesial
0,91 – 0,94	Very good
0,81 – 0,90	Very nice
0,67 – 0,80	Enough
< 0,67	Weak

Furthermore, to see how independent learning is related to the problem-solving abilities of fifth grade elementary school students, a correlation analysis was carried out which required testing the product moment correlation with the Pearson formula (Tninus, 2018).

$$r_{xy} = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{\{N \sum X^2 - (\sum X)^2\} \{N \sum Y^2 - (\sum Y)^2\}}}$$

To show the measurement of the strength of the relationship and the strength of the influence between the two variables, namely the independence learning variable and the problem-solving ability variable, then the Effect Size measurement is used with the criterion value of $d < 0.2$ then it is in the small category, if $0.2 < d < 0.8$ then it is in the medium category, and the value of $d > 0.8$ then it is in the high category (Saregar et al., 2016).

Results

Analysis of Instruments

The validity test which was carried out on the independence learning questionnaire instrument using the Winsteps software got the results that there were 6 invalid items and 36 respondents who were not valid. Meanwhile, in the test instrument for problem solving ability to get results, there are 1 item invalid item and 68 respondents invalid person.

Judging from the results of the analysis using Winstep software, the reliability test on person reliability, item reliability, and Cronbach's Alpha formula on the independence learning questionnaire instrument respectively got 0.81; 0.96; 0.90. It can be concluded that the consistency of students in answering the questionnaire statements is included in the very nice criteria, besides the quality of the items in the questionnaire is included in the special

criteria, and the relationship contained in the item and person is included in the very nice category (Sumintono & Widhiarso, 2015).

Table 4. Summary Statistics Questionnaire

	<i>Mean</i>	<i>SD</i>	<i>Reliability</i>	<i>Cronbach</i>
Person	2,21	1,37	0,81	0,90
Item	0,00	1,05	0,96	

Meanwhile, the reliability test on the problem-solving ability test instrument got the results of person reliability, item reliability, and Cronbach's Alpha formula, respectively 0.84; 0.97; 0.81. It can be concluded that the quality of the person on the test questions shows the quality of entering the criteria is very nice, while the quality of the items on the test questions shows the quality of entering the special criteria, and the relationship between the person answering the items entering the criteria is very nice. (Sumintono & Widhiarso, 2015).

Table 5. Summary Statistics Test Question

	<i>Mean</i>	<i>SD</i>	<i>Reliability</i>	<i>Cronbach</i>
Person	-0,24	0,65	0,84	0,81
Item	0,00	0,49	0,97	

Independent Learning Variable

Based on Figure 1. There is a Wright Map derived from the Winstep software which analyzes independent learning instruments with logit lengths ranging from 5 to -2. In addition, there is also a person map on the left and an item map on the right which describes the level of ability of the person and the level of difficulty of the item. The ability level of the person on the independence learning instrument there are 6 students who rank at the top, namely students with numbers (034, 097, 103, 109, 110, and 117), this shows that students occupy quality with high ability to answer questions. Meanwhile, there is 1 student who ranks at the bottom with the number (061), thus showing the ability to answer questions that the student has in the low category. In addition, in the item map, there is 1 item that is in the top right order, namely (I22), this explains that the item is included in the category of high difficulty level. While the 4 items in the lowest order on the right, namely (I16, I2, I25, I6) explain that the items are included in the category of low difficulty level.

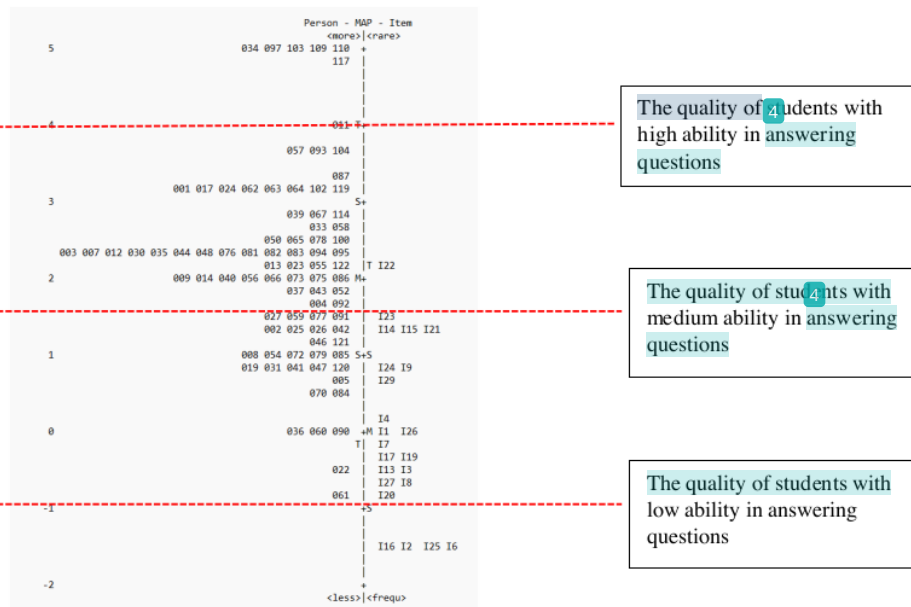


Figure 1. Wright Map Independence learning Questionnaire

To find out the difficulty of the item (item fit) can be seen in Figure 2. There is a column containing logit data from each item (Measure) which can make it easier for researchers to see data about difficult and easy questions, besides that there are numbers that indicate data loss. (Total Count) so that it can be read that there are 86 students who answered this question, and can see the item questions with the highest difficulty level to the lowest difficulty which is found in the (Item) column which shows items labeled I22 are items with a high level of difficulty to items with the label I25 which is a low difficulty item. In addition, there are MNSQ outfit results, ZSTD outfit results, and PT-MEASUREURE CORR results which make it easy to see valid data using Rasch modeling criteria.

Item STATISTICS: MEASURE ORDER

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S. E.	MNSQ	ZSTD	OUTFIT MNSQ	ZSTD	PT-MEASURE CORR.	EXP.	EXACT MATCH OBS%	EXP%	Item
17	213	86	2.10	.15	1.06	.4	1.06	.4	.62	.66	48.1	47.6	I22
18	240	86	1.52	.15	1.09	.7	1.14	.9	.55	.63	54.3	45.6	I23
10	245	86	1.41	.15	1.31	2.1	1.31	1.9	.51	.63	46.9	45.5	I14
11	251	86	1.28	.15	1.31	2.0	1.25	1.6	.57	.62	44.4	47.5	I15
16	251	86	1.28	.15	.94	-.4	.90	-.6	.63	.62	46.9	47.5	I21
19	269	86	.88	.15	.97	-.1	.91	-.5	.61	.59	53.1	48.2	I24
8	274	86	.76	.16	1.30	1.9	1.34	1.8	.53	.58	40.7	49.3	I9
23	276	86	.71	.16	.95	-.3	1.13	.8	.50	.58	53.1	48.9	I29
4	295	86	.20	.17	1.26	1.5	1.12	.6	.49	.53	59.3	59.8	I4
21	299	86	.08	.18	1.46	2.4	1.20	.9	.46	.52	65.4	62.0	I26
1	303	86	-.05	.18	.96	-.2	.93	-.2	.50	.50	58.0	65.0	I1
6	306	86	-.16	.19	.84	-.8	.88	-.4	.54	.49	66.7	65.6	I7
13	309	86	-.27	.19	.76	-1.3	.65	-1.4	.56	.48	66.7	67.8	I17
14	312	86	-.38	.20	1.25	1.2	1.09	.4	.46	.47	65.4	69.7	I19
9	315	86	-.51	.21	1.01	.1	.68	-1.1	.52	.45	69.1	71.6	I13
3	316	86	-.55	.21	.69	-1.6	.59	-1.4	.55	.45	74.1	72.4	I3
7	320	86	-.74	.22	.77	-1.0	.56	-1.4	.53	.43	76.5	74.9	I8
22	320	86	-.74	.22	.67	-1.6	.64	-1.1	.51	.43	77.8	74.9	I27
15	322	86	-.85	.23	.71	-1.3	.57	-1.3	.50	.42	80.2	77.0	I20
5	331	86	-1.45	.29	.70	-1.0	.35	-1.7	.50	.34	91.4	86.0	I6
12	331	86	-1.45	.29	.84	-.5	.52	-1.1	.43	.34	88.9	86.0	I16
2	332	86	-1.53	.30	.84	-.4	.62	-.7	.40	.33	88.9	86.7	I2
20	332	86	-1.53	.30	.76	-.8	.52	-1.0	.41	.33	86.4	86.7	I25
MEAN	294.0	86.0	.00	.20	.98	.1	.87	-.2			65.3	64.6	
S.D.	33.9	.0	1.05	.05	.23	1.2	.29	1.1			15.3	14.4	

Figure 2. Item Measure Independence learning Questionnaire

Problem Solving Ability Variable

It can be seen in Figure 3. That is the Wright Map obtained from processing data on problem solving ability test questions using Winstep software and shows that there are 2 students who occupy the high quality section in the ability to answer questions, namely on the label (064P and 069P) and there are 5 students with the ability to answer questions with low quality, namely on the label (083P, 093P, 042L, 102L, 110P). In addition, if you look at the right side of the Wright Map, there are items that are included in the high difficulty level, namely the label (I2, I6, I7) and the item with the low difficulty level is the label (I1).

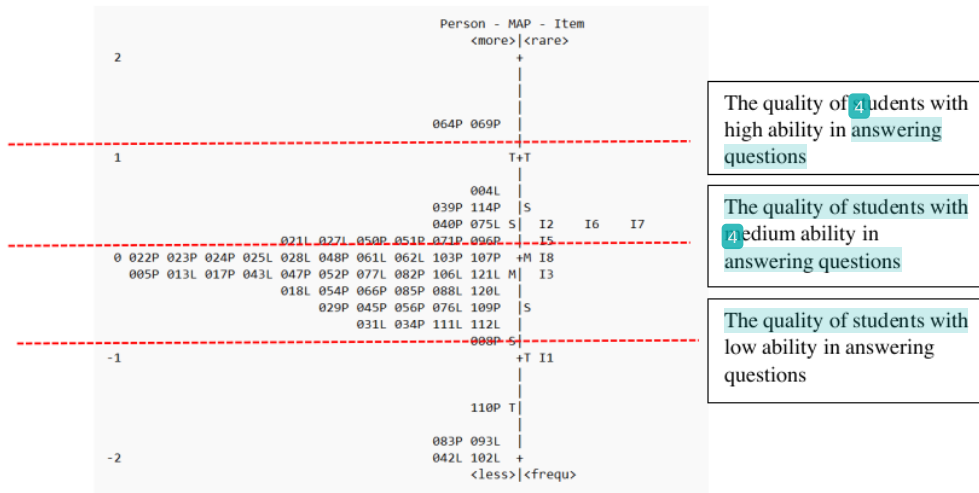


Figure 3. Wright Map Test Questions

To see the value of the measure that can make it easier to determine the quality level of students answering questions and the quality of the items can be seen in Figure 4. which shows the item measure table so you can see the logit measure value on test questions, items that include high to low quality difficulty so that you get the results that the item questions with label I6 place the top order in the category of highest difficulty quality compared to other questions, then there is a total score obtained for each item, besides that there is a total count that shows the amount of data that answers the item, which is 54 people, and there are MNSQ outfit results, the results of the ZSTD outfit, and the results of the PT-MEASUREURE CORR which can make it easier for us to determine valid data.

Item STATISTICS: MEASURE ORDER													
ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	TOTAL MEASURE	MODEL S.E.	INFIT MNSQ	ZSTD	OUTFIT MNSQ	ZSTD	PT-MEASURE CORR.	EXP.	EXACT OBS%	MATCH EXP%	Item
5	201	54	.41	.07	.92	-.4	.88	-.5	.59	.61	16.7	21.4	I6
2	207	54	.37	.07	1.22	1.3	1.22	1.0	.54	.61	16.7	18.9	I2
6	211	54	.35	.07	.99	.0	1.05	.3	.64	.62	11.1	20.2	I7
4	246	54	.18	.07	1.17	1.0	1.04	.3	.70	.65	16.7	18.9	I5
7	283	54	-.02	.07	.72	-1.5	.71	-1.3	.77	.69	33.3	23.7	I8
3	319	54	-.23	.08	1.23	1.0	1.18	.7	.69	.73	25.9	34.2	I3
1	444	54	-1.07	.08	.86	-.8	.89	-.5	.72	.74	24.1	20.0	I1
MEAN	273.0	54.0	.00	.07	1.02	.1	.99	.0			20.6	22.5	
S.D.	80.7	.0	.49	.00	.18	1.0	.17	.8			7.0	5.0	

Figure 4. Item Measure Test Instrument

The Relationship of Independent Learning with Problem Solving Ability

Testing the product moment correlation using the Pearson formula assisted by the SPSS application by entering the logit measure value of the questionnaire and the logit measure test value obtained from data processing through the Winstep software. In this correlation test, the results show that the significant value obtained is 0.000 and is included in the category there is a correlation. These results also show a positive value so that it shows the relationship that is in the independence learning variable and the problem-solving ability variable is positive, and there is a Person Correlation result of 0.776 which is included in the category of strong correlation according to the relationship degree guidelines (Fadila & Khoirunnisa, 2021). After that, the Effect Size value was tested to see how effectively independence learning affects problem solving abilities and got an Effect Size value of 1,035, which means that the independence learning of class V students affects the ability to solve problems in the high category.

Discussion

Table 4 and Table 5 in the research results section explain that the data derived from the independence questionnaire instrument while studying and the ability test instrument in problem solving have entered the reliable criteria so that they are ready to carry out the next process. After that, Figure 1 and Figure 3 are Wright Maps of the questionnaires and test questions obtained from the Winstep software so that you can see the quality of the person's abilities and the quality of each item. In the Wright Map, the independence learning questionnaire illustrates that the quality of students' abilities in answering the questionnaire questions is higher than the quality of the difficulty of the questionnaire. Meanwhile, on the Wright Map, the problem-solving ability test questions illustrate that there are 2 students who have a higher quality of answering questions compared to the level of difficulty of all question items, making it easier for these students to work on test questions. Furthermore, it was found that 5 students occupy a low quality level and their placement is under low quality items, this shows that the 5 students cannot answer or have difficulty on test questions of low or high quality. That way it can be concluded that students who can solve problems well on test questions are due to having good independence learning too. This is in line with Ansori & Herdiman (2019) with an explanation that students can easily work on problems well because they have the ability to solve quality problems based on

independence when doing quality learning on themselves and between the two of them influence each other.

The next discussion is about the correlation test to examine the existence of a relationship or relationship between independence learning and problem solving abilities. The results obtained from this correlation test get a significant value of 0.000 which is classified in the category there is a correlation, and shows a positive value. The Pearson Correlation value was found to be 0.776 which was classified in the category of strong correlation according to the relationship degree guidelines (Fadila & Khoirunnisa, 2021). In addition, the Effect Size test conducted in this study showed a result of 1,035 which was included in the category of mutual influence at a high level. This effect size is carried out to determine the reflection of the relationship between variables in a study (Prahesti & Suparji, 2021). So that it can be interpreted that students who have independence learning above average will be good at solving the problems they face. While students who are not good at solving the problems they face, show independence learning below average. This happens because the variables influence each other. In accordance with what was reported by Amalia et al. (2018) obtained the results of an investigation which stated that independent learning and problem-solving abilities had a very strong and positive relationship between the two, and concluded that the two were interrelated.

Conclusion

Based on the results of the research analysis, the researchers found that there was a relationship between independence learning and problem-solving abilities, especially on fractions in online learning for elementary school students. In this study, it can be seen that the more students have independence learning above average or high, the problem solving abilities they have are getting better or better. and conversely, the more students have independence learning below the average or low, the solving abilities that exist in students are also less good.

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Conflicts of Interest

The authors declare that no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely by the authors.

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