



# Validity and Reliability Test of the Learning Independence Questionnaire Instrument in Using Electronic Modules

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**Abstract:** This research aims to create an instrument that can measure students' learning independence by measuring the level of validity and reliability. The instrument is a questionnaire for student learning independence consisting of 41 statements (20 positive statements and 21 negative statements) with responses based on a Likert scale score of 1 to 5. The research location for the empirical test of learning independence was at SMAN 1 Kalasan class XII MIPA in 3 classes. The number of empirical trial participants was 99 students. The results of the empirical test of the learning independence questionnaire instrument were then analyzed using the Winstep Rasch model program. The quality of the instrument can be determined from the unidimensional assumption test, the suitability test of the statement items to the Rasch model (item fit), and the bias of the statement items with the help of the Winstep program. The results obtained were that in the validity calculation there was 1 invalid statement out of 41 existing statements, namely the statement "I try to study as best as possible to achieve good performance" on the responsibility indicator. The reliability of the learning independence questionnaire instrument regarding the use of electronic modules is 0.93 and is in the very high category, so it can be concluded that the other 40 statements are declared valid and variable so that they can be used as instruments in measuring learning independence regarding the use of electronic modules.

**Keywords:** Questionnaire; Learning independence; Reliability; Validity

## Introduction

Industrial revolution 4.0, in this era educators can apply a hybrid/blended learning model, namely learning that combines online learning with face-to-face (face-to-face learning) (Graham & Bonk, 2006). This learning builds a constructive learning platform, combining with careful curriculum design, good learning, and learning quality evaluation shows good results in practical technology learning during the epidemic (Liu et al., 2020). The birth of society 5.0 is an era that must be watched out for. One of the government's efforts to create quality human resources is through education (Aulia & Fitria, 2023). Education efforts in Indonesia to welcome this era, namely by looking at existing infrastructure, developing human resources, synchronizing education with industry, and using technology as a tool for teaching and learning

activities (Nastiti & Abdu, 2020). Considering the importance of globalization and the need to train students' broad thinking skills and knowledge to prepare them to face the demands of the 21st century, education from the start needs to look more critically at educational practices and learning methods that should be directed (Algiani et al., 2023). Since 2020, educational institutions around the world have been closed due to the COVID-19 pandemic. According to UNESCO, as of May 2020, 153 countries had implemented national school closures (UNESCO, 2020). The WHO report (2020) on April 6 2020 stated that patients with COVID-19 infection had reached 1,210,956 people in 205 countries with a mortality rate of 5.6%.

Chemistry learning is a complex and abstract process of teaching and learning chemistry. One of the chemistry subject materials is chemical equilibrium. Students in studying chemical equilibrium must be able

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to master concepts at the macroscopic, microscopic and symbolic levels in order to understand equilibrium equations (Johnstone, 1993). Chemical concepts are not only taught abstractly by teachers, but students also need to do it independently to better understand them, of course with the help of teachers (Warlinda et al, 2022). Middle school level students range from 11 years and above. According to Piaget's theory (Suyanto, 2005), a student aged 11-15 years, cognitive development should have reached the formal operational stage. However, based on research, students who should have entered the formal operational development stage, in reality only 26% of students have entered the formal development stage, meaning that there are still many who have difficulty understanding material at the submicroscopic and symbolic levels well in chemistry (Rakhmawan et al., 2018).

Students' difficulties in understanding chemical concepts have an impact on students' independence. Students' learning independence is still minimal, shown by low learning outcomes because students still learn a lot if they have help from other people (Siagian et al, 2020). The habit of participants who only depend on educators in the learning process results in low students' thinking abilities in understanding lessons and low levels of independence that a student has (Sugianto et al, 2020). The current phenomenon is that many students copy their friends' work without trying to do it themselves when facing exams. This shows that this attitude or behavior lacks independence and confidence in its abilities and there is no self-motivation in learning (Slavin, 2009). This is not in line with Martinis's (2007) statement which states that students who have good learning independence will be able to regulate their learning style, be active in seeking information, and look for ways to solve obstacles, and they will be more responsible. According to Aspin (2007) student independence in learning is something that is very important and needs to be developed in students because students will have high independent learning abilities in completing the exercises given by the teacher with the abilities they have.

Learning independence in students can be increased by teachers in learning (Dahlan, 2011), namely by (1) letting students know that they can learn with new strategies and incorporate their ideas independently; (2) setting goals as a learning strategy rather than assigning tasks; (3) demonstrate strategy and self-talk about how and why something is done; (4) planning work process feedback is part of the learning process; and (5) ask students to monitor learning strategies and record their effects. Teachers need to measure students' learning

independence to find out the extent of learning independence that students have, or whether there is an influence of learning carried out by teachers on students' learning independence. To measure students' learning independence, an instrument is needed in the form of a questionnaire that refers to indicators of learning independence. Students are said to have learning independence if they can complete learning tasks without being dependent on other people. Song & Hill (2007) explain that learning independence can be achieved through three aspects, namely self-management, self-monitoring; and motivation.

English & Kitsantas (2013) explains that learning independence is the ability to learn on one's own initiative, with or without the help of others and can determine one's own learning methods. Suhendri (2011) believes that learning independence is a student's ability to make independent efforts to explore learning information from learning sources independently. The use of online media such as learning videos, e-books, e-libraries and virtual laboratories as independent learning sources by students is still very low, as a result teachers are still the main learning source. This shows the low level of learning independence of students, even though independence is one of the factors that influences learning achievement (Mukhlisa et al, 2021).

Efforts that can be made to increase learning independence are by using interesting teaching materials in the form of innovative modules. E-modules are teaching materials in the form of modules displayed in electronic format where it is hoped that students can try to understand the content of the material, find sources of information, and solve problems independently (Najuah et al., 2020). Cho et al. (2017) reported that students who study independently have a stronger understanding of concepts and achieve good affective results. The use of electronic modules can trigger students' learning independence because learning using e-modules can be done anytime and anywhere (Rifa'i, 2019). Based on this description, this research will conduct research to test the validity and reliability of the learning independence questionnaire instrument in the use of electronic modules.

The learning independence questionnaire was designed by developing indicators of learning independence based on aspects of learning independence according to the description by Cukurova et al. (2018), Hockings et al. (2018), Martin & Evans (2018), and Shah et al. (2020). A synthesis of learning independence from several journals is presented in Table 1.

**Table 1.** Synthesis of Learning Independence According to Several Experts

Expert	Definition of Learning Independence	Indicator
Cukurova <i>et al.</i> , (2018)	Learning independence is the learning ability of students who can make the decisions necessary to meet students' learning needs.	make responsible decisions; take appropriate action in relation to learning; and increase motivation and self-confidence.
Hockings (2018)	Independent learning is learning to support students to become effective independent learners by providing interesting assignments and several forms of learning support.	take responsibility; set your own goals; deciding what, as well as, when and how to study; monitor own progress; ability for critical inquiry and evaluation; and evaluating and reflecting on what has been learned.
Martin <i>et al.</i> , (2018)	Independent learning means that students learn more independently, so that students can be encouraged to apply the skills and knowledge they have acquired in independent, new and creative ways.	Motivation measurement; Intrinsic cognitive and extrinsic cognitive which refer to the level of difficulty and complexity of a topic; and student achievement.
Shah <i>et al.</i> , (2020)	Independent learning is the process of students in relationship with other people being able to make the decisions necessary to meet the students' own learning needs.	Creativity, cognitive skills, self-reflection, affective skills, and adaptive motivation; Enabling environment-equipment, enabling environment time, and enabling environment-guidelines.
Hasil Sintesis	Independence is carried out based on internal encouragement from individuals who do not depend on others and have responsibility for themselves to master the desired competencies.	Independence; Motivation; Self-confident; And Responsibility

**Method**

The instrument for student learning independence is a learning independence questionnaire consisting of 41 statements (20 positive statements and 21 negative statements) which refer to indicators of learning independence. The learning independence questionnaire uses a Likert scale with scoring guidelines according to Table 2.

**Table 2.** Score Category Criteria

Score	Information
1	STS (Strongly Disagree)
2	TS (Disagree)
3	KS (Disagree)
4	S (Agree)
5	SS (Strongly Agree)

(Widoyoko, 2012)

The instrument designed is first validated theoretically. After being validated theoretically, the questionnaire was then subjected to empirical testing and then analyzed for the validity and reliability of the questionnaire results. The research location for the empirical test of learning independence at SMAN 1 Kalasan class XII MIPA was 3 classes. The number of empirical trial participants was 99 students.

The results of the empirical test of the learning independence questionnaire instrument were then analyzed using the Winstep Rasch model program. The

quality of the instrument can be determined from the unidimensional assumption test, the suitability test of statement items to the Rasch model (item fit), and the bias of statement items with the help of the Winstep program (Subagja *et al.*, 2023). Rasch shows how appropriate and internally reliable the items are when carried out by research subjects (Hizqiyah *et al.*, 2023). The Rasch model can see the relationship between student responses and items simultaneously (Faisal *et al.*, 2023). If the processing of student response data produces the MNSQ, ZSTD, Pt mean square scores for all three then the item is said to be feasible, otherwise if it does not meet three or two criteria then the questionnaire item is not feasible. The research flow can be briefly seen in Figure 1.

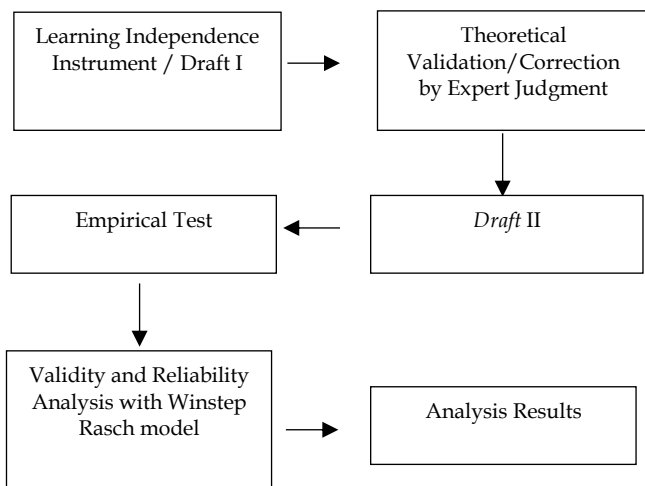


Figure 1. Research Flow

*Unidimensional test*

Dimensions describe unique measuring components that have no correlation with each other (Sumintono & Widhiarso, 2015). The unidimensional assumption test is used to determine whether the instrument for assessing conceptual understanding and learning independence measures one type of dimension. Bond & Fox (2015) explained that IRT uses a unidimensional concept of items used to measure something that is latent or in this research is the ability to understand students' concepts. The unidimensional concept in the instrument is demonstrated by each question or item measuring one indicator. The aim of instrument analysis is to obtain the characteristics of each question item, so that the question instrument has good quality (Sirait, 2023).

*Level of suitability of statement items to the Rasch model (item fit)*

The quality of suitability of the test items is also known as item fit. Item fit explains whether the item functions normally to carry out measurements or not. If the question items do not fit, this indicates that students have misconceptions about the question items. The criteria used to check the suitability of the question items can be seen in Table 3.

Table 3. Criteria for Level of Conformity of Question Items

Creteria	Information
$0.5 < MNSQ < 1.5$	Accepted MNSQ scores
$-0.2 < ZSTD < +0.2$	Accepted ZSTD value
$0.4 < Pt Measure Corr < 0.85$	Accepted Pt Mean Corr value

(Bond & Fox, 2015).

If a question item does not meet the criteria for the level of suitability of the question item, it indicates that the question item is not good enough, so it must be

eliminated or replaced to meet the measurement of each indicator.

*Reliability Test in Summary Statistics*

The reliability test in Rasch modeling is shown from the person and item reliability values, Cronbach alpha values as well as student ability groups (person separation) and question groups (item separation). The separation value is used to look at groups, both questions and students' abilities. The greater the individual separation value, the better the assessment instrument that is prepared because each question item used is able to reach students' abilities from high to low.

Table 4. Cronbach's Alpha Value Criteria

Value Cronbach's Alpha	Reliability Level
0.0-0.20	Less Reliable
>0.20-0.40	Somewhat Reliable
>0.40-0.60	Fairly Reliable
>0.60-0.80	Reliable
>0.80-1.00	Very Reliable

(Hair et al., 2010)

Table 5. Person Reliability and Item Reliability Criteria

Criteria	Information
$\alpha < 0.5$	Low
$0.5 \leq \alpha \leq 0,8$	Currently
$\alpha \geq 0.9$	Tall

(Boone et al., 2014)

Table 6. Indicators of Learning Independence

Indicators/Statements	Number of Indicators	
	Positive	Negative
Discipline in carrying out tasks	8,13,35	18,23,28
Study time management	5,20	17,34
Self evaluation	33,37,40	16,39
Interest in learning	6,25,38	21,3
Trying to get information	12,29	36
Responsible for carrying out tasks	22,27,31,3	4,9,14
Have learning goals	26	19
Believe in yourself	1	11,24,32
Don't depend on other people	10	2,7,15,30

The Cronbach's Alpha value criteria (measuring the reliability of the interaction between the person and the items as a whole can be seen in Table 4. The reliability values of the person and items can be seen in the statistical summary results. The criteria for person reliability and item reliability can be presented in Table 5. As for the indicators for the learning independence questionnaire are presented in Table 6.

## Result and Discussion

The learning independence questionnaire that has been developed is then corrected by experts or lecturers who have expertise in learning independence. Experts provide suggestions for improvements to the learning independence questionnaire instrument that has been developed. The suggestions for improvement given by experts can be seen in Table 7.

**Table 7.** Suggestions for Improving the Learning Independence Questionnaire Instrument

Validator 2	Improvement Suggestions
First	The Independence Questionnaire is appropriate but makes it clearer about the selection options that students will complete
Second	General editorial use

Suggestions for improvement that have been given by experts regarding the learning independence questionnaire are then followed up by carrying out revisions.

### *Empirical Validation of the Learning Independence Questionnaire*

The improved learning independence questionnaire instrument was declared valid by two experts, then empirical testing was carried out by testing the instrument on students who had studied chemical equilibrium material. The empirical validity of the questions was carried out on 99 students who had studied chemical equilibrium material, namely students in class XII Mathematics and Natural Sciences at SMAN 1 Kalasan. The empirical validation results were then analyzed using the following Winstep Rasch model program.

### *Unidimensional*

Trial results of 41 learning independence questionnaire items for 99 class XII MIPA students using item response theory or Modern Item Response Theory (IRT), Rasch model with the help of the Winstep program. The unidimensionality of the instrument can be seen from quantitative analysis with the help of the Winstep program in output tables 23. Based on the results in output tables 23, it can be seen that the raw data variance measurement results are 32.8%. The value is not much different when compared to the expected value, namely 32.9%. This shows that the unidimensionality requirement of 20% can be met (Sumintono & Widhiarso, 2014).

### *Level of suitability of questionnaire items to the Rasch Model (Item Fit)*

The results of the item fit analysis of the questionnaire items in the learning independence questionnaire trial are presented in Table 8.

**Table 8.** Results of Analysis of the Suitability of the Learning Independence Questionnaire to the Rasch Model.

Question Item Number	Measurement Accuracy Criteria			Decision
	<i>Outfit</i> MNSQ	<i>Outfit</i> ZSTD	<i>Pt-Mean</i> Corr	
3	1.81	4.3	0.34	Fall
22	1.44	2.6	0.49	Valid
41	1.37	2.3	0.59	Valid
2	1.39	2.6	0.56	Valid
28	1.30	2.0	0.54	Valid
34	1.33	2.2	0.46	Valid
9	1.29	1.8	0.46	Valid
31	1.21	1.3	0.42	Valid
17	1.25	1.7	0.49	Valid
12	1.20	1.3	0.52	Valid
30	1.19	1.3	0.52	Valid
26	1.15	1.0	0.50	Valid
23	1.12	0.8	0.55	Valid
35	1.03	0.3	0.49	Valid
19	1.05	0.4	0.31	Valid
14	1.04	0.4	0.57	Valid
37	0.99	0.0	0.50	Valid
16	1.04	0.3	0.46	Valid
7	0.99	0.0	0.42	Valid
32	1.01	0.1	0.63	Valid
27	0.96	-0.2	0.49	Valid
39	0.99	0.0	0.47	Valid
36	0.90	-0.7	0.56	Valid
18	0.94	-0.4	0.47	Valid
4	0.89	-0.7	0.60	Valid
40	0.87	-0.8	0.56	Valid
13	0.87	-0.9	0.45	Valid
29	0.85	-1.0	0.56	Valid
21	0.84	-1.1	0.42	Valid
8	0.84	-1.1	0.59	Valid
33	0.84	-1.1	0.48	Valid
15	0.82	-1.4	0.56	Valid
10	0.82	-1.3	0.54	Valid
25	0.81	-1.3	0.43	Valid
5	0.76	-1.7	0.65	Valid
20	0.76	-1.8	0.62	Valid
24	0.74	-2.0	0.61	Valid
11	0.70	-2.3	0.56	Valid
6	0.65	-2.7	0.66	Valid
38	0.64	-2.7	0.53	Valid
1	0.60	-3.2	0.52	Valid

Based on Table 8, one of the 41 statement items does not meet the MNSQ score criteria between 0.5 to 1.5; ZSTD value between -2.0 to +2.0; and/or PT Mean Corr between 0.4 to 0.85 (Bond and Fox, 2015). If the processing of student response data produces the

MNSQ, ZSTD, Pt mean square scores for all three then the item is said to be feasible, otherwise if it does not meet three or two criteria then the questionnaire item is not feasible. One statement that failed was statement number three. Forty statement items were declared valid because they met the MNSQ, ZSTD and/or Pt Mean Corr score criteria, so they could be used to measure students' level of learning independence.

*Reliability test in summary statistics*

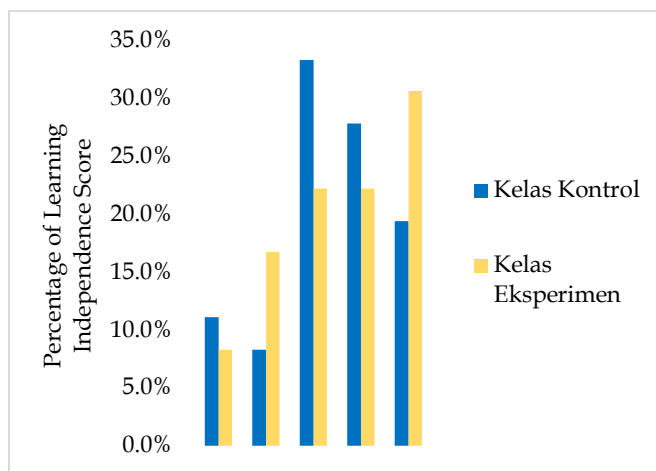
The person (student) reliability value of the scores obtained in empirical validation is 0.93. This value shows that the reliability of the person (student) is in the high category. The item reliability value was obtained at 0.90 in the high category. Overall the average reliability value or Cronbach Alpha is 0.93 in the very reliable category. The reliability value shows the reliability or consistency and suitability of the statement items when tested on students. Reliability values and categories are presented in Table 8.

**Table 9.** Reliability in Summary Statistics

Reliability	Value	Categories
Item Reliability	0.90	Hight
Person Reliability	0.93	Hight
Cronbach Alpha	0.93	Very Reliable

The reliability value of the level of learning independence tested was 0.93 with very reliable criteria, or in the range of 0.8-1.0 (Hair et al., 2010). The distribution of learning independence in the control class and the experimental class is seen based on the percentage of the ideal category for the level of student learning independence. Grouping the distribution of learning independence based on the percentage of students' ideal categories was carried out by calculating the number of students who had very high to very low learning independence criteria for each group (experimental class and control class). Next, it is made in the form of an ideal percentage and compared between the two groups used in the research sample. The distribution of learning independence categories can be seen in Figure 2.

Based on Figure 2, it can be seen that the largest percentage is dominated by the experimental class for achieving a level of learning independence in the very high category, 30.6%. The differences in the level of learning independence obtained show that learning using electronic modules based on guided discovery learning has an influence on the level of learning independence. The discovery learning learning model is a two-way learning system with a learning process that involves students and teachers (Nursakinah & Suyanta, 2023).



**Figure 2.** Distribution of Learning Independence Categories

This is relevant to research conducted by Lu'luilmaknun & Wutsqa (2018), students who used e-learning media with the guided discovery learning method had an average learning independence score that was superior to students who only received learning using the guided discovery method. or it could be said that learning using e-learning media with the guided discovery method is effective in terms of students' learning independence. Then in research conducted by Shahrul and Muladi (2018), students who used electronic modules showed learning independence results of 82.04% because students were able to understand information and problems in videos, audio and images. The effective contribution of electronic module representation based on buffer solution material to learning independence is 20.3%, which means that the use of electronic module representation in buffer material has a positive influence on students' learning independence (Syam & Louise, 2023). High learning independence will result in high learning outcomes, conversely, if students' learning independence is low then the learning outcomes obtained will be low (Woi and Prihatni, 2019). Therefore, the quality of independent learning needs to be improved so that the learning outcomes obtained are better.

**Conclusion**

Based on the results of empirical tests including validity and reliability tests that have been carried out, it can be concluded that the learning independence questionnaire instrument in this study has 40 valid statements and the reliability value for the level of learning independence tested is 0.93 with very reliable criteria so that it can be used as an instrument in measuring learning independence regarding the use of electronic modules.

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### Author Contributions

Siti Imroatus Sa'adah: preparation of original manuscript, results, discussion, methodology, results and discussion, conclusions and editing; Jaslin Ikhsan: analysis and proofreading.

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### Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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