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To cite this article: I W Redhana and N P Wahyuni 2021 *J. Phys.: Conf. Ser.* **1806** 012187

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Critical thinking disposition inventory: Its validity and reliability

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Abstract. In everyday life, we are always faced with problems. In trying to solve problems, we need higher-order thinking. One of higher-order thinking is critical thinking. Critical thinking includes critical thinking dispositions and skills. The critical thinking dispositions are an attitude or soul to develop critical thinking skills. This study aimed to describe the validity and reliability of the inventory of critical thinking dispositions. Testing of inventory used survey research. The testing was conducted at the public senior high schools in Buleleng Bali Indonesia. The population of the study was 4579 students from natural science classes. The samples were determined using the proportionate stratified random sampling technique. By the margin of error of 5%, the minimum number of samples needed was 355 people. By considering a return rate of 80%, the number of samples drawn was 444 people. The number of questionnaires returned by the students was 443. The data obtained were analyzed using the moment product correlation statistics and Cronbach's Alpha to determine the validity and reliability of inventory, respectively. The results showed that the instrument's validity is in the range of 0.095 to 0.756. Meanwhile, the reliability of the instrument is 0.727. There are two invalid items from 62 items. It can be concluded that this inventory of critical thinking dispositions can be used to measure the critical thinking dispositions of senior high school students.

1. Introduction

Critical thinking is one of the important cognitions needed to face a complex life. It contains two dimensions, namely dispositions and skills. The dispositions are related to the aspect of attitude which shows a person's tendency to use critical thinking skills in everyday life [1,2,3]. Meanwhile, the skills are a person's ability to carry out the process of problem solving and/or making decisions.

Many researchers have developed critical thinking skill instruments, either content- or content free-based. However, the development of this instrument has received little attention from researchers. This may be due to these dispositions related to aspects of attitude. Usually, researchers prioritize cognitive and skill aspects.

This critical thinking disposition instrument was first developed by Facione [4]. This instrument contains seven scales and 75 items. This instrument is widely translated into various languages and is administered by researchers to measure students' critical thinking dispositions around the world. However, an Indonesian version of this instrument does not yet exist. Therefore, Redhana et al. [5] has developed an instrument of critical thinking dispositions in the Indonesian version according to the Indonesian context. They developed this instrument by sticking to seven scales (Table 1), such as the scale used by Facione [4], but the difference lies in the sub-scale which consists of 33 units. From this sub-scale, 66 items were formulated. This instrument has been tested on junior high school students.



The results of a number of tests on this instrument result in 62 valid items. Meanwhile, the reliability of this instrument is 0.908. Thus, this instrument can be used to measure the critical thinking dispositions for junior high school students. However, this instrument has not been tested its validity and reliability for high school students.

This study has aimed to describe the item validity and reliability of the instrument for high school students. This is important so that this instrument can also be used to measure the critical thinking dispositions of high school students. By knowing students' dispositions, teachers will be able to plan better and more targeted learning in developing students' competencies, especially the critical thinking skills. As we know that the critical thinking skills are higher-order thinking skills that must be mastered by every citizen to face a life that is complex and full of uncertainty. This critical thinking skill is also one of the 21st century skills that all citizens of the world must master.

2. Method

Measurement of the validity and reliability of the inventory was carried out by surveying high school students in Buleleng Regency, Bali, Indonesia. In this study, the population was 4579 people.

Table 1. Blueprint of critical thinking disposition inventory

No.	Scales	Sub-scales	Number of items
1.	Truth-seeking	Attempting to discover the fact	2
		Having a high power struggle to ask	2
		Being honest with the data received	1
		Attempting to comprehend something well	2
		Applying credible sources	1
2.	Open-mindedness	Taking into consideration other opinions in making choices	2
		Being tolerant to the other point of view	2
		Altering an idea if it doesn't match the information	1
3.	Analyticity	Being aware of the consequences of events	2
		Being able to grant a cause to the complex cases	2
		Being able to supply concrete facts of specific cases	2
		Having a passion for critical thinking	2
		Predicting possibility of an event	2
		Being able to link investigation results to theory	2
		Searching an alternative explanation	2
		Reflecting on the notion that has been learned	2
4.	Systematicity	Considering and committing in a well-structured way	2
		Concentrating the mind on a dilemma	2
		Utilizing the scientific approach to solve a dilemma	2
		Not concluding from the minimum data	1
5.	CT self-confidence	Having a conviction with the opinions and decisions that are made	2
		Being convinced on your arguments	2
		Having a conviction to guide others to solve a dilemma rationally	2
		Being fearless to act and make choices	2
		Being satisfied with your skills to explain dilemmas	2
6.	Inquisitiveness	Having a high enthusiasm for learning even though the utilization of the science being studied is not successful	2
		Having a high passion for learning something new	2
7.	Cognitive maturity	Not ignoring any problems	2
		Being aware that some problems were interconnected	2
		Being aware that appraisal must have a criteria	2
		Not causing others to be confused	2
		Having peace of mind	2
		Understanding how other people think	2
Total number of items			62

According to the Slovin formula, the minimum number of samples that must be drawn from the population was 355 people at an error level of 5%. However, the number of samples drawn was 444 people for reasons of usually 80% return rate. The instruments tested consisted of seven scales, 33 subscales, and 62 items. Each subscale consists of two statements, a positive and negative statement, respectively. Each statement contained five response options, namely strongly disagree, disagree, neutral, agree, and strongly agree. The instrument blueprint is shown in Table 1.

The data collection stage was carried out as follows. Researchers administered a research permit to the District/City Education Office and to school principals in Buleleng Regency, Bali, Indonesia. After the permit letter was issued, the researcher asked the teacher for help to distribute the inventory to students and collect it from students at a predetermined time. The number of questionnaires returned by students was 443 people (99.8%). Data were in the form of disposition scores. These data were analyzed using product-moment correlation and Cronbach's Alpha to calculate the item validity and reliability of the instrument, respectively. The analysis was performed using SPSS ver. 22.

3. Result and Discussion

The results showed that there were two invalid items, namely item number of 54 and 61, each of which related to subscales "understanding of ways of thinking" and "realizing that some problems are related to each other." These two subscales were part of scales of "cognitive maturity." These items had a correlation value of less than 0.093 ($r_{critical}$) so that these two items were not used. The sixty valid items had a correlation value of 0.094–0.756. By eliminating invalid items, the reliability of the inventory was 0.727.

Other researchers also developed instruments of critical thinking dispositions [6]. This instrument consisted of 23 statements. This instrument had a degree of significance with loading factors of 0.66–0.76, and the reliability of each of the scales was in a high category. On the other hand, Syahfitri et al [7] developed and validated a critical thinking disposition test in biology. This test had good content and construct validity.

Students need to have enthusiasm or dispositions of critical thinking because this will help them apply critical thinking skills in everyday life. Without these dispositions, these skills that are applied do not show the expected results, for example, students may experience misconceptions [8,9,10]. In addition, this condition can also affect students' learning styles [11], and raise problems in the learning process [12,13]. Someone who has good critical thinking dispositions can use critical thinking skills well too. These skills are needed in dealing with a complex life full of uncertainty. In this century, there has been a great deal of fraud, brainwashing, indoctrination, and so on. All of this can be countered with the critical thinking skills. These skills will develop well if a person has good critical thinking dispositions.

Nowadays, fake news and hate speech have filled social media. This news can bring disaster to someone and devastation to a country. Some people who use social media unwise have dealt with the law, especially the Constitution of Electronic Information and Transaction. Many social unrests also occurred because people consumed fake news and hate speech without thinking rationally. They do not analyze the information created or passed on so that they can eventually deal with legal cases. All problems arising from fake news and hate speech can only be countered by critical thinking. Therefore, everyone must have critical thinking to be able to help himself from problems and be able to face life successfully. In fact, the progress and retreat of a country are also determined by the quality of its human resources. One of the indicators of quality of human resources is critical thinking in which dispositions and skills are included.

The Delphi Project headed by Facione [4] has developed the California Critical Thinking Disposition Inventory (CCTDI) instrument. These dispositions have been used to measure students' dispositions. These dispositions have been extensively investigated by several researchers. The results showed that the critical thinking dispositions have a positive correlation with the critical thinking skills [14,15], social-emotional skills [16], and teaching efficacy [17]. On the other hand, the dispositions of critical thinking as the dependent variable has also been investigated by several researchers. Yildirim et al. [18]

reported that skills-based education programs can improve students' critical thinking dispositions. On the other hand, Hajhosseiny [19] proved that the dialogue process in learning is very effective in increasing students' critical thinking dispositions. Another, Ding [20] showed that problem-based learning with the help of WeChat was proven to be effective in improving students' critical thinking dispositions.

Concerning the application of comparative studies that involve the use of the inventory of critical thinking dispositions, the following results have been reported. There are differences in the dispositions of critical thinking of preservice teachers based on their departments, but there are no significant differences based on class or gender [21]. Sheppard and Charles [22] found that master students have better critical thinking dispositions than undergraduate students. Meanwhile, Abrami et al. [23] reported that the use of authentic problems and mentoring has a positive effect on the critical thinking skills. Furthermore, Huber and Kuncel [24] found that critical thinking skills and dispositions can improve college experience substantially.

The relationship or influence of the dispositions on other variables has also been reported by several researchers. There is a weak, but positive, relationship between the dispositions and academic achievement [21]. Other researchers reported that the dispositions can predict an increase of business students' learning outcomes [25]. In other words, students who have higher critical thinking dispositions will achieve better learning outcomes. A positive relationship between the dispositions of critical thinking and learning approaches among nursing students is also reported by Kabeel and Eisa [26].

Evaluation of the dispositions of prospective science teachers using The CCTDI was reported by Demirhan and Köklükaya [27]. They found that the dispositions of prospective science teachers is low to moderate level. Meanwhile, Bakir [21] reported that general teachers tend to have low critical thinking dispositions. As'ari et al. [28] found that prospective mathematics teachers were not a critical thinker. These dispositions are important for teachers to plan learning strategies in achieving learning goals effectively. Furthermore, the curriculum can be revised based on the results of research on students' critical thinking dispositions. If this is planned and done well, students will get satisfaction [29].

This study is still limited to measuring the item validity and reliability. The measurement of validity and reliability is still in the early stages before testing the construct validity and reliability of the instrument. Therefore, this study is continuing through several investigations to reveal the construct validity and reliability of the inventory.

4. Conclusion

The results indicated that 60 out of 62 items of critical thinking disposition inventory were valid. On the other hand, the reliability of the inventory is high. This instrument is an Indonesian version so that teachers in Indonesia can use the instrument to measure the dispositions of high school students without the need to translate from English into Indonesian, where the language factors can affect students' understanding of the instrument.

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Acknowledgments

We would like to thank the Universitas Pendidikan Ganesha for providing research funding through the BLU DIPa Fund with a research contract letter of No. 356/UN48.16/LT/2019. We also thank the senior high school principals in Buleleng Regency, Bali Indonesia for the permission that was given so that we could collect research data at the school.