An instrument measuring prospective mathematics teacher self-regulated learning: validity and reliability

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Abstract. Self Regulated Learning (SRL) is an individual's ability to achieve academic goals by controlling behavior, motivate yourself and use cognitive in learning, so it is important for a teacher especially teachers of mathematics related to the ability of management, design, implementation of learning and evaluation of learning outcomes. The purpose of the research is to develop an instrument to describe the SRL of a prospective mathematics teacher. Data were collected by (1) the study of the theory of SRL produced the indicator SRL used to design the questionnaire SRL; (2) analysis of the questionnaire SRL obtained from several references; and (3) development stage of the SRL questionnaire through validity test of content and empirical validation. The study involved 2 content experts in mathematics, 1 linguist, and 92 prospective mathematics teachers. The results of the research on content validity test based on Indonesian expert and 2 content experts indicate that the content can assess the indicator of the SRL and feasible to be used, in the test of legibility of two prospective mathematics teacher concluded that the instrument has a language that can be understood by the prospective teacher of mathematics and on empirical validation involving 92 prospective mathematics teacher generate data that of 65 statements there are 3 invalid statements. Reliability calculation shows high category that values 0.93. The conclusion is the SRL instrument developed for the prospective mathematics teacher.

1. Introduction
In the education process many things that affect the academic progress of a person. The academic progress achieved depends on the behavioral patterns and learning independence (self regulated learning) [1]. Self-regulation of cognition and behavior is an important aspect of learning and the extent to which school students become self-regulating of their learning in influencing their academic success [2,3,4,5]. The skills required for self-regulation in academic settings such as schools have been researched under the rubric of self-regulated learning (SRL) [4-10]. Students who have self-regulated learning are students who are metacognitive, motivational and behavioral are active participants in the learning process [11]. Meanwhile, self-regulated learning aspects into four aspects: 1) Cognition, 2) Motivation and Affect, 3) Behavior and 4) Context. [12] States that self-regulated learning will bring the achievement of success in the learning process [7]. A teacher and prospective teachers are required to have the ability to manage learning, design, implementation of learning, evaluation of learning outcomes, and student development to actualize the various potentials it has contained in the pedagogical competence by the task of professionalism of teachers [13]. This is by self-regulated learning that is in goal setting, planning, and self-monitoring which is an important aspect of the achievement of children and adolescents [14-15]. So based on the results of these studies, self-regulated learning will also have a positive effect on teachers and prospective teachers to perform...
professional duties teachers well. In this research will be developed self-regulated learning instruments for prospective mathematics teacher because of the importance of self-regulated learning in learning. The novelty in this research raises the problem solving of mathematics in context aspect which aims to see self-regulated learning teacher and prospective mathematics teacher. Siswono et al describes a mathematics teacher who has a relationship of belief and knowledge of mathematical problem solving can look for possible interactions between two variables [16]. An instrument is a tool which because it meets the academic requirements can be used as a tool to measure a measuring object or collect data about a variable [17]. Based on the description, then the problem presented in this research is how to develop the instrument used to describe self-regulated learning for prospective mathematics teacher?

2. Methods
This research is explorative research with the qualitative descriptive approach which aims to develop self-regulated learning instrument used to describe self-regulated learning prospective mathematics teacher. The procedure is done by researchers: (1) study of self-regulated learning theory produce self-regulated learning indicator used to design self-regulated learning questionnaire; (2) self-regulated learning questionnaire analysis obtained from several references; and (3) development stage is done through content validity test and empirical validation. Content validity and empirical validation were taken using questionnaire techniques and analyzed descriptively and statistically. Content validity test carried out by involving 1 Indonesian language expert and 2 content experts in mathematics; legibility test was conducted by involving 2 prospective mathematics teachers, in this case, the mathematics education students. The results of the content validity are improved based on the inputs obtained. Questionnaire self-regulated learning has been improved in empirical validation by involving 92 students of mathematics education. In empirical validation generate self-regulated learning questionnaire are valid and reliable. Data analysis is done in advance collecting data, data reduction, data presentation and finally draw the conclusion and data verification [18]. The conclusion is to know the self-regulated learning questionnaire valid and reliable and feasible to use.

3. Results and discussion
3.1. Study of self-regulated learning theory
Self-regulated learning is an effort by individuals to organize themselves in learning by involving metacognitive, motivational and behavioral abilities to achieve goals [7,19-21]. Aspects of self-regulated learning include: (1) cognition, students are involved in planning, monitoring, and managing cognition; (2) Motivation and Affect, students can try to control affect and emotion; (3) Behavior, behavioral regulation is an aspect of self-regulation that involving individual efforts to control behavior, such as deliberate planning, and planned behavior; and (4) Context, involves efforts to control or arrange the environment in ways that facilitate objectives and task completion [7,22]. Self-regulated learning is also a key component to mediating success in most learning environments [4, 23-24].

3.2. Development of Research Instruments
The instruments used in this study are self-regulated learning questionnaires and interview guidelines. The indicator item contained in the instrument has a purpose of digging up self-regulated learning that is owned by students of prospective mathematics teacher. The questionnaire was developed based on the study of theory about self-regulated learning indicators. Interview guidelines are developed based on the statement of self-regulated learning questionnaire. Development is done concerning language with the adjustment of research subjects. The results of the development are validated by Indonesian language experts and content specialists in mathematics. The linguist's validation results state that the overall self-regulated learning questionnaire and interview guidelines were developed has a language that has been in accordance with the language of prospective mathematics teacher students with various inputs, among others: (1) the words in bahasa is "Kamu" should be replaced "Saudara" because it is used for students; (2) the instructions for the essay question should be added, so that the
respondent is not confused in the questionnaire; (3) the question of the essay on the questionnaire should be marked question; (4) there is a question of essays containing two and should be split into two questions; (5) one or two sentences still affect the language of Java; (6) capital letters, and hyphens should be considered so that they are easily understood by respondents; (7) the interview guidelines need to be paid attention to greeting in bahasa such as "Anda", "Kamu" and consistency and there is still little oral language influence.

The validation results of two content experts in mathematics stated that the overall self-regulated learning questionnaire and the interview guidelines developed were appropriate and worthy of use with various inputs, among others: (1) in context aspect required statement about concept or formula used to solve math problem; (2) open questions should ask about "how ...." and "why ...." Instead of asking about "what ...": it is meant to be more able to explore the thinking process divergingly; (3) on the interview guidelines there are several questions that need to be improved; (4) interviews like this are not necessarily sequential; (5) there are items that should be observed not in interviews such as liveliness. Also, there has been a test of legibility on some students of prospective mathematics teacher with the result of the overall questionnaire developed has a good level of legibility with indicators only a few sentences that are not understood. Here are some inputs from the legibility test: (1) statements are often asked, meaning that there is almost the same answer, so no need to ask again; (2) the effectiveness of the sentence in the statement is good but too much use of the word "effort what", as if there should be action; (3) the point is that many statements use the word "what effort", so the reader is difficult to understand the sentence; (4) there is an obstacle/doubt in the understanding of the message or information because there is an "interesting language" such as item 41 is the word estimation; (5) there is a sentence that is used less precisely, so it is difficult to understand.

3.3. Validity and reliability of the instrument

Table 1. Result of validity test item questionnaire self-regulated learning

| Stages and Aspects of SRL | The Number of Items is valid | Invalid Number of Items | Invalid item number |
|---------------------------|-----------------------------|-------------------------|---------------------|
| 1. Planning, Thought, and Activation | | | |
| a. Cognition | 6 | | |
| b. Motivation/ Affect | 4 | 1 | 9 |
| c. Behaviour | 4 | | |
| d. Context | 8 | | |
| 2. Monitoring | | | |
| a. Cognition | 4 | | |
| b. Motivation/ Affect | 1 | 1 | 29 |
| c. Behaviour | 6 | | |
| d. Context | 7 | | |
| 3. Control | | | |
| a. Cognition | 2 | | |
| b. Motivation/ Affect | 1 | | |
| c. Behaviour | 4 | 1 | 47 |
| d. Context | 6 | | |
| 4. Reaction and reflection | | | |
| a. Cognition | 2 | | |
| b. Motivation/ Affect | 1 | | |
| c. Behaviour | 3 | | |
| d. Context | 3 | | |

The next step that is done in the development of the instrument is the validity and reliability test of self-regulated learning questionnaire. The validity of each instrument item is used to analyze the grain
by using product moment correlation formula. An instrument is said to be valid if the $t$ calculated coefficient is greater than $t$ table at 5% significance level. Acquisition price $t$ count smaller than $t$ table then the item is considered invalid. With subject (N) 92 student of the prospective math teacher in self-regulated learning questionnaire obtained $t$ table 1.66 at 5% significance level. Based on the calculation of the validity of 65 items of statement there are 3 items declared invalid statement point 9, 29 and 47 so that the validity percentage of valid self-regulated learning questionnaire 95% and 5% invalid. Summary of the calculation of the validity of the item can be seen in Table 1.

Reliability leads to the accuracy and precision of a measuring instrument in a measurement procedure. Reliability of self-regulated learning questionnaire that conducted in this study is using Cronbach's Alpha formula. From the calculation results, the obtained reliability coefficient of 0.93 indicates the reliability of high criteria.

3.4. Discussion Construction of self-regulated learning indicators
Self-regulated learning includes three aspects, namely metacognition, motivational, and behavioral [22]. While [7] states self-regulated learning framework consists of four aspects of cognition, motivation and affect, behavior and context. Context is an important aspect for prospective math teachers because it can support the competence of a teacher so that in this research raises mathematical content in the form of solving mathematical problems to form, control and arrange the learning environment as an important strategy in self-regulation. [25] states that a teacher who has good content knowledge is a very valuable teacher because it will make students develop estimate errors and develop mastery of the concept. Mastery of good mathematical content makes prospective math teacher able to develop a delivery strategy that is the easiest material for students to understand. This supports the theory that contemporary knowledge in learning is multidimensional and positively influences student learning [26,27].

3.5. Discussion Instrument validity and reliability
Validation of content is done by expert validation, where the result shows that self-regulated learning instrument developed can measure self-regulated learning of prospective mathematics teacher, so it is feasible to be used. This is by the content validation function [27] is an attempt made to determine whether the instrument can measure the aspects to be studied. As for the empirical validity, the results of legibility tests show that developed instruments have a good level of legibility. This means that the language possessed by the instrument can be understood by the student prospective math teacher. Communication with a language that can be understood by students can affect the level of student understanding, such as research results [29-30]. The results of non-test instrument test show high accuracy, as evidenced by 65 items tested only 3 items that are declared invalid. From the calculation results, the obtained reliability coefficient of 0.93 indicates the reliability of high criteria. This suggests that the developed instrument has the accuracy and accuracy of a measuring instrument in a measurement procedure [28].

4. Conclusion
Based on the results of research and discussion, it can be concluded that the self-regulated learning questionnaire consists of four aspects namely cognition, motivation and affection, behavior and context. Context is an important aspect for math teacher candidates so that in this research math content arises in the form of problem solving mathematics to form, control and arrange the learning environment as an important strategy in self-regulation. The test results of non-test instrument show high accuracy, as evidenced from 65 items tested only 3 items that are declared invalid. From the calculation results obtained reliability coefficient of 0.93 indicates the reliability at high criteria. This result shows that the developed instrument has the accuracy and validity of a measuring instrument in a measurement procedure.
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