Development of attitude assessment instrument in engineering mathematics 1 course to assess discussion on MOOC platform

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Abstract. Affective assessment instruments have been developed, especially those related to attitudes. In engineering mathematics learning through the MOOC platform, it was carried out with discussion. The development of attitude instrument assessment to assess student activity was carried out after learning was complete. This development research used the Plomp Model. The Plomp Model consisted of 5 stages. They were the initial investigative stages, design stage; construction stage; the test, evaluation, revision stages; and implementation stages. Two experts and trials carried out validation were carried out on 100 students. The result of developing an attitude assessment instrument was a questionnaire. The difference from other questionnaires lies in paying attention to the internal continuum interval of attitudes developed by Bloom's Taxonomy. They were Responding, Valuing, and Organization. Afterward, The instrument is tested for reliability and validity until it is declared to validate each item and the instrument's reliability in the excellent category. The value of Cronbach's Alpha instrument is 0.848. The value indicates that the attitude assessment instrument is classified as having good criteria. Then the instrument is implemented in discussion on the MOOC Platform.

1. Introduction
The internet and new technologies make e-learning a promising solution in many universities [1]. It needs to be supported by teachers' digital competence for them to develop their future profession [2]. MOOC, a widely accessible online education platform, is a cheap and effective educational alternative [3]. MOOC transformed realistic transformative areas in higher education in the case studies at the University of Bucharest [4]. Besides, MOOC is also exploratory learning full of communication and expert guidance [5]. In India and China, MOOC began to be developed [6,7].

The purpose of internet learning also follows Bloom's Taxonomy, thus offering a variety of different forms. It is suitable for learning [8,9,10]. The majority of students who follow MOOC like active learning style, so it is worth noting the concept of educational assessment in terms of attitude [11,12]. The development of disciplinary attitude measuring instruments have been carried out in
HOTS learning, impacting character formation. The revised Bloom taxonomy began to be developed in 2017 [14-16].

Attitude assessment can be done at discussion activities. This is because the discussion can be known as the activities of students in communication and collaboration. So the development of instruments is needed to get quality assessment results [17,18]. The more people who develop MOOCs, the more thought about educational design is devoted to it. In Banyuwangi State, Polytechnic began to be developed MOOCs in 2018 [20]. There needs to be a development of discussion assessment in MOOC so that later can be done to develop assessment and evaluation in the future.

2. Research Method
This developmental research method used Plomp Model [20]. Plomp Model had 5 stages. They were the initial investigative stages, design stage; construction stage; the test, evaluation, revision stages; and implementation stages. The quality of MOOC content was also worth noting in its development [21]. For more accessible development stages could be seen in Figure 1.

![Flow Chart of Attitude Assessment Instrument Development](image)

**Figure 1. Development of Attitude Assessment Instrument Flow Chart**

In Figure 1, which was referenced in the development of attitude assessment instruments in the discussion, namely The Taxonomy of Bloom affective realm. The scale used is the Likert scale with 4 answer options [23]. The validation and reliability of attitude assessment instruments are carried out to
maintain the instrument's quality [24]. The reliability formula used is Cronbach’s alpha [25], with the instrument criteria in Table 1 below.

**Table 1. Reliability Criteria of Attitude Assessment Instruments**

| Value Range | Criteria       |
|-------------|----------------|
| $\alpha < 0.5$ | Unacceptable  |
| $0.5 \leq \alpha < 0.6$ | Poor          |
| $0.6 \leq \alpha < 0.7$ | Questionable  |
| $0.7 \leq \alpha < 0.8$ | Acceptable    |
| $0.8 \leq \alpha < 0.9$ | Good          |
| $0.9 \leq \alpha$ | Excellent     |

### 3. Results and Discussion

#### 3.1 Design Stage

The initial investigation stage provided development boundaries as the basis for development in the following stages. At the design stage, there were a few things to do. The first the validation of the instrument. Experts performed instrument validation includes surface validation, content validation, and construct validation. Furthermore, it was done logging on the level and range of the internal continuum of attitudes on the Bloom Taxonomy. The Internal Continuum Range in Bloom’s Taxonomy could be seen in Figure 2.

**Figure 2. The Range of Internal Continuum Range Affective Domains in Bloom’s Taxonomy**

Figure 2 could be seen attitudes assessment in Bloom’s Taxonomy was only at several levels. They were Responding Valuing and Organization. At the Responding level, there were two indicators.
These indicators were willingness to respond and satisfaction in response. Besides, Valuing Level had three indicators. They were Acceptance of value, Preference for value, and Commitment. Then the last level, Organization, had one indicator. Namely was the Conceptualization of a value. These indicators would be used as the basis for making a statement in the instrument.

3.2 Construction Stage Result
In the construction phase, the development of the internal continuum range (student attitude assessment indicator) becomes a Likert scale instrument statement. The Likert scale used was SA (Strongly Agree), A (Agree), D (Disagree), SD (Strongly Disagree). The spread of statements on each indicator could be seen in Table 2. All statements were formed into a Questionnaire which was typed on Google Form. Establishment of a discussion assessment development research questionnaire that has been conducted. Most of the discussions were assessed using a rubric which was translated into assessment points that had to be filled in by the lecturer [18]. The paper format is not efficient in the time it takes to make an assessment [6,8].

| Table 2. Development Indicators of Each Level into Statements in Instruments |
|-------------------------------|-----------------|-----------------|
| Level                        | Indicator       | Number of Statement |
| Responding                   | Willingness to respond | 1, 2          |
|                              | Satisfaction in response | 3, 4         |
| Valuing                      | Acceptance of value     | 5, 6           |
|                              | Preference for value     | 7, 8           |
|                              | Commitment               | 9, 10          |
| Organization                | Conceptualization of a value | 11, 12     |

3.3 Test, Evaluation, and Revision Stage
2 experts carried out the process of validation of attitude assessment instruments. If there was an average that was not good, improvements were made and resumed in the trial activities. The average value of validation results from both experts could be seen in Table 3

| Table 3. Expert Validation Results |
|-------------------------------|-----------------|
| Aspect of Validation          | Average Value   |
| Validation of Face            | 4               |
| Validation of Content         | 3               |
| Validation of Construct       | 3.5             |

Table 3 showed the average surface validity value describing the instrument very well on display. The average value of the validity of the contents was quite good. This indicates the contents of the instrument need to be improved to fit the curriculum. While the average value of the construct validity has shown good value, it means that the statement follows the indicator. After the repair, 100 students were tested. It was to know the validity and reliability of instrument grains. Validation process results could be found in Table 4.

| Table 4. The Result of Validation Process |
In Table 4 it was known that all items were valid after a trial had been tested twice. In the first trial, there were 2 invalid numbers. The number was later corrected and re-tested. It could be seen in the $R_{\text{value}}$ on each number is smaller than $R_{\text{table}}$. The results of the reliability test could be seen in Table 5.

### Table 5. Result of Instrument Reliability Test

| Items                  | Cronbach's Alpha if Item Deleted | Cronbach's Alpha | Reliability | Bloom Taxonomy Level |
|------------------------|----------------------------------|------------------|-------------|----------------------|
| Statement of Number 1  | 0.839                            | 0.849            | √           | Responding           |
| Statement of Number 2  | 0.839                            | 0.849            | √           | Responding           |
| Statement of Number 3  | 0.836                            | 0.849            | √           | Responding           |
| Statement of Number 4  | 0.839                            | 0.849            | √           | Responding           |
| Statement of Number 5  | 0.828                            | 0.849            | √           | Valuing              |
| Statement of Number 6  | 0.839                            | 0.849            | √           | Valuing              |
| Statement of Number 7  | 0.843                            | 0.849            | √           | Valuing              |
| Statement of Number 8  | 0.830                            | 0.849            | √           | Valuing              |
| Statement of Number 9  | 0.838                            | 0.849            | √           | Valuing              |
| Statement of Number 10 | 0.830                            | 0.849            | √           | Valuing              |
| Statement of Number 11 | 0.835                            | 0.849            | √           | Organization         |
| Statement of Number 12 | 0.835                            | 0.849            | √           | Organization         |

Table Caption : √ = Reliable Item, - = Unreliable Item

In Table 5, it could be seen all items of the reliable instrument. It was indicated from Cronbach's alpha's value if the item deleted was smaller than the value of Cronbach's Alpha instrument. The value of Cronbach's Alpha instrument is 0.849. The value indicates that the attitude assessment instrument was classified as having good criteria. There are 12 student attitude measurement numbers for discussion assessment on MOOC. In The implementation stage, it was given to students who have participated in Mathematics Engineering Course. This implementation is different from the discussion
in general, where the discussion process is assessed through a rubric [26]. The teacher fills in this rubric so that the assessment of attitudes is carried out subjectively by the teacher, not from the students directly [27].

4. Conclusion
This research was developmental research. The products were a student’s attitudes assessment instrument when they participated in discussions on the MOOC Platform. The process of developing attitude assessment instruments used validity and reliability test. Experts, lecturers, and students conducted the test. After testing the validity and reliability of the instrument, Cronbach's Alpha value of 0.849 was generated. This means that this instrument could be used to measure student attitudes in discussions at a later time. Indicators developed this instrument. Each indicator had two statements. The suggestion that can be given in similar research was that each indicator had more than two statements. It gives impact if there was an invalid item, it can be immediately discarded so it streamlined research time.

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