

## Printed and IT THOTSIC as a Benchmark of Students' Ability in Facing the National Examination

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**Abstract.** This research aims to determine the characteristics of THOTSIC in class X chemistry material and to develop a valid and reliable package of questions. The results of PISA study in 2015 showed that the performance of Indonesian students was still relatively low. National Examination, as a benchmark for national standards, should consist of questions component with higher level thinking skills. Chemistry is a central science because it connects various other scientific fields. This is development research based on Research & Development (R & D) using the Plomp model. The results showed the average score of the material expert validator assessment was 99.27%. Limited trials consisted of 1 chemistry teacher and 10 students in class XI. Data analysis showed that teachers' response questionnaires were 4.93 as a very good category and students' were 78.95% as a good category. The analysis of the reliability level of the questions was 0.62 in the high category level. The level of difficulty of the questions was 0.3 as a difficult criteria and the problem differentiator was 0.39,  $D_p \geq 0.3$  = as the question was accepted.

**Keyword:** *Chemistry class X, National Examination, THOTSIC*

### 1. Introduction

The results of PISA (Program for International Student Assessment) study in 2015 showed that the performance of Indonesian students was still relatively low. In a row, the average scores of Indonesia students achievement for science, reading, and mathematics were ranked 62, 61, and 63 of 69 countries evaluated (OECD, 2016).

There is a lot of programs carried out by Indonesian government to improve the quality of education, one of which is an evaluation activity in the form of National Examination (UN). UN is an official test conducted by the government. In terms of the objectives, the implementation of UN is as a

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benchmark of national standard in achieving the good quality of students. Therefore, the question components with the higher order thinking skills should be available. This prompted Badan Standar Nasional Pendidikan (BSNP) to adjust to these needs. One of the needs is an educational outcome where the students have Higher Order Thinking Skills (HOTs) in dealing with their needs (Musa, 2015). Higher-order thinking is the level of thinking at a higher level in the cognitive hierarchy (Yennita, 2018). For the sake of the implementation of good management then the implementation of managerial competence of the principal should be maximized, and how the implementation of managerial competencies executed by the principal to be effective (Siagian, 2018).

Higher Order Thinking Skills require not only memorization ability, but also critical thinking skill, creative thinking skill, and everyday life problem solving ability. Teachers' competency, based on Permendiknas number 16 year 2007, includes pedagogical, personality, social, and professional competencies. One of teachers' competencies in pedagogical dimension is being able to hold assessments and to evaluate the learning process and outcomes. Assessment is a general term that includes about student learning process (observation, average score, written test implementation) and learning progress assessment format (Rochmad, 2012). Learning outcomes assessment is expected to help students improve the higher order thinking skills (Kemendikbud, 2017).

Chemistry is a study of compositions and properties of substances or matter from the atomic to molecules as well as the changes or transformation and their interactions to form materials found in everyday life. Chemistry is often referred to as central science because it connects various other sciences such as physics, material science, biology, pharmacy, medicine, and for the development of other scientific fields. Meanwhile, Class XII students who will face the National Examination, most of them have started to forget about the grade X materials. Thus, teacher in this case must review the class X material by presenting the HOTs questions for the students. because student centered learning is also believed to be one of the ways to foster learning enjoyment among students (Nik Zarini et al., 2012). This research aims to determine the characteristics of THOTSIC in class X chemistry material and to develop a valid and reliable package of questions.

## **2. Methodology**

This research was conducted at Chemistry Education Study Pogram, Teachers Training and Education Faculty, Universitas Riau. The try-out was conducted in three different schools namely MAN 2 MODEL Pekanbaru, SMA Cendana Pekanbaru, and SMAN 1 Bangkinang city.

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This was a development research based on Research and Development (R&D) by using Plomp consisted of preliminary investigation, design, realization/construction, test-evaluation and revision, and implementation phase (Azhar, 2011). But in this research, implementation phase was not carried out because it was only a development. The research using model Plomp has done by Linda et al. (2012).

In this research, the validation of printed THOTSIC was conducted by two lecturers (as validators) from Chemistry Education, FKIP, Universitas Riau. Printed THOTSIC that had been developed and claimed valid by validator team was then tested to the teachers and students as respondents that aimed to obtained input on whether or not develop THOTSIC could be read clearly (readability test) and understood (Noraffandy, 2012). Limited trials consisted of 1 chemistry teacher and 10 students in class XI were required to did on the questions of THOTSIC. Limited trial aims to determine whether the resulting product is easy to use by the user in this case is the teachers and students and to determine whether the desired situation as described in the initial phase of the investigation has been resolved (Linda, 2018). Techniques of data analysis used in this research is descriptive analysis percentage using the formula (Abdul, 2013) and the criteria of scoring can be seen in Table 1.

$$P = \frac{n}{N} \times 100\%$$

Description :

P : score percentage (%)

n : number of obtained score

N : number of maximum score

Table 1. Criteria of validity analysis (Widoyoko, 2012)

Interval(%)	Criteria
85,33– 100	Very Good
69,33 – 84	Good
53,33 – 68	Adequate
37,33 – 52	Less
20 – 36	Very Less

### 3. Results and Discussion

This research was conducted in two steps. They are; the development stage based on Research and Development (R&D) using the Plomp Model and the trial stage. The product of this research was a printed THOTSIC questions package on grade X chemistry subject. THOTSIC products were designed and independently developed by the researcher as a teacher's tool in providing questions for students. Then, Students were expected to able to work properly in the face of national examination especially for grade X

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chemistry material. THOTSIC development used research and development (R & D) methods with the Plomp model.

### ***Preliminary Investigation***

#### Front End Analysis

At this stage, the analysis was carried out in the form of observations and interviews with chemistry teachers about class X chemical material and obstacles encountered in facing The National Examination. After interviewing chemistry teachers of SMA Cendana and MAN 2 Pekanbaru, it was known that class X chemistry material was the basis for learning the next material. Whereas, class XII students who would face the National Examination had have mostly forgotten about class X material.

#### Students Analysis

Based on the statements of the chemistry teachers at SMA Cendana and MAN 2 Model Pekanbaru, students of class XII generally forgot about the chemistry material of class X. So, it was difficult for them to understand the class material later because the basis of chemical material was in class X material.

#### Material analysis

Data at the material analysis stage was obtained from interviews with chemistry teachers and from discussions with counselors. So that the material in the THOTSIC questions package was the Periodic System of Atomic Elements and Structures, Chemical Bonds, Electrolyte and Non-Electrolyte Solutions, Redox and Nomenclature, Basic Law and Stoichiometry.

#### Competency analysis

At this stage, a syllabus analysis was carried out so that the learning achievement indicators and learning objectives were obtained by students.

### ***Design***

Initial design of printed THOTSIC. Validation sheet for Media Experts and Materials Experts along with the elaboration of instrument validation sheet designed, Teachers and Students' response sheet, Formulating THOTSIC questions, Gathering images, questions, number of questions, types of questions and conformity with basic competencies related to class X chemistry material and Designing the THOTSIC display format.

### ***Realization / Construction***

The construction is of the THOSTSIC resulting the following items:

1. THOTSIC is organized in the form of questions package
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2. The Questions grid of THOTSIC
  3. The validation sheet for material experts and attachment media experts
  4. User response sheet (teachers and students)

### ***Test, Evaluation, and Revision***

The validation of printed THOTSIC was conducted by two lecturers (as validators) from Chemistry Education, FKIP, Universitas Riau. THOTSIC validation covered 4 aspects of eligibility, namely aspects of content eligibility, aspects of presentation eligibility, aspects of language eligibility, and aspects of graphic eligibility.

#### **Aspects of Content Eligibility**

The aspect of content eligibility had 10 components of assessment that aimed to assess the accuracy of the chemistry concepts of class X material in THOTSIC. The average score of the validation aspect of the content eligibility before revision was 71.99%. The THOTSIC validation results got suggestions for constructive improvements from the validator team. The suggestions given included the improvement of the questions editor, the revision of the reaction equation, the use of images/ illustrations/ supporting tables, and the revision of the flow of questions presentation. Furthermore, the average score for the validation aspect of the content eligibility after revision was 95.33%. Where, according to Widoyoko (2012), from a range of values of 85.33% - 100% was considered as a very valid category

#### **Aspects of Presentation Eligibility**

The eligibility aspect of presentation had 5 components of assessment that aimed to assess the quality of THOTSIC presentation. The average score of validation in the aspect of presentation eligibility before revision was 72%. The suggestions provided included the incomplete THOTSIC format. Furthermore, the average score of the validation aspect of the presentation eligibility after revision was 100%. Where, according to Widoyoko (2012), from a range of values of 85.33% - 100% was considered as a very valid category.

#### **Aspects of Language Eligibility**

The Eligibility aspect of language had 5 components of assessment that aimed to assess the readability or use of language in the THOTSIC question package in order not to cause many interpretations (double meaning). The average score of validation in the language eligibility aspect before revision was 74.67%. The suggestions given include the THOTSIC problem which did not yet contain clear question sentences. Furthermore, the average score of the language eligibility aspect after revision was 100%. Where, according to Widoyoko (2012), from a range of values of 85.33% - 100% was considered as a very valid category.

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### Aspect of Graphics Eligibility

The eligibility aspect of graphics had 10 assessment components which aimed to assess the accuracy of the layout, writing, pictures/illustrations and printed THOTSIC designs. The average score of validation on the aspects of graphic eligibility before revision was 76.67%. The suggestions given included color combinations, images, and letters that were not yet interesting. Furthermore, the average score of the graphics eligibility aspect after revision is 100%. Where, according to Widoyoko (2012) from a range of values of 85.33% - 100% was considered as a very valid category.

Figure 1 shows the graphic of validation average scores of each aspect on THOTSIC. THOTSIC validation covered 4 aspects of eligibility, namely aspects of content eligibility, aspects of presentation eligibility, aspects of language eligibility and aspects of graphic eligibility.

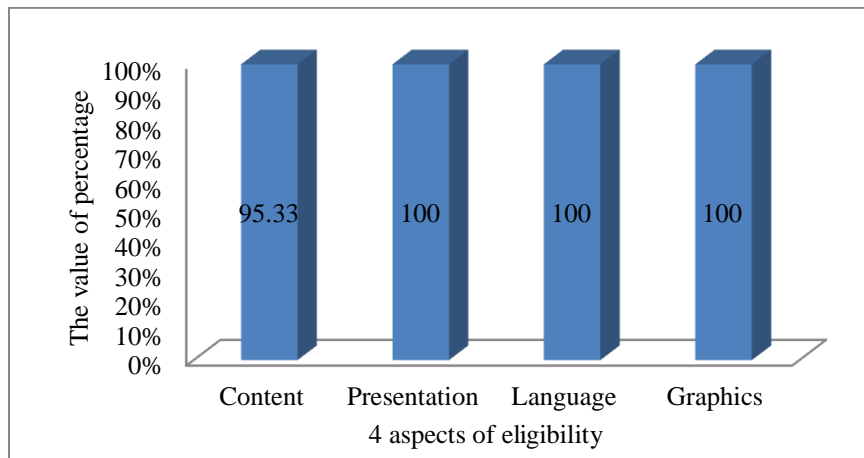


Figure 1. The Graphic of Validation Average Scores of Each Aspect on THOTSIC

Figure 2 shows the THOTSIC is getting a advice from the validator such as add the production team, interesting pictures of students, and interesting font, improvement of the validator has been fixed as shown in Figure 2. Printed THOTSIC that had been developed and claimed valid by validator team was then tested to the teachers and students as respondents that aimed to obtained input on whether or not developed THOTSIC could be read clearly (readability test) and understood. Limited trials were conducted by selecting 3 teachers and 30 students on each school. The trial was conducted at MAN 2 Models, SMA Cendana, and SMA 1 Bangkinang. The teachers' response results were 4.93 on a scale of 5 with a very good category and 78.95% with a good category. Based Widoyoko (2012) for scale 5 included in the excellent category and for the responses of students, the results of 78.95% entered into in good category as well.



Figure 2. Before and after THOTSIC

The analysis of the reliability level of the THOTSIC question was 0.62, it was categorized as high category. The level of difficulty of the problem was 0.3, it was included in the difficult criteria. The differentiator of multiple choice questions was 0.39. Based on the criteria of differentiation,  $D_p \geq 0.3$  = the question is accepted.

Nowadays, National Examination has been using IT system by using computer. So we accommodated the printed THOTSIC into IT system by using Wondershare Quiz Creator application. This application is used to make an online test or well-known as electronic test. It works by uploading files from application of a website.

THOTSIC IT was validated by one media expert from Informatics Engineering lecturer, Universitas Islam Negeri Sultan Sarif Kasim, Riau. The validation of THOTSIC IT included the aspect of content substance, learning design, display (virtual communication), and software utilization (Ali, 2009).

#### ***Content substance validation sheet (media expert)***

The validation sheet of software utilization had 10 assessment components that aimed to measure the quality of content in the developed THOTSIC IT. Some suggestions were given in the form of feedback or response given when answering questions when working on the question omitted replaced with the final results after working on the whole question in THOTSIC IT. Furthermore, the average score of software utilization after revision was 86.67%. According to Widoyoko (2012) from the value range of 85.33% - 100% was included as a very valid category.

#### ***Learning Design Validation Sheet***

The learning design validation sheet had 5 components that aimed to assess the quality of the display and design of THOTSIC. The average score of the learning design validation after revision was 80%. Where, according to Widoyoko (2012), from a range of values between 69.33% - 84% was included in the valid category.

#### ***Display Validation Sheet***

The display validation sheet had 8 assessment components that aimed at measuring the display quality of developed ITOTIC IT. The suggestions given were; omitting music icon, repairing the front cover to distinguish the layout of the questions, the different background colors for the "continue" button, laying out the THOTSIC IT instructions, outlines, fixing the problem image, and improving review feedback. Furthermore, the average score of software utilization after revision was 84%. According to Widoyoko (2012), from a range of values of 69.33% - 84% was included in the valid category.

#### ***Software Utilization Validation Sheet***

The software utilization validation sheet had 10 assessment components that aimed to measure the quality of ease in using the developed THOTSIC IT. The suggestions given included the THOTSIC response when working on problems, and operating the program. Furthermore, the average score of software utilization after revision was 84%. According to Widoyoko (2012), from a range of values of 69.33% - 84% was categorized as a valid category. Figure 3 shows the graphic of validation average scores of each aspect on THOTSIC. THOTSIC validation covered 4 aspects of content, content substance validation sheet (media expert), learning design validation sheet, display validation sheet and software utilization validation sheet.

THOTSIC IT which had been declared valid by media experts. Then, its practicality was tested to teachers and students as practitioners. Limited trials were conducted at SMA Cendana Pekanbaru with the same students while conducting a limited printed THOTSIC trial. The results of the response from the teacher were 4.3 from a scale of 5 and students 85.60%. According to Widoyoko (2012), for a scale of 5 and a value range of 85.33% - 100% was categorized as a very good category.

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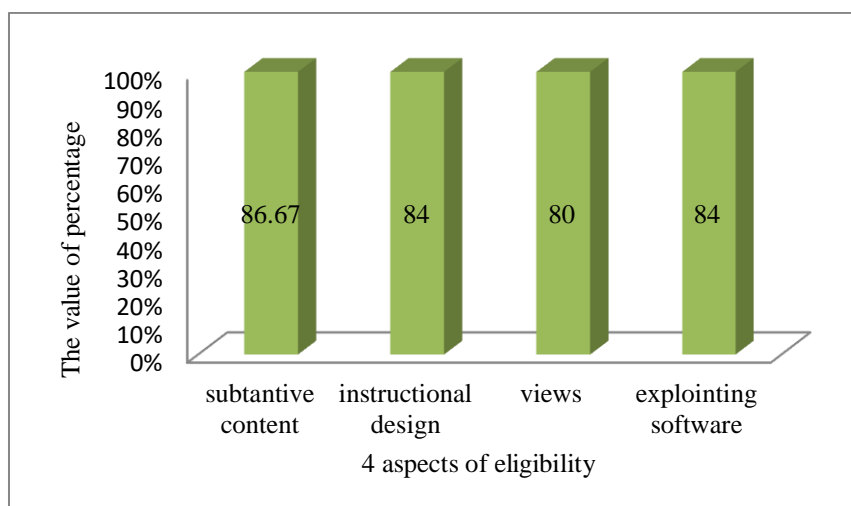


Figure 3. The Graphic of Validation Results Average Score of THOTSIC media experts

#### 4. Conclusion

Based on research development (R & D), it can be concluded that THOTSIC chemistry material in class X are valid and reliable. THOTSIC printing and IT can be used by teachers to test students' abilities in facing the National Examination and adjust to these needs is an educational outcome where the students have Higher Order Thinking Skills (HOTs) in dealing with their needs.

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