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THE DEVELOPMENT OF HANDOUT BASED ON GUIDED NOTE TAKING TO IMPROVE THE QUALITY OF ANALYTICAL CHEMISTRY LEARNING

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Abstract

Learning quality of a student is also influenced by the availability of teaching materials which can be in the form of handouts as print materials that are very economical and practical. The long-term goal of this research was to improve the quality of analytical chemistry learning in the Chemistry Department, Medan State University, Indonesia. While the specific target was to develop innovative teaching materials, called Handout based on Guided Note Taking (HGNT). The method used was Research & Development followed 4 stages: define, design, develop and

disseminate (4-D). The defining approach aimed to define the need for developing handouts and this stage found that students were very difficult to understand analytical chemistry which related to chemical separation. The second stage was to design HGNT. The cover and content were designed as attractive as possible. The title, time allocation, and learning objectives were adapted to the syllabus. Tables and images used appropriate forms and attractive color combinations. Then all interrelated data were used for the third stage, which was development. Contents development was consisted of the separation concepts, distillation, sublimation, and extraction, and bleaching. Furthermore, it was validated by two experts with some aspects, i.e., presentation, visualization, and media clarity. The average of validation value was reached of 85 percent, which means very feasible to use. Furthermore, in the fourth stage, the dissemination was carried out to 3rd year of 35 students in odd semester. Students and lecturer responses were measured using questionnaire and the positive responses were found to be 80.30 and 95 percent, respectively with excellent criteria. Student learning outcomes showed an increase from 70.81 to 97.00 for the sub topics with five meetings. This study concluded that the HGNT could improve the learning quality of students in analytical chemistry learning.

Keywords

Handout, Guided Notes Taking, Quality of Learning, and Analytical Chemistry

1. Introduction

1.1 Background of Study

Analytical Chemistry is a compulsory subject in the Department of Chemistry, Medan State University (UNIMED) which is offered to 5th semester students. Based on the teaching experience of this subject, there were some problems experienced by students in the teaching and learning process, such as difficulties in understanding of concepts, unable to connect between concept and low ability to do problems solving. In addition, some of the issues raised by some lecturers who've polled, namely learning activities were not maximized, the lack of student participation in the learning process, and the habit of students in memorize concepts without any effort to understand these concepts.

Teaching material is an important factor in improving student learning outcomes in the learning process. Teaching materials can be in the form of handouts as print materials that are very economical and practical, which only contain summaries or conclusions from important

material sections. The use of handouts is to help students to not have to note, as a companion explanation educators, as reference material learners, motivate students to study harder, a reminder of the main points of what is taught (Majid, 201; and Prastowo 2012).

The Guided Note Taking (GNT) approach is one of the lessons that uses a summary guide to the main points derived from the learning material coupled with modifications. Some parts of summary notes are given empty spaces which will be filled by students themselves. Thus this strategy can train students to hone their skills in communicating and making conclusions. The application of GNT can improve science process, understanding of concepts, provide a positive response and better learning achievement (Nugroho, *et.al*., 2013; Prabowo & Hadisaputro, 2014; and Utami, *et.al*., 2013).

Based on the problems, then it was necessary to make efforts to overcome the problems that arise in analytical chemistry lecture. The proposed efforts were to develop of innovative teaching materials, called Handout based on Guided Note Taking (HGNT). By considering the above problems, the problem in this study was formulated as follows:

1) How to develop a HGNT on analytical chemistry subject?
2) What was the response of students and lecturers to the developed HGNT?
3) How the students' learning outcomes after using the developed HGNT?

2. Research Methods

The type of research was research and development (R & D) with 4 (four) stages, namely *define, design, develop* and *disseminate* which were adapted to the 4-D Model. The approach used in this study was a qualitative approach to examine the condition of natural objects. This research was conducted in the Department of Chemistry, Faculty of Mathematics and Sciences, Medan State University in odd semester. It has been carried out from June to September 2018. The subject was 5^{th} year students as many as 35 people. Data collection was carried out with media feasibility and questionnaire. The media feasibility and response were using percentage formula as in the following Equation (1):

$$Percentage = \frac{Total\ acquisition\ score}{Total\ maximum\ score}\ x\ 100\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (Eq.1)$$

The percentage results of media feasibility were range from 0 to 100 with the criteria very unworthy to very decent. In addition, response was analyzed with range from 0 to 100 with the failed to very good in category (Sudijono, 2011; Arikunto, 2011, and Sugiyono, 2015).

3. Results and Discussion

3.1 Development of Guided Note Taking-Based Handouts

3.1.1 Define

The defining stage was aimed to define the needs for developing handouts by analyzing the objectives and boundaries of the material. At this stage, the syllabus was prepared and the media was determined. This stage was included:

1) *Analysis of student* was purposed to find out the difficulties experienced by students in the learning process and to know students' thinking skills based on information and experiences from lecturers those who teach in analytical chemistry. Based on student defining, it has been found that the level of thinking ability of students was heterogeneous, so that the handouts would be adjusted to the heterogeneous level of students' thinking.
2) *Material analysis* was served to find out material that was difficult to understand by students. Based on the results of interviews with students and lecturers, it has been found that there were still many unfinished on chemical separation. Therefore, the handouts developed using the guided note taking approaches were specifically for chemical separation.
3) *Selection of media* was considered difficult to the material that was difficult by students, so it was expected that students could be helped by a learning media. The chemical separation was classified as difficult to understand; therefore the selection of developed media was a HGNT.

3.1.2 Design

Stages in preparing handout teaching materials proposed by Pusdiklat, (2010) include: conducted curriculum analysis, determined titles according to basic competence and the material to be achieved, collecting relevant references as writing material, and the sentence used was not too long. The purpose of designing stage was to design learning tools in the form of handouts.

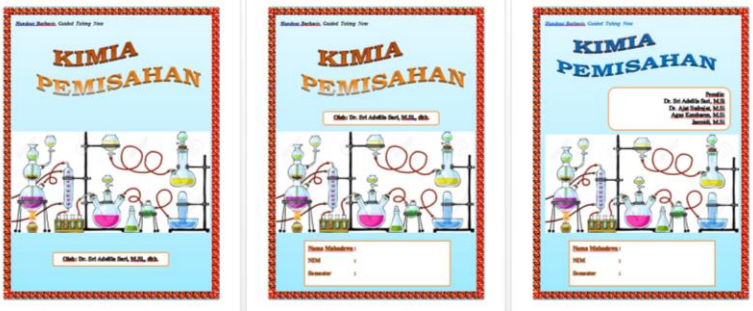
This was included the preparation of the contents of HGNT based on syllabus, the initial design of the handout display, as well as the drafting of instruments those being use.

This handout was designed in Microsoft Word application. The size of paper used in was A4 paper. The design was started from cover of HGNT and followed by the contents of the materials. The titles, time allocation, and competencies were adapted to the chemical syllabus. Some pages were consisted of tables and images. It was designed using appropriate shapes and attractive color combinations that can attract students' attention and interest. Furthermore, some pages were designed with a few concepts regarding materials then there was a table consisting of empty spaces for students to fill. The material presented in this handout was designed to language usage that was easily understood by students and lecturers.

In general, the designed handouts consist of titles, learning objectives of separation methods. This HGNT was consisted of 5 (five) chapters, *i.e.*, separation methods, distillation, extraction, sublimation, and bleaching. Handout was prepared for several meetings to enrich students' knowledge (Academic Development Agency, 2009; and Majid, 2011). The depth and amount of materials was also considered, because if the information provided is too small, the reader will not benefit from the handout. Conversely, if the information in the handout is too much, the reader would be reluctance to read it (Irsan, 2012).

3.1.3 Development

The design of HGNT was then further developed according to the advices of validators those who expert on chemistry and media. Several additional components in developing handouts, such as color matching, variation of font size, and appropriate words and sentences. Initial cover was in the form of the title handout, Name of Student, ID, and Semester. This cover is shown in Fig.1 and undergone a slight change in the writing of the title, color, writing of the lecturer name which was then revised to the final product handout.



(a) (b) (c)

Figure 1: Cover Development: (a) Initial Design; (b) Initial Product; (c) Final Product

Based on Fig.1, there was a change in the initial design of the cover handout. Fig.1 (a) was the initial design designed by the author, and then there was input from the validator in terms of color, so the color selection was changed to be brighter, so that it looks interesting and clear as. While Fig.1. (b) and (c) were the initial and final design of the product produced based on input from the validator in terms of writing the title, author, and student's identity. In the development of HGNT based on page per page in chapters, there were several changes in terms of design, use of words or sentences, spaces. Chapter 1 to 5 were about Separation Methods, Distillation, Sublimation, Extraction, and Bleaching, as shown in Fig.2.

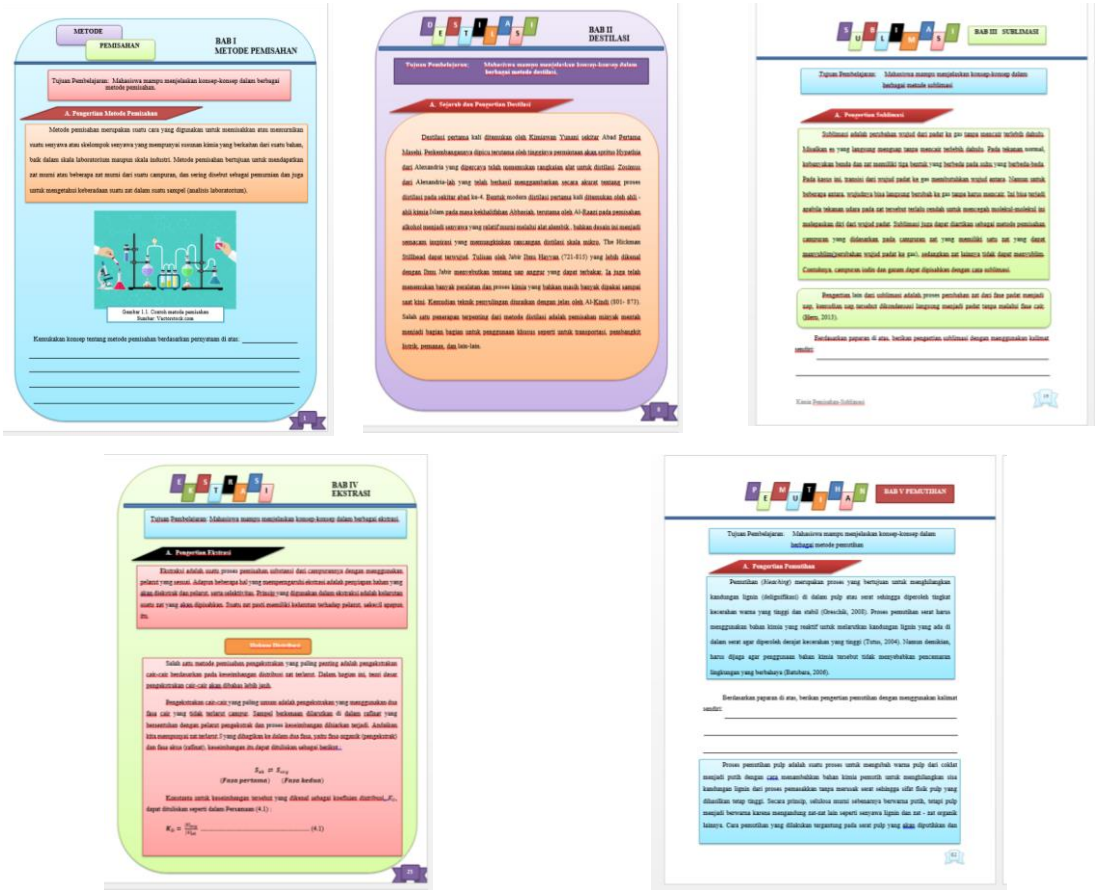


Figure 2: *First page view of chapter 1 to 5*

Every chapter has empty spaces that were only filled by students, such as connecting concepts, while at the end of chapter some numbers of exercise was attached as well (Fig.3).

(a) (b) (c)

(d) (e) (f)

Figure 3: *Sample of exercise: (a) to (d) Chapter 1 to 5, and (e) Problem solution of Chapter 4*

Before being given to students and teachers, the handout and questionnaire were validated in advance by 2 (two) validators those who experts in analytical chemistry and media. Handout validation process by scoring with ranges from 1-4. The score used as an alternative answer was a score of 1 to 4 for less good, sufficient, good, and a very good category. It has been found that the average validation values of the two validators for HGNT was reached 85 percent, so this instrument was suitable for use. The validation results of HGNT based on three aspects as shown in Fig.4.

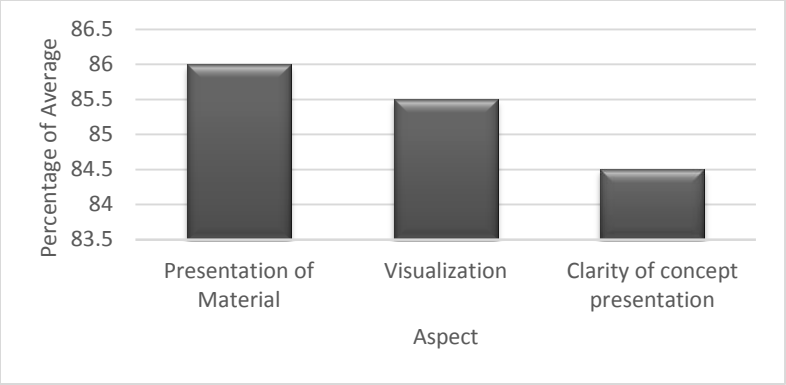


Figure 4: *Validation results of HGNT*

The feasibility of each criterion in Fig.4 is as follows: The first components of the presentation aspects were included: (i) the systematic presentation of the material, and (ii) the suitability of the material with sub-indicators expressed very good with a percentage of 86 percent. The second component was the visual aspect which included: (i) the quality of the picture or illustration, (ii) the clarity and form of the media, (iii) the design and size of the media, (iv) the clarity and understanding of the use of language or sentences in the media were considered very feasible with the percentage 85.5 percent. It might be due to the clarity of the letters, the design and the easy to understand of language in HGNT. The third component was aspects of media clarity in the presentation of concepts included: (i) separation method, (ii) distillation, (iii) sublimation, (iv) extraction, and (v) bleaching, was up to 84.5 percent. It can be concluded that the overall feasibility of HGNT was found to be 85 percent with very feasible categories. This is in line with study done by Ulya, *et al*., (2016) which found that the HGNT obtained the assessment criteria with a very feasible category with a percentage of 85.41 percent. It was also accordance with Roziqiyah, *et al*., (2017), who found that the developed HGNT was feasible to be used with an average expert assessment of handouts with very good categories.

4.1.4 Disseminate Stage

In this stage, the use of GNT required students to concentrate on learning to fill in the blank points of the given handout, so that in learning students not only listen or record. After the presentation of the material was completed, students were asked to read or collect their handouts. In addition, with the GNT worksheet, students were directed and guided in learning so there was no misconception in understanding their concepts.

Students and Lecturers' Responses to HGNT

Questionnaire response for students and lecturers were validated by scoring with a range of 0-2. The score 0 for each question item whose sentence composition was not communicative and not in accordance with the contents of the concept to be studied. Score 1 for each question item whose sentence composition was communicative but not in accordance with the contents of the concept to be studied, and score of 2 for each question item the composition of the sentence was communicative and in accordance with the contents of the concept to be studied. Questionnaire validation process, both validators provide validation and improvement values for the words and questions in the questionnaire. Students' responses to HGNT can be seen in Fig.5 (a).

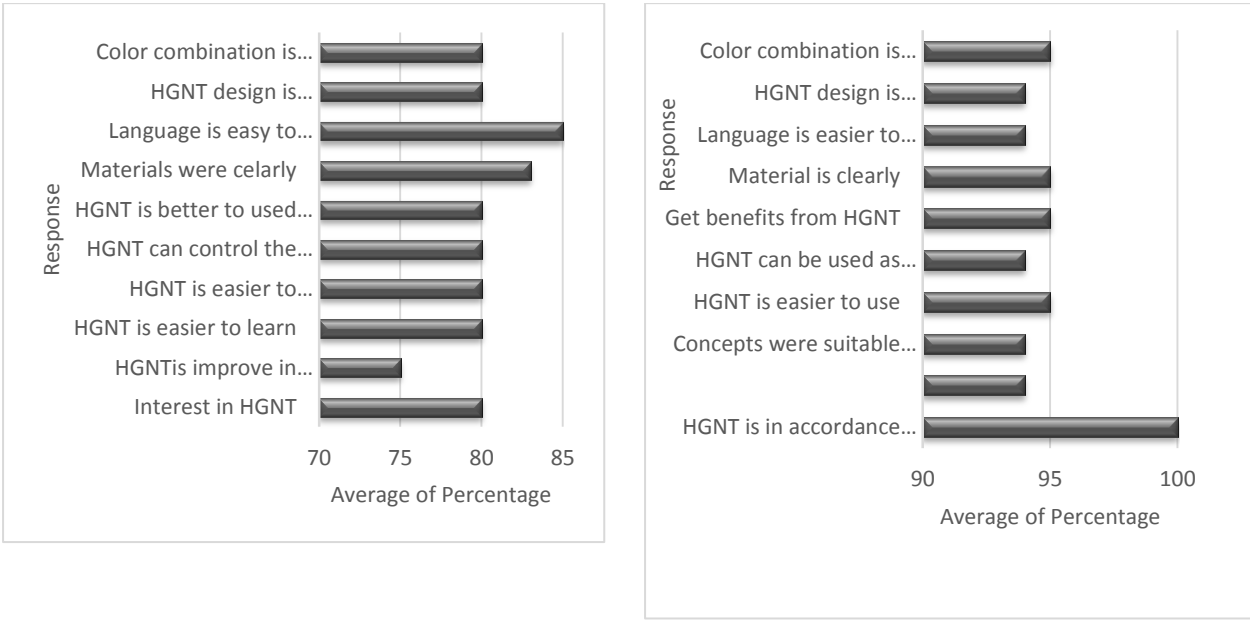


Figure 5: *Responses to HGNT: (a) Students, and (b) Lecturers*

The questionnaire validation result for questionnaire of student response was obtained an average percentage of 80.30 percent. Whereas the results of questionnaire validation of lecturers' response was obtained an average percentage of 95 percent. Therefore, the percentages of eligibility criteria for students and lecturers' responses were of 61 percent. It has been declared that the questionnaires were valid and could be used as a research instrument (Hariyadin and Rusmini, 2013).

Response is defined as images of observations, memories and observations where objects that have been observed, acceptance, deep feeling of knowledge & memory, responses and activities given by students during learning through the application of learning approaches (Kaltsum, 2014; Zulhelmi, 2009; Purwanto, *et al*., 2014; & Rahyubi, 2012). Students those who gave "Yes" response to first and second questions were 80 and 75 percent, respectively. It means that the development of HGNT could attracted students' attention and interest students to study. The third question was 80 percent of students who gave "Yes" response because of HGNT was a new approach used in learning so students experience difficulties at first because students must be able to remember their material concepts. This was in accordance with Cesari, *et al*., (2013) that students initially found it difficult to accept a new learning model that required them to think first about material concepts, but slowly students began to enjoy it. In the process of thinking about the discovery of the concept of material carried out by students with the guidance of lecturer, has provided memorable experiences in the minds of students compared to the learning process they normally did, so that the results were more satisfied both in the process and learning outcomes.

The fourth item questions about the ease of students in learning colloidal material with a percentage of 80 percent. While the fifth question item was only 80 percent of students respond with the answer "Yes". This might be due students have not previously studied the whole concept contained in separation methods, so students found it difficult to fill in the handouts. In the sixth question item, there were 80 percent of students who gave the answer "Yes". Whereas in the seventh item which was regarded clarity in the presentation of separation method materials, the students responded with the answer "Yes" was reached 83 percent. According to students, in the HGNT, the material presented was complete and clear. The eighth item which was regarded language usage, the language used was easily understood by students so the percentage was of 85 percent. The ninth question item was 85 percent of students who answered "Yes" to the interest in the HGNT. While the tenth question item about the color combination of the student handout gave a response with a "Yes" answer of 80 percent. The average percentage of students who gave a positive response or "Yes" reached 80 percent. Therefore, the results of student responses to the developed HGNT were found to be very good.

However, the results of the lecturers' responses to HGNT in Fig.4 (b) was found to be 95 percent. According to the lecturers, the development of this handout was facilitated the lecturers

in assessing students' cognitive abilities and could be used as a teaching resource. This findings were in line with some previous researches Ulya, *et.al*., (2016) who found a positive response by the chemistry teacher regarding HGNT obtained a score of 98 percent. It was also in accordance with Pusdiklat, (2010) stated that several advantages of handouts, such as a companion explanation from the teacher, helping students not to need to record the material described, as reference material for students, and motivating students to be more active in learning. In addition, it also reminders of the subject matter being taught, giving feedback, and assessing learning outcomes.

Students Learning Outcomes

Student learning outcomes showed an increase from 70.81 to 97.00 for the sub topics with five meetings. Average of learning outcomes for each topic is shown in Fig.6. For the topic of separation methods, learning outcomes of students were found to be 70.81. In addition for the topics of distillation, sublimation, extraction, and bleaching were found to be 84, 92, 95, and 97 respectively. It shows that learning outcomes were increased in meeting. This findings might be due to the understanding of concepts of students could be increased by using HGNT, from first to fifth meeting. This is in line with study done by Prabowowati and Subiyanto, (2014) who was applied the GNT method to measure students' understanding of concepts. This study found that students' understanding of concepts was improved and influenced. Besides, positive response to the media was provided. Bui, *et.al*., 2012 also suggested that individuals who have poor working memory could still took effective notes if they used a note-taking strategy.

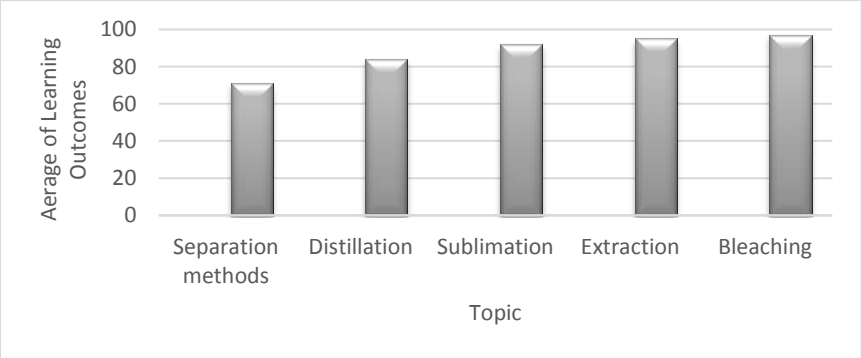


Figure 6: *Students' learning outcomes*

Increase in learning outcomes was also accordance with Cesari, *et.al*., (2013) who found that GNT entries students to complete when the teacher delivered the material. Students' stock of knowledge, concluding, communicating, interest, and learning outcomes could be improved (Christianti, *et al*., 2012; Nugroho, *et al*., 2013; Utami, *et al*., 2013; Prabowowati and Subiyanto, 2014; and Roziqiyah, *et al*., 2017). In addition, Haydon, *et.al*., (2011) also found that using guided notes has a positive effective on student outcomes, as this practice has been shown to improve accuracy of note taking and student test scores.

Learning outcomes were also increased might be due to more interesting atmosphere of chemistry learning. The topics were not given away but students filled in the important matter of chemical separation lessons in available handouts. Wong, *et.al*., (2013) found that students performed better with complete handouts. HGNT also helped students to process knowledge together.

In addition, learning was not only dominated by lecture activities by teachers, so higher enthusiasm of students because students were required to actively think. The material was also understood carefully by students. Reed, *et.al*., (2016) concerned to focused on whether students were taught the knowledge and skill necessary to actively engage in note taking either in preparation for or during class. Jamil and Munoto, (2013) said that using the GNT strategy, the complete and accurate notes during learning would be produced. Larwin & Larwin, (2013) indicated that guided notes could produce a moderate impact on student achievement. Boyle, (2012) discussed that teachers could helped students improve their note-taking skills, and ultimately, improve their achievement in these classes. In the process of thinking about the discovery of the concept of material carried out by students with teacher guidance, has provided a memorable experience in the minds of students compared to the learning process they normally did. Therefore, the results in this study were more satisfying both in the process and learning outcomes.

5. Conclusions and Suggestion

5.1. Conclusions

Based on the results of the research, therefore some conclusions can be drawn as follows:

1) Handout based on Guided Note Taking (HGNT) on analytical chemistry was successfully developed with 4-D stages. The feasibility of the learning media was found to be 85 percent, which means very feasible to use.
2) Students gave positive responses to HGNT with average up to 80.30 percent.
3) The average percentage of positive responses from lecturers was found to be 95 percent.
4) Student learning outcomes showed an increase from 70.81 to 97.00 for the sub topics with 5 meetings. Therefore, the developed HGNT could improve the learning quality of students in analytical chemistry learning

5.2 Suggestions

It is suggested to develop HGNT with other analytical chemistry topics to improve the learning outcomes of students.

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