The Practicality of Statistical Physics Handout Based on KKNI and the Constructivist Approach

S Y Sari [1*] and R Afrizon

[1]Physics Department, Faculty of Mathematics and Science, State University of Padang, Indonesia

silviyuliasari@fmipa.unp.ac.id

Abstract. Statistical physics lecture shows that: 1) the performance of lecturers, social climate, students' competence and soft skills needed at work are in enough category, 2) students feel difficulties in following the lectures of statistical physics because it is abstract, 3) 40.72% of students needs more understanding in the form of repetition, practice questions and structured tasks, and 4) the depth of statistical physics material needs to be improved gradually and structured. This indicates that learning materials in accordance of The Indonesian National Qualification Framework or *Kerangka Kualifikasi Nasional Indonesia* (KKNI) with the appropriate learning approach are needed to help lecturers and students in lectures. The author has designed statistical physics handouts which have very valid criteria (90.89%) according to expert judgment. In addition, the practical level of handouts designed also needs to be considered in order to be easy to use, interesting and efficient in lectures. The purpose of this research is to know the practical level of statistical physics handout based on KKNI and a constructivist approach. This research is a part of research and development with 4-D model developed by Thiagarajan. This research activity has reached part of development test at Development stage. Data collection took place by using a questionnaire distributed to lecturers and students. Data analysis using descriptive data analysis techniques in the form of percentage. The analysis of the questionnaire shows that the handout of statistical physics has very practical criteria. The conclusion of this study is statistical physics handouts based on the KKNI and constructivist approach have been practically used in lectures.

1. Introduction

Abdullah (2007) [1] explains that the actual statistical physics is the mathematical study materials such permutations and combinations due to an abstract issue. The abstractness of the statistical physics material is tried to study deeper instatistical physics course on July to December, 2015 using a questionnaire. The questionnaire results provide a deeper understanding of the needs of students and lecturers in lectures. These results are recorded through a set of analysis known as the needs analysis of the development of statistical physics learning material.The results of needs analysis is preliminary research results from this study are summarized in Table 1.

Table 1. Results of Needs Analysis [2]

No	The Typeof Analysis	The Results of Needs Analysis
1.	Preliminary analysis	Performance of lecturers, social climate, student competence, soft skills and the difficulties of students in following the statistical physics lectures are in enough categories
2.	Learner analysis	• 57,14% of students have a good preliminary ability • 40,74% of students have low understanding in statistical physics • 40,72 % of students require more understanding in the form of repetition, practice questions and structured assignment • 100% of the environment affects the ability of mastery
3.	Task Analysis	• The group learning and repetition of material need to be improved • The structured assignment has been in accordance with the competence
4.	Concept Analysis	The depth of statistical physics material needs to be increased gradually and structured

The preliminary analysis showed the importance of developing lectures material based on the Indonesian National Qualification Framework (KKNI). Analysis of learners, tasks and concepts illustrates that the need for a constructivist approach applied in statistical physics lectures in order to create lectures which are structured, coherent and clear. Constructivist learning approach can improve and develop the active participation of students, student independence in learning and students knowledge construction [3].

The statistical physics lectures device had been designed in accordance with the needs analysis and learning objectives formulated aresyllabus, lesson plan, learning materials, and assessment sheets. The design of instructional materials in the form of handouts in Figure 1 is prepared based on the needs analysis that has been recorded. Handout has been developed based on KKNI as indicated on the learning outcomes and learning objectives. Orientation phase is already reflected in the introduction summary handout materials. The elicitation and restructuring ideas phase have emerged on the part of the study material handouts discussion. The designed questionsare expected to be able to reconstruct and clarify ideas on the students themselves. This discussion study material also comes with a "keep in mind!" menu. Structured assignments have embodied the steps of implementing ideas and reviews.

Figure 1. Design Handout [2]

The design of statistical physics handout is a continuation of preliminary research.The statistical physics handout are designed based on the results of a needs analysis.The designed handouts have been validated by experts with very valid category. The validation results consisted of 89.58% of content aspects, 92.71% of construct aspects, 91.67% of language aspects, and 89.58% of presence aspects [2]. Handout construction showed the highest percentage means that the handout preparation has been based on KKNI with a constructivist approach according to expert assessment. After it validated by experts and revised, then handouts need to be tested right in the classroom. The testing of handouts in the classroom is useful to know the level of the handout practicalities.

Practical based on Indonesian Dictionary or *Kamus Besar Bahasa Indonesia* (KBBI) defined as 1) based on practice, 2) easy and happy to use, and 3) efficient. It also expressed by Jan van den Akker, et al.[4] that *'Practicality' refers to the extent that users (and other experts) consider the intervention as clear, usable and cost effective in 'normal' conditions*. Thus, the indicators are used to look at the practicalities of handout is easy to use, attractive, and efficient. The practicalities associated with use of lecture material by users such as students and lecturers and other experts. The practicality of a handout should be seen in the class with normal conditions. It means if the material kinetic theory of gases designed for the 3rd and 4th meeting in the semester plan, it should be implemented in the classroom then tested at that meetings.
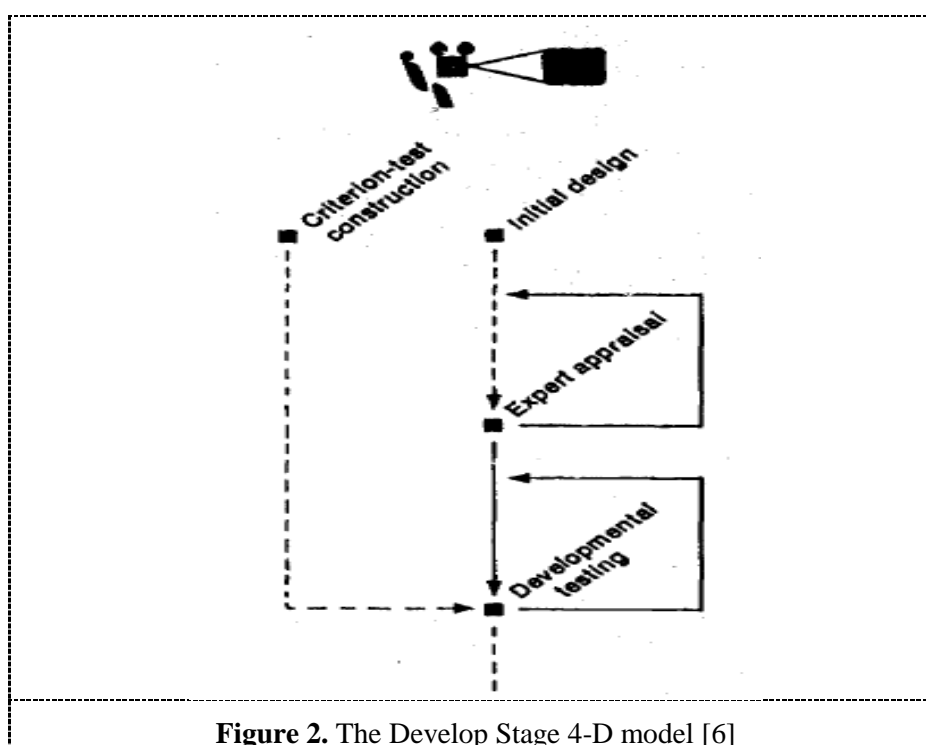
Nieveen and Folmer [5] stated four quality criterias that can be applied in resolving complex issues related education world intervention to get the best solutions, including:

a.   Relevance shows that intervention should be based on state-of the art (scientific). It is known as the content validity.
b.   Consistency, shows that intervention should 'logically' designed. It is also called construct validity.
c.   Practicality, indicating that this intervention can be used in a setting that has been designed.
d.   Effectiveness, shows that interventions can produce products on the desired results.

Based on the quality criteria which have been advanced, quality practicality of the product becomes very important to be tested. Therefore, the research is aimed to see whether the handouts that are valid according to experts has been practically used in statistical physics lectures.

2. Research Methods
This study is a research and development model of the 4-D developed by Thiagarajan. This research and development should be carried out systematically and sequentially. Thus, the implementation should not be arbitrary nor abandoned the steps. This research has been conducted in the semester of July-October 2016 in the Physics Department, Faculty of Mathematics and Natural Sciences, State University of Padang. The stages that have been passed by this study are define, design and develop (expert appraisal) phase. The develop phase steps shows in Figure 2.
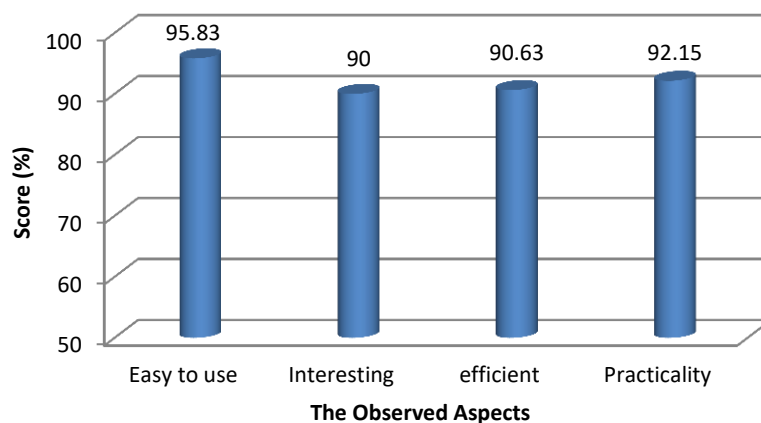

Figure 2. The Develop Stage 4-D model [6]

The research conducted has entered the final part of the develop stage is development testing. In this section, it involves the testing of learning materials for users to obtain the revised parts. Respons/reaction and comment from users, indispensable as an evaluation and revision of improving the design of handouts to get practical qualities. The cycle in development testing are test, revise and test again to be repeated so that materials used are consistent and effective [7]. Data collection was done by questionnaire. The analysis technique used to process data is the technique of qualitative data analysis with 5 criteria: 1) it is not practical (0% $<P <20\%$), 2) less practical (20% $<P <40\%$), 3) reasonably practicable (40% $<P <60\%$), 4) practical (60% $<P <80\%$), and 5) very practical (80% $<P <100\%$) modified from [8].

3. Result and Discussion
The practicality of handouts in the study will describe the quality of handout development.The questionnaire responses of lecturer and students toward the use ofstatistical physics handouts in lecture can describe the level of handout practicality. The result of questionnaire analysis of lecturer and students response will be explained as follow.

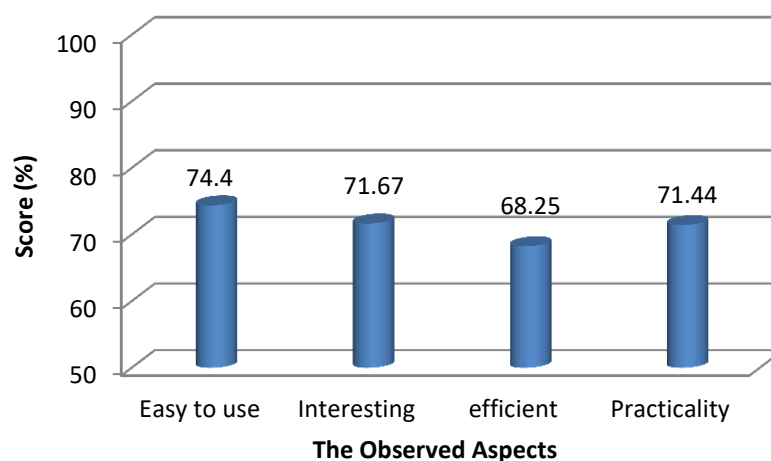### 3.1. The Questionnaire Response of Lecturers

The statistical physics lecture using handouts as one of the media that will be used in a lecture based on KKNI and constructivist approach will be monitored well when given questionnaires to lecturers. Two statistical physics lecturers who became a practitioner will be asked for opinions and comments related to the use of handouts in the class whether it is practical or not. The implementation of assessments took place while using handouts for students. The results of handouts practicalities by lecturers are shown in Figure 3. Figure 3 shows that the handout has been very practical for use with the practicalities value 92.15%. "Interesting" indicator is the lowest one and the indicator "easy to use" is the highest. Nevertheless, the handout quality is still in very practical criteria.

Figure 3. The Results of Handout Practicality of Lecturer Questionnaire

3.2. The Questionnaire Response of Students

Students have been involved as a user in order to obtain advice and suggestion for the improvement of statistical physics handout that has been designed. Handouts that have been designed are regularly fixed at each meeting according to students requirement and validator suggestions. The practicality of handout is obtained through a questionnaire distributed to students at the end of the 3rd meeting. The results of handout practicality is shown clearly in Figure 4.

Figure 4. The Results of Handout Practicality of Students Questionnaire

Figure 4 shows that efficient component has the lowest value though overall handout is practical (71.44%). This shows that the students are still difficult in arranging time to solve discussion materials and guiding questions on the handout. "Easy to use" component gets the highest score as 74.40%.

Based on the analysis of questionnaires that have been distributed to students and lectures about practicality of handout is obtained that statistical physics based on KKNI and constructivist approach has a practical value by lecturers and students as users. This is similar with the opinion of Fauzan [9] that "the practicality is useful to see how the users (lecturer and students) and other experts consider whether the product is attractive and can be used in normal condition".

4. Conclusion
Statistical physics handouts based on KKNI and constructivist approach has been practically used in lectures. It is obtained from very practical criteria handouts based on questionnaire of lecturers and students.

Acknowledgement

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