

Conference Paper

Developing New Generation of Learning Material for Inorganic Chemistry Course

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Abstract

Learning material plays an important role in all courses of higher education. They works as delivery of course content from the lecture to students especially in open and distan learning higher education institution like Universitas Terbuka (UT) This article will explore the use of research course. This study is divided into three big steps, design phase, develop phase and evaluate phase. This article will also describe the process and result of the study that results in designing new generation of instructional and learning materials of inorganic chemistry course

Keywords: learning materials, inorganic chemistry course, research and development

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Received: 18 January 2019

Accepted: 24 March 2019

Published: 31 March 2019

Publishing services provided by
Knowledge E

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Selection and Peer-review under the responsibility of the ICEST 2018 Conference Committee.

1. Introduction

The research and development of innovative distance learning materials especially on chemistry subject for Indonesian Open University (UT) students in Indonesia is described in this study which aims to obtain distance-based teaching materials of chemistry with **printed, blended and full online models**. This development will improve the understanding for students in the subject of Chemistry in the Indonesian Open University. The chemical section presented is Inorganic Chemistry 3. Chemical learning includes several components, namely emphasizing the mastery of symbolic language implies improvement in thinking. A multi-media assisted learning approach to chemistry with animated images and modeling is an attempt to find the easiest way to master abstract chemical concepts. According to Tsoi (2007) each group of students studying, 75% of them will be able to learn effectively by visual, auditorial and kinesthetic. The way of learning is grouped into: a. look, b. learning by listening, c. learning by working and touching.

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To meet the advancement of education in distance teaching with the integration of face-to-face teaching, animation, laboratory experiments, instructional media, and relevant contextual application, the material is then designed on a print and electronic basis. Then we could develop high quality chemistry learning materials, including guidebooks of student services (face to face, online tutoring, Final exam implementation), student interviews, online tutor interviews and face-to-face tutorials. Tracer study research conducted by Afridar, Ketut Budiastara and Udan Kusmawan (2014) on Chemistry Education students graduated from 2009.1 until the graduation period of 2010. 2 found that Printed Lesson Materials is the main learning source. However lack of face-to-face teacher is remain important drawback although there are some online teaching materials ie https://www.youtube.com/watch?v=KB_xi7oAYUI (Teori Medan Kristal yang berhubungan dengan warna senyawa kompleks Cu(II) dengan ligan Cl & NH₃ episode 5, 6 dan 7).

2. Method and Discussion

This study implements Research and design approach which was conducted systematically and thoroughly. There are three steps of research and development approach used in this study such as: design phase, development phase and evaluation on research phase.

In design phase the program was planned based on the competencies that must be achieved by the student. In the development phase the program was printed before distribute to students. The evaluation phase was conducted by gathering data related to the program effectiveness

Respondents are active students who have followed the final examination of the semester of Inorganic 3 registration period 2014.1 until 2016.1 with total number of 192 students. However we only interview 30 of them (12 student answered the email and 18 students were visited at UPBJJ Jakarta, Bogor, Serang and Yogyakarta).

The new generation UT learning model (2017) is a combination of Research and Development model developed by Borg and Gall in 1983 and Gall, Joyce and Walter in 2007. The combination of this model was chosen for several reasons: that research can be widely used by UT students throughout Indonesia, so that the planning steps to develop the learning materials are made in more detail so that Adapted from Borg and Gall in 2007 by the Open University team.

The research and development of chemistry learning materials is currently entering the second year. Initially started with an expert review, which states there are some things that need to be improved in Inorganic Chemistry (BAC) 3, among others: elusive

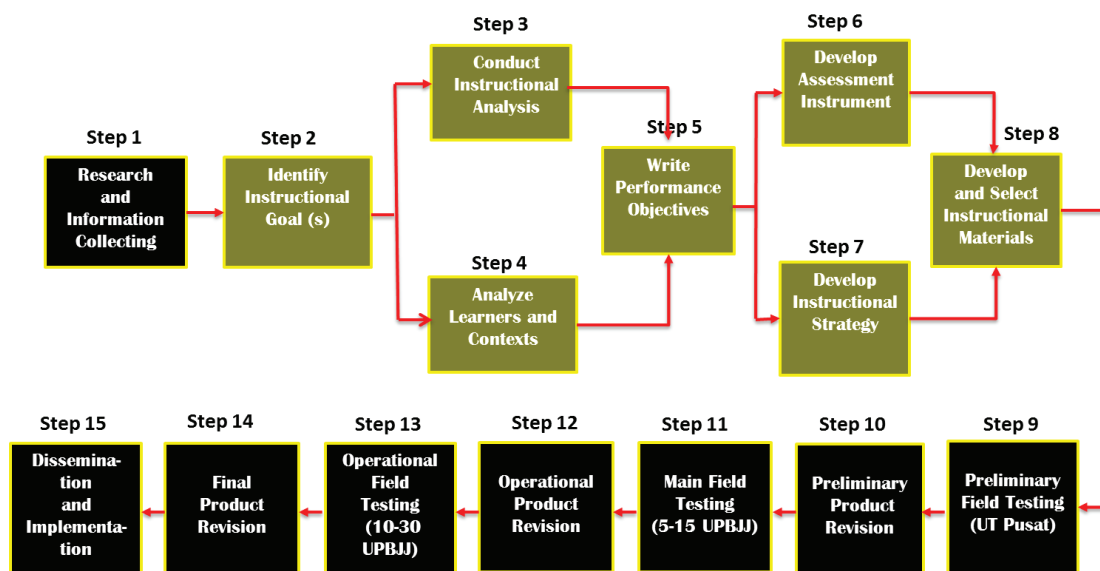


Figure 1: Research Model and Development of New Generation Learning Material UT 2016. (R&D Training materials, 2017 Profesor Atwi suparman).

language, too high level of material for undergraduate level, typos in complex chemistry writing, the media drawing less interesting, each module less build linkages that support the learning process. In addition, as technology develops, the environmental conditions of learning in the UT changed. According to Atwi Suparman (2017) and Sugilar (2014) UT Online utilization by students is increasing. This has led UT to develop a new generation UT learning model to meet the needs of students and accommodate UT learning environment conditions in various places. The same is stated by Trini and Hasnah Said.

This study is divided into three big phase, design phase, develop phase and evaluate phase. This article will also describe the process and result of the study. The all steps this research there are 15 steps in the research and development model of new generation UT learning materials, but the design phase discussion is limited to steps 1 through 7. And now the eighth step is being processed

Step 1. Research and information collecting

Research and information gathering. In this step the first thing to do is to collect all the information related to research such as learning materials and online tutorial programs that have been done. Research on online chemistry tutorials Inorganic 3 has not been studied in depth but from year to year the problem is about UAS is recognized not similar to the problems in the online tutorial, because the module is heavy as well as difficult to understand. This is very we noticed and immediately revise the module first is the

matter of UAS will be fixed. In 2018 there is a new module to the students. Students love to follow online tutorials and get good grades but maybe in UAS small value, so that most graduates get the value of C.

Based on the results of research, the ability to read and understand the average student is 5-6 pages per hour so to read and understand the teaching materials with the weight of 3 credits takes about 75 hours (360-450 pages divided by 5-6 pages). If one semester has 16 weeks, then the time required to read and understand the teaching materials with the weight of 3 credits is 75 hours divided by 16 weeks, or approximately 5 hours per week. For example, a student takes 15 credits / semester, then the student must allocate 15 credits of learning time divided by 3 credits times 5 hours = 25 hours per week or approximately 5 hours per day (1 week counted 5 days study).

Step 2. Identify instructional Goal(s)

Comparing Instructional Objectives of old modules and new generation (GERU) modules.

TABLE 1

Instructional Objectives of Old Modules	Instructional Objectives of Discussion Modules	Instructional Objectives of New Generation Modules
UT students who take this course will be able to have a comprehensive understanding of the coordinating compound	UT students who take this course will be able to have a comprehensive understanding of the coordinating compound	UT students who take this course will be able to have a comprehensive understanding of coordination compound

Step 3. Conduct instructional analysis

Describe existing in general instructional objectives into specific competencies so that they are arranged / linked logically / systematically between each other and ends in general instructional objectives. The process of developing ICT has undergone several improvements because experts have their respective reasons, modules 1 and 2 have merged and are now being module 1 while module 6 new creation and development of current science. Experts have the same opinion, too difficult to present to UT students. To achieve instructional goals students are expected to be able to achieve the objectives of the subject by achieving the objectives of the general subjects are the accumulation of the objectives of each objective of special learning. Not too much change only the subject only, the presentation of the old module too widens in the new while expected simpler but includes what should be required by undergraduate students 1. For the

achievement of each module the experts discuss to obtain agreement, even though experts from education and science at first differed opinions but finally got the deal. The authors in the first year are from UNY, UNBRAW Malang and UNJ Jakarta.

Instructional strategies relate to the approach in managing content and instructional processes comprehensively to achieve one or a group of instructional goals. It integrates the various components that include the sequence of learning activities, outline content, methods, media & tools, and learning time (in minutes). (Atwi 2017)

Step 4. Analyze learners and contexts

Student analysis produces a description of student characteristics that relate to their learning skills as UT students. Context analysis provides a description of the availability of student learning facilities and infrastructure when associated with the ideal need to follow the UT learning system.

Step 5. Performance objective

In this step, we want to write performance goals or specific learning objectives that contain the performance that students expect to achieve at the end of the lesson. Basically, a list of performance goals is derived from each sub-competence listed on the learning outcomes. The usual Performance objectives are also called Special Purpose Objectives (instructional objectives). The contents are specific (specific) competencies about knowledge, skills, or attitudes. The term performance goal uses the term achievement

Step 6. Assessment instrument development

At this stage, we develop assessment instruments to be used in measuring student learning outcomes. The instrument must be valid that is able to measure the competencies that are intended in the learning objectives, reliable ie consistent measurement results, as well as practical ie efficient use.

To measure whether the level of attainment of the learners is sufficient, then the measurement of the level of achievement is Atwi Suparman (2014) Competence that has been determined in the Special Instructional Goals (ICT) by using assessment tool.

Step 7. Instructional strategy development

At the 7th step, we develop the instructional strategy of the Speaking 1 course that matches the instructional objectives of the course. Each instructional strategy is directed at achieving one or a group of instructional goals.

3. Conclusion

UT students have not studied inorganic chemistry 3 or BANC that exist on you tube. Expert review is done before the development of new teaching materials, as a first step before researching. Teaching materials are still lacking in delivery is perceived cause of not interested students to be more comfortable and diligent study of teaching materials. The design of instructional strategies is compiled: collecting information related to teaching materials, developing ITU, developing ICT and competency map, analyzing student condition, making lattice about formative test, developing formative test then ending by designing learning strategy, the description then proceed with exercise. Media supplement used in the form of audio and video. The draft of learning strategy is arranged by a module. In addition, the development process as part of this research resulted in a set of performance tests accompanied for each module. Grids and grains are also completed and later on the current research will be tested to students who take inorganic chemistry course 3.

Acknowledgement

This research is funded by Indonesian Open University (2017).

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