



# Designing and developing the constructivism-based online learning

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**Abstract.** This present study aims to explore the use of constructivism learning theory in online learning activities. The students, the instructional designer, the subject matter expert, and a computer programmer were involved in this research and development study. The research and development stages were employed to analyze, design, develop, try out, and evaluate constructivism based on online learning. The research and development steps used in this study include 1) identifying instructional goals, 2) conducting instructional analysis, 3) analyzing learners and context, 4) writing instructional objectives, 5) developing criterion-referenced tests, 6) Developing instructional strategies, 7) developing and selecting instructional materials, 8) Developing and conducting formative evaluation, 9) Revising instruction. In this study, at the end of the study a formative evaluation was implemented to assess the adequacy of the prototype of the program. the formative evaluation steps include the one-to-one, small group, and field trial evaluation. The result of the study indicates that the constructivist learning theory implemented in online learning enables students to explore knowledge and actively use the learning resources to build the required knowledge. In addition, the constructivism-based online program support students' learning process to complete their academic writing assignments.

**Keywords:** Constructivism learning approach, online learning, academic writing.

## 1 Introduction

Since the network and digital technology have been developed rapidly, information technology in learning has enhanced significantly. Many educational institutions, both informal and non-formal, deliver their courses through online learning networks. The paradigm of human learning has shifted with the advent of online learning. An innovative method of acquiring knowledge and information is through online learning. People gather the required information and knowledge more flexibly than in the previous time. Online learning has opened a wider opportunity for students to build and construct their understanding of the learned substances.

tually to understand the course content. Online learning facilitates the students to elaborate on the given course materials.

In addition, the lecturers and the students can also use many credible learning resources which are available on the internet. This will expand the horizon of the student's knowledge and skills. The use of online technology in learning activities increases learning interactions between the lecturers and the students and among the students. Learning is a process of gaining knowledge, skills, and attitude. Learning is considered a success if the students engage intensively in understanding the course substances. The students gain the required knowledge, skills, and attitude at the end of the learning process.

Online learning is a tool used by Universitas Terbuka (UT), the largest university in Indonesia that uses an open and remote learning system, to help students learn. This support aims to help the students who have difficulties understanding the course concepts which are learned through printed materials. UT uses printed modular-based instructional materials as the main medium to convey all course substances. Most of the course contents offered by UT are delivered through this type of instructional material. Besides, UT uses supplemented learning materials such as audio, video, and web-based materials to support students' learning process.

UT was established in 1984 by The Government of Indonesia. Recently, the university has had around 350.000 students. Those are distributed in all the provinces of Indonesia. UT uses the online learning mode to deliver all the offered courses. The number of students who participate in UT's online learning has increased every semester. Recently more than 50.000 UT students have been enrolled in offered online learning programs. All the UT online courses can be accessed by registered students.

UT must find the appropriate learning approach that can be used as the basic guidelines to convey the course substances effectively to the students. The selected approach must be able to develop student's knowledge, skills, and attitude that can facilitate them to attain course objectives. Since the students must interact actively to master the substances of the online course, the use of the constructivism approach can be considered an appropriate learning approach. The use of appropriate learning theory will enhance the quality of online learning to support students' learning process. The purpose of this study is to provide more details on how constructivism learning theory is applied to enhance students' online learning experiences.

### **1.1 The purposes of the study**

The aim of the research is to identify a substitute methodology or theoretical framework that can enable remote and open learning learners to achieve the goal of the academic writing course. At the end of the program, the students must be able to write an academic paper which is based on their learning interests.

### **1.2 Research questions**

These three research questions can be elaborated in this present study: (1) How to increase the student's engagement in online learning; (2) Is using constructivism

learning approachable to enhance the students' learning engagement; (3) is the constructivism approach used in online learning facilitate the students learning achievement?

### 1.3 Constructivism learning theory

Constructivism is a theory that explains how individuals come to know what they do. According to constructivism theory, people build their knowledge and comprehension of the world by having experiences and thinking back on those experiences. Constructivism learning theory views that learning occurs if there is intensive interaction between students and the learning environment.

Constructivism is an epistemological view of knowledge acquisition emphasizing recording knowledge construction rather than knowledge transmission and the dissemination of information conveyed by others. The role of the learner is conceived as one who builds and transforms knowledge. Learning will happen if the students conduct continuous discussions of certain topics both with the teacher or instructor and peer students.

Constructivism is also seen as a theory about human learning that is grounded in observation and empirical research. According to (Bhattacharjee, J., 2015), we have to make sense of new information by weighing it against our prior knowledge and experiences. This may require us to revise our beliefs or reject the new information as unimportant. Still, we actively contribute to the creation of our knowledge. In order to accomplish this, we need to investigate, evaluate, and pose questions. The central thesis is that students actively create their knowledge, using their minds to filter information from the outside world and decide what they will learn. Learning is not only taking in information passively; it requires active mental labor (Koohang et al., 2009; Woolfolk, 1993).

Constructivism is based on the assertion that the learners actively create, interpret, and recognize knowledge in individual ways. Learning or constructing knowledge happens when students make sense of formal educational experiences in relation to what they already know, the social and cultural context of ideas, and a variety of other factors (Gordon, 2009)

Constructivism can also be viewed as a synthesis of multiple theories diffused in one form. (Amineh & Asl, 2015). It is the blending of cognitive and behaviorist principles. According to the constructivist perspective, learning is the process of creating meaning. That's how individuals interpret their experiences.

Constructivism views that learner construction of knowledge is generated from a meaning-making search in which learners participate in a process of constructing individual interpretations of their experiences. The learning process occurs when the students connect their previously learned knowledge with recently new knowledge. The process happens systematically which is called scaffolding. The students build knowledge by integrating previous and new meaningful learning experiences.

Constructivism is a philosophy of knowing that contends that people learn and make sense of the world through interacting with ideas and experiences. There is a relationship between an infant's experiences and its reflexes, or behavioural patterns.

These knowledge sets were dubbed schemata by Piaget. (<https://web.era-edta.org/uploads/stinfe73/995412-constructivist-theory-piaget>)

His classic work stated the principles of learning under the guidelines of constructivism as follows. (1) Learning as an active process; (2) People learn to learn as they learn; (3) Crucial action of constructing meaning ;(4) Learning involves language; (5) Learning is a social activity; (6) Learning is contextual; (7) One needs the knowledge to learn; (8) It takes time to learn; (9) Motivation is key components for learning. (Hein, 1991).

Another common criticism of constructivism as a learning philosophy is that it forces pupils to "reinvent the wheel." Constructivism awakens and satisfies students' natural curiosity in the world and how things function. Instead than trying to invent the wheel, students try to comprehend how it rotates and works. By applying their prior knowledge and practical experience, learning to make hypotheses, putting their theories to the test, and finally drawing conclusions from their research, the students become actively involved in the learning process.

(<http://www.thirteen.org/edonline/concept2class/constructivism/>).

Proposes the following instructional strategies to implement the constructivism approach in learning activities that include. (Koohang et al., 2009)

- Provide experience with the knowledge-construction process,
- Provide experience and appreciation for multiple perspectives,
- Embed learning in a realistic and relevant context,
- Encourage ownership and voice in the learning process,
- Embed learning in social experience,
- Encourage the use of multiple modes of representation, and
- Encourages self-awareness in knowledge construction.

#### **1.4 Online learning as a vehicle to deliver course content**

The development of digital and internet technology contributes to significant impacts on the way people learn. It is easier to find the required information and knowledge than in the prior time. People find websites as unlimited sources of information and knowledge to be learned through network connections. With this network and digital technology, the term online learning has been used intensively by many educational institutions globally.

Online learning refers to correspondence or distant learning courses that use the Internet to deliver their curriculum. The program for online learning offers a broad choice of topics, target groups, and costs. This educational paradigm is becoming more and more well-liked as an affordable way to give a large number of people access to education.

The use of online learning, viewed as a part of e-learning, increases considerably. Many higher education institutions deliver their instructional materials or course substances through online modes. Defined the activities of learning online as: "... An approach to teaching and learning that utilizes Internet technologies to communicate and collaborate in an educational context". (Paulsen, 2002)

Online learning is considered distant learning since there is a geographical separation between the instructor and the students in the learning process. (Paulsen, 2002) also proposed some of the following characteristics of the distance learning system which include (1) Personal; (2) Structured; (3) Active; (4) Interactivity; and (5) Connective.

**Personal Learning** is a personal process to get information and knowledge. By participating in online learning, the student will have personal experiences in absorbing information and knowledge. Learning online requires the students to be active in exploring the course substance. The students can use various digital learning sources to construct their knowledge. Besides, they can collaborate with other students to grasp the course content.

**Structured** In general, online learning content is designed in a systematic structure. This will enable the students to understand learned concepts gradually. Online learning requires the students to practice a systematic learning process. To initiate the students' learning process, it is necessary for the institutions which conduct online learning to provide instructional materials at the beginning of the learning process.

Students must actively investigate information and knowledge when learning online. The students can use various digital and online sources to understand course substances or content. In addition, the students can interact with other students. This enables the students to construct their meaning from the provided learning resources.

**Interactivity**, Interactivity is considered the main characteristic of online learning. Learning through online mode enables the students to interact intensively with provided learning materials. Online instructors and students can interact both synchronously and asynchronously. In this sense, the learning feedback from the online instructor is necessary for the students.

**Connective**, Online learning connects users to share and discuss learning materials. The learning connection happens through Learning Management System (LMS) and the web. The LMS consists of learning components that can support and facilitate students' learning. (<https://flo.flinders.edu.au/mod/book/view.php?id=672340>). The LMS in this sense consists of learning substances, assignments of learning, exercise, feedback and assessment.

## **1.5 Constructivism online learning**

A new pedagogy for online learning is needed, one based on building rapport between the learners and the facilitator or instructor. The ability to learn regardless of location or time is one of the most notable aspects of online learning. Students are able to fit their education around their daily schedules (Huang, 2002). Online learning has several notable advantages over traditional education, including the ability to overcome geographic barriers and the ability for students to attend the virtual classroom at any time and from any location as long as they have access to the Internet (Hong, 2003).

Conducted a study concerning the case for online course pedagogy to support the constructivism learning model (Schell & Janicki, 2012). The way that instructional materials are presented online is a fantastic fit for today's college students, who use

technology in their daily lives and have established social media habits. It is not being argued that all courses ought to be offered online or that all students benefit most from taking classes online. It is argued that online courses are beneficial because they facilitate communication between students and instructors as well as between students and other students in ways that help students build their knowledge and develop strategies for learning new information.

Constructivism is among the theories of learning that describe how students learn to master their competencies. All students have previous existing knowledge derived from prior learning. With the use of active, cooperative, and socially constructed learning activities created by the teacher and their prior knowledge, students will be able to write academic writing assignments. Participating actively in student-centered learning activities and experiences enables the students to construct new knowledge and personal meaning.

## 2 Method

Thirty students were engaged in this research and development study. The research and development model were implemented in this present study. (D. Gall et al., 2007) Besides, the students as the participant, the study also involved an instructional designer, a subject matter expert, and a computer programmer. They were involved in designing and developing the constructivism-based online tutorial program.

Three stages of the research and development approach were done in this study – the analysis stage, the design and development stage, and the evaluation stage. Each stage was done systematically in this multi-year study. The stages can be shown in the following figure,

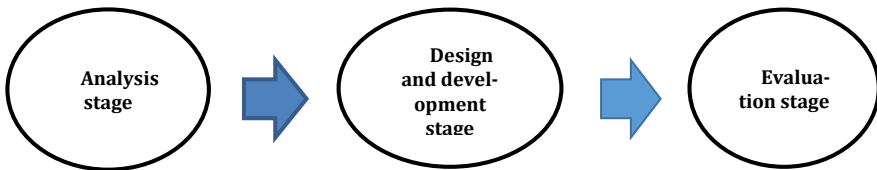


Fig. 1. The research and development stages.

In the analysis stage, the need for instruction is identified and verified. It was determined that the constructivism learning theory had to be implemented in the academic writing course of this study. It is because most of the students have difficulties in pursuing this course. The instructional goal of online academic writing courses was determined in this stage. The students will be able to write a draft of an academic paper that potential to be published in an existing academic journal.

After the analysis stage was completed, the program of the constructivism-based online tutorial was designed and developed which included some systematic steps – determining the course objectives, the course content, and the constructivism instruc-

tional methods. Besides, the learning materials and constructivism-based course assignments were also designed and developed in this study stage. These design components of academic writing constructivism-based learning theory are considered as blue-print that can be used to develop the program and required learning materials.

The evaluation stage was held by applying the pre-test and post-test sessions of the study. This evaluation step was held to get information concerning the student's learning achievement or gaining scores before and after participating in the constructivism-based online tutorial program. Formative evaluation steps applied at the end of the study are considered as the research part of the research and development model used in this study.

### 3 Results

The result of the analysis stage indicated that students require intensive learning engagement to understand the presented course content. The study showed that most of the participants had difficulties in learning how to write academic articles delivered through online learning. One of the strategies that can be applied to involve students in online learning is creating intensive learning interaction. Participating in online learning requires learning interaction between student-teacher, students-course content, and students-students.

The use of constructivist learning theory which emphasizes two-way interaction is necessary to facilitate students in online learning. Intensive interaction through learning involvement enables the students to build their learning comprehension of the course content. Constructing comprehensive knowledge occurs through mutual interaction between students and learning resources.

In this study, the constructivism strategy was selected because the students had to use many resources, read reading materials, and discuss constructing their knowledge before completing their academic paper assignments. Constructing knowledge or substances is required to be able to write the paper.

The online program was designed and developed based on the principles and constructivism learning theory which includes: 1) the use of facilitating knowledge-construction process; 2) giving appreciation for multiple perspectives; 3) conducting learning in a realistic and relevant context; 4) enabling ownership and voice in the learning process; 5) embed learning in social experience; 6) use of multiple modes of representation, and 6) Encourages the self-awareness in the knowledge construction.

The constructivism-based online learning program was designed and is described by several system components such as (1) the goal of the program; (2) the objectives of the program; (3) the content of the substances of the program; (4) the program assignments and evaluation; (5) provision of learning resources.

The prototype of the constructivism-based online program was produced to be the academic writing course online learning materials. The online learning program consisted of following program instructions or navigation such as the content of the program, learning exercises for the students, and program assignments.

One-to-one and small-group formative evaluations were conducted to get information regarding the weakness and feasibility of the constructivism-based online learning program. The results of these formative evaluation stages indicated some factors that should be revised to make the program more effective and efficient.

In the end, the field trial formative evaluation was implemented by conducting the pre and post-test sessions. After completing the constructivism-designed online learning program, this field trial formative evaluation was conducted to get information regarding the students' gained knowledge. The pre and post-test results of the evaluation stage indicated a significant difference in students' scores after participating in the constructivism online learning program ( $t = 24,393$ ). The difference between the students' pre and post-test scores can be seen in the following table.

**Table 1.** The difference between the students' pre and post-test score

	<b>Mean</b>	<b>SD</b>
<b>Pre-test</b>	53.07	2.348
<b>Post-test</b>	70.43	3.569

## 4 Discussion

Bernard, et.al. (2009) noted that student interaction can be viewed as an essential factor in any kind of instruction, particularly when learning online. In the context of online learning, interaction can take many different forms, such as interaction with classmates, the teacher, or the course material.. In addition,(Bernard et al., 2009) propose three types of online interaction student-student interaction, student-instructor interaction, and student-content interaction. Through participating in these online learning interactions, students will be able to construct their knowledge.

The importance of interaction in online learning can be supported by implementing the constructivism learning theory. The proposes that learning occurs by constructing knowledge from various learning resources. Learners must be active in organizing learned knowledge. Learning is an adapted process to receive knowledge from various learning resources. Learning experiences provide an opportunity for learners to construct their knowledge. Social factors facilitate students' learning process.

Understanding constructivist learning theory is essential to comprehending how pupils learn. constructivism as a theory of learning. The core of constructivism learning theory is the notion that students actively create knowledge. Students construct their new knowledge on top of their current foundation of understanding. In this matter, (Woolfolk, 1993) noted that "learning is active mental work, not passive reception of teaching". Constructivism learning theory has a fundamental assumption that states that learners actively develop their own knowledge.

Learning online provides opportunities for learners to explore and discover knowledge from many relevant online sources. Participating in online learning requires the students: 1) to be involved actively in elaborating relevant knowledge; 2) to



be committed and consistent in completing tasks or assignments; 3) to follow the schedule and learning activities; 4) to discuss the important topics actively.

Students' online learning will be aided by the application of constructivist learning theory. Constructivism learning theory implemented in the online learning program provides chances for students to interact intensively with learning resources. This was advocated by some studies suggesting that the success of online learning depends on constructivist course design Chan (2010).

## 5 Conclusion

The use of online learning as a mode of instructional delivery requires an appropriate strategy to involve students in the learning process. One of the strategies that can be used to enhance the effectiveness of online learning is to implement constructivist learning theory. This theory emphasizes that students construct their knowledge through interacting with various learning resources – instructors, peer students, and course content.

Participating in online learning enables the student to interact with teachers, peer students, and course substances intensively. Through engagement in these types of online learning interactions, students will be able to build their skills and knowledge of the learned subject. Constructivism learning theory implemented in online learning programs supports students' learning process to master the course substances. Implementing constructivism learning theory and principles in online learning provides wider chances for students to interact intensively with learning resources. The result of this study was advocated by some previous studies which noted that a constructivist course design is an essential factor that can support the success of conducting an online learning program.

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