International Journal of Education and Practice
2020 Vol. 8, No. 1, pp. 86-105.
ISSN(e): 2310-3868
ISSN(p): 2311-6897
DOI: 10.18488/journal.61.2020.81.86.105

IMPACT OF ELECTRONIC INTERACTION PATTERNS IN A COLLABORATIVE LEARNING AND INSTRUCTIONAL ANCHORS-BASED ENVIRONMENT ON DEVELOPING INSTRUCTIONAL DESIGN SKILLS AND ACHIEVEMENT MOTIVATION

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Article History
Received: 28 October 2019
Revised: 2 December 2019
Accepted: 8 January 2020
Published: 11 February 2020

Keywords
Electronic interaction
Collaborative learning
Instructional anchors
Instructional design
Achievement motivation.

ABSTRACT

This study aimed to investigate the impact of electronic synchronous and asynchronous interaction patterns, in a learning environment based on collaborative learning and instructional anchors, on developing instructional design skills and achievement motivation. A quasi-experimental design was used to develop a theoretical framework and research tools, while a sample of 50 students from the College of Education at Prince Sattam bin Abdulaziz University were selected and 25 allocated to each of two experimental groups. Synchronous and asynchronous interaction patterns were used to teach instructional design skills to and stimulate achievement motivation in the first and second groups, respectively. The impact on each group was then assessed through achievement, observation card, evaluation card, and achievement motivation scale pre- and posttests. The results from the asynchronous exceeded the synchronous interaction pattern, due to its 24/7 availability, revealing the impact on enhancing students' achievement motivation to be significant.

Contribution/Originality: The primary contribution of this study is the discovery that adapting modern technology to the educational context opens up new horizons for e-learning and instructional anchors. It provides a new teaching style and develops the planning and design skills for collaborative learning, which plays a significant role in enhancing students' achievements and achievement motivation.

1. INTRODUCTION

Interaction is essential in any electronic medium, but especially for learners, who always need direct instructional interaction in any learning environment to meet their learning needs, be autonomous, and complete learning tasks by themselves; it is thus integral to the e-learning process. Moreover, electronic interaction provides the guidance learners require to know how and when to do some things and ensures they can undertake the required tasks independently and avoid many mistakes (Khamis, 2009; Tolba, 2011).

Electronic interaction takes many forms, including synchronous and asynchronous. Synchronous interaction refers to the communication tools used in e-learning that enable learners to converse directly and simultaneously with not only each other but also their teachers. Such instant-response tools include chat rooms, videoconferencing, whiteboards, and virtual classrooms (Abdelhaleem, 2010).

The advantages of synchronous interaction include enabling learners to: exchange ideas and information instantly with peers and teachers via text messages or audio and video chats; discuss, express feelings, use emoticons, and respond to questions and data; take text notes, and use a microphone or sidetalk for working in small groups on educational tasks. Therefore, it develops learners' cooperative and social interactive skills and enhances their motivation (Mahmoud, 2011). However, there are some issues with e-learning environments, including different time zones, failure to accomplish challenging tasks, and bandwidths restricting the transfer and quality of large videos and images (Mealy and Loller, 2007).

In contrast, asynchronous interaction refers to the communication tools used in e-learning that enables learners to converse indirectly both with each other and their teachers without committing to a certain time. These tools include discussion forums, email and e-mail lists, as well as whiteboards (Almaghraby, 2007).

The advantages of asynchronous interaction include enabling: 24/7 access to learning resources and materials; learning at an individual pace, such as replaying lectures or pausing to think through a problematic aspect; participation and expression of opinions without embarrassment. Therefore, it promotes higher-order thinking and cooperative skills (Shehata, 2015).

As an activity, electronic interaction is related to social constructivism: learning is a social activity based on sharing and discussing ideas. In fact, group learning is more efficient, since forming social, constructive, and reciprocal relationships improve and deepen learning, enabling knowledge to be retained longer (Zaytoon, 2004). Some learners prefer asynchronous interaction because it suits their special conditions, enables them to express their ideas, and provides adequate time for them to apply their acquired knowledge and skills (Daniels and Pethel, 2005).

Some studies have investigated the impact, and importance, of different interaction patterns in an e-learning environments on cognitive achievement, skills development, and attitude (e.g, Alghamdy, 2018; Mahmoud, 2011; Shehata, 2015). Collaborative learning has been proved a distinctive and importance strategy, offering the opportunity to share resources and experiences, and learn e in a new, innovative way (Cooper and Burfor, 2010). It is an interaction pattern that facilitates group learning despite different time zones and learning styles (Hamad, 2019).

Collaborative learning is not effective when learners are simply allocated to groups and learning tasks assigned, but when the variables related to both the learning environment and collaborative learning are taken into account to determine the best strategies, tools, and level and type of interaction to adopt (Alshiekh, 2013). The Web offers an effective collaborative learning environment, providing learners with cognitive assistance to develop their knowledge, as well as social skills, through learning tasks (Alghoul, 2012).

In other words, collaborative learning is essential for creating a more interactive learning environment. This helps reduce learners' anxiety and enhance their psychological satisfaction: high achievement affects the cognitive aspect of learning while increased achievement motivation in all subjects influences the psychological. Indeed, many studies have reported on the effectiveness of collaborative e-learning (e.g., Almashiekhy, 2019; Azzahrany, 2019; Hamad, 2019).

One collaborative learning strategy involves instructional anchors, the main aim of which is to create a learning environment that helps resolve potential cognitive problems. For instance, instructional anchors support learners in applying the knowledge, facts, and skills acquired to real life (Vye, 2008).

Roe (2014) defines instructional anchors as "… an approach that uses macro contexts or complex problem spaces as anchors that students can examine for long periods of time and from different perspectives to find plausible solutions. … [They] may be an informational text or a video … [provide] background knowledge about the problem and [create] a shared learning experience …" Gerges (2017) also stated that they are "a constructive instructional approach that allows students to acquire knowledge through a set of aids, including videos, simulation models, and interactive activities" (p. 271).

Sener (2013) reported that, as learners are unaware that their acquired knowledge can be used to solve real-life problems, instructional anchors establish scenarios that encourage students to continuously explore and understand different situations and problems. Thus, learning is achieved through examining and testing functional problems faced by experts in a specific field.

Further, Fehr and Hoff (2011) had argued that, when using a problem-based approach, web-anchored instruction in nanotechnology positively affected learners' perceptions of scientific concepts and their place in society. Likewise, Coelho (2010) had reported that instructional anchors helped learners overcome the problem of understanding new information through observation.

Elsayed (2019) emphasized the effectiveness of e-learning when using instructional anchors to develop the digital video production skills, learning engagement, and cognitive abilities, emotional intelligence, and proficiency of educational technology students. Hartanto and Reye (2013) had similarly reported their effectiveness in a C# intelligent tutoring system, helping learners to not only program effectively but also enjoy the activities and receive feedback and assistance. In addition, learners acquire their programming skills through real and authentic tasks and problems, which is the most important feature of instructional anchors.

Both K. Abu (2010) and S. Abu (2013) argued that instructional design is strongly related to those theories of teaching and learning focused on the methods and techniques that create the best conditions for effective learning and achieving better results, which is of great importance. Although Albatea (2015), along with others (e.g., Alghamdi, 2018; Attia, 2014; Harb, 2013; Ibrahim, 2015), emphasized the importance of acquiring and developing instructional design skills for training students, there are still few teaching programs incorporate instructional design courses, despite the urgent need.

In addition, motivation facilitates an understanding of the confusing aspects of human behavior and is important because of its reinforcement contingencies that guide behavior toward a particular goal: it assists with maintaining that behavior and achieving the desired outcome. Consequently, it plays a significant role in the persistence in accomplishing a task (Alawna, 2004).

Achievement motivation is therefore an important factor when designing e-learning environments. Yunus (2007) believes that motivation is evident from a learner's desire to do a good job successfully, overcome difficulties, and avoid failure; moreover, achievement may result in greater motivation.

As a result, the Educational Technology and Communication Course offered by the College of Education at Prince Sattam bin Abdulaziz University advocates expanding and developing students' knowledge and skills in instructional design; however, the traditional teaching approach affects achievement motivation. Therefore, this study aimed to investigate the impact of both synchronous and asynchronous electronic interaction patterns, in an e-learning environment based on collaborative learning and instructional anchors, on developing instructional design skills and achievement motivation.

1.1. Background to the Study

This subsection describes of the lead-up to the study.

1.1.1. Experience

As a faculty member in the College of Education at Prince Sattam bin Abdulaziz University, the author noticed students' poor achievement in instructional design skills on the Educational Technology and Communication Course, which is taught in the traditional way and affects their motivation.

1.1.2. Pilot Study

A questionnaire was distributed to 10 students' on the Educational Technology and Communication Course to determine their learning needs, and especially the required instructional design skills. The results revealed the students' poor achievement (94%), lack of any training (91%), and need for training (97%).

1.1.3. Interviews

Interviews were conducted with five of the students on the availability of training in instructional design skills and achievement motivation. The findings revealed not only the poor achievement of these five students (80%) but also a wish to acquire these skills, but through a non-traditional approach.

1.1.4. Recommendations from Conferences and Symposia

In 2015, the 5th International Scientific Conference entitled "Information and Communication Technology and Empowering Special Needs" stressed the importance and development of technology-supported collaborative learning and instructional anchors based on learning styles and patterns. Adopting large-scale technology to supporting innovative learning was recommended. Following on from this, the 3rd Egyptian E-Learning University Conference on E-Learning entitled "Innovative Learning in the Digital Age" underlined the need to create innovative educational communities by integrating several technologies in 2016; then in 2017, the 12th Conference of the Arab Association for Educational Technology entitled "Educational Technology and Interactive E-learning Environments" highlighted the need for further studies into instructional anchors, the development of interaction and content presentation patterns, integration of such learning strategies as collaborative and adaptive, and diversity of content presentation and instruction.

Consequently, having identified the lack of instructional design skills and achievement motivation among the students at the College of Education, the following question emerged: "What is the impact of both synchronous and asynchronous electronic interaction patterns, in an environment based on collaborative learning and instructional anchors, on developing instructional design skills and achievement motivation?" This was further deconstructed into the following questions:

- *Q1:* What instructional design skills do the College of Education students need?
- *Q2:* What is the impact of both synchronous and asynchronous electronic interaction patterns, in an environment based on collaborative learning and instructional anchors, on the cognitive aspect of learning instructional design skills?
- *Q3:* What is the impact of both synchronous and asynchronous electronic interaction patterns, in an environment based on collaborative learning and instructional anchors, on the performance aspect of learning instructional design skills?
- *Q4:* What is the impact of both synchronous and asynchronous electronic interaction patterns, in an environment based on collaborative learning and instructional anchors, on the quality of the end product?
- *Q5:* What is the impact of both synchronous and asynchronous electronic interaction patterns, in an environment based on collaborative learning and instructional anchors, on developing achievement motivation?

1.2. Objectives

This study therefore aims to:

- Determine the skills required by students at the College of Education.
- Determine the impact of both synchronous and asynchronous electronic interaction patterns, in an environment based on collaborative learning and instructional anchors, on developing the cognitive aspect of learning instructional design skills.
- Determine the impact of both synchronous and asynchronous electronic interaction patterns, in an environment based on collaborative learning and instructional anchors, on developing the performance aspect of learning instructional design skills.

- Determine the impact of both synchronous and asynchronous electronic interaction patterns, in an environment based on collaborative learning and instructional anchors, on developing the quality of the end product.
- Determine the impact of both synchronous and asynchronous electronic interaction patterns, in an environment based on collaborative learning and instructional anchors, on developing achievement motivation.

1.3. Significance

The following points highlight the importance of this study:

- It facilitates further studies into instructional anchors and their impact on developing various aspects of learning instructional design skills.
- It points out to the importance of interaction patterns in modern electronic environments to instructional designers.
- It reflects the modern trend toward utilizing electronic collaborative learning patterns to improve educational achievements.
- It develops a theoretical framework for a collaborative e-learning environment for the Arab library.
- It provides a design for a collaborative e-learning environment, using instructional anchors, for educational program planners.
- It may instigate a scientific orientation toward utilizing educational technology effectively to provide courses related to the Educational Technology and Communication Course.

1.4. Hypotheses

This study intends to verify the following hypotheses:

- *H1: There is no statistical significance, at a ≤0.05 level, in the mean difference between the first (synchronous pattern) and second (asynchronous pattern) experimental groups in the post-achievement test.*
- *H2: There is no statistical significance, at a ≤0.05 level, in the mean difference between the first (synchronous pattern) and second (asynchronous pattern) experimental groups in the observation card posttest.*
- *H3: There is no statistical significance, at a ≤0.05 level, in the mean difference between the first (synchronous pattern) and second (asynchronous pattern) experimental groups in the evaluation card posttest.*
- *H4: There is no statistical significance, at a ≤0.05 level, in the mean difference between the first (synchronous pattern) and second (asynchronous pattern) experimental groups in the achievement motivation scale posttest.*

1.5. Limitations

There are limitations to this study, as follows:

- *Human*: Students at the College of Education of Prince Sattam bin Abdulaziz University.
- *Objective*: Instructional design skills (analysis, design, development, evaluation, and management).
- *Temporal*: The first semester of the 2019/2020 academic year.
- *Spatial*: The College of Education in Dalam.

1.6. Methodology

- *Analytical–descriptive method*: This was used to describe, analyze, and apply the variables identified from the literature review.
- *Quasi-experimental design*: This was used to determine the impact of the independent variable (i.e., synchronous and asynchronous electronic interaction pattern, in an environment based on collaborative learning and

instructional anchors) on the dependent variables (i.e., instructional design skills and achievement motivation) among students at the College of Education of Prince Sattam bin Abdulaziz University.

1.7. Population and Sampling

The population comprised all the students attending the College of Education in Dalam during the 2019/2020 academic year, from which a sample of 50 fourth-level students was selected and allocated to two experimental groups:

- The first experimental group was taught using a synchronous interaction pattern.
- The second experimental group was taught using an asynchronous interaction pattern.

1.8. Design

Due to the independent variable and nature of the study, the most appropriate research method was the quasi-experimental (pre-test–posttest) design. This method is depicted in Figure 1.

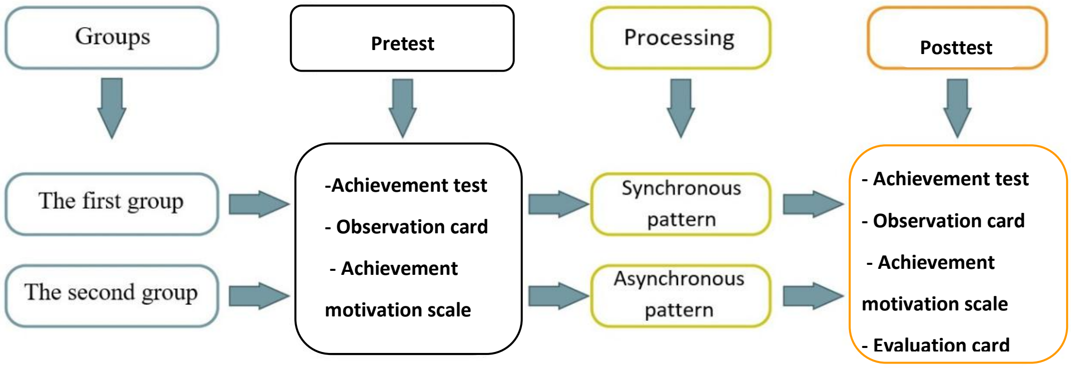

Figure-1. Pretest–posttest study design. The first and second experimental groups were taught using the synchronous and asynchronous patterns, respectively, within an environment based on collaborative learning and instructional anchors.

1.9. Definition of Terms

1.9.1. Electronic Interaction

Aql *et al.* (2012) define electronic interaction as "free and complete student participation using the e-course tools according to the steps in the educational strategy that enhance motivation" (p. 10). Procedurally, it is defined as the communication, dialog, effect, and influence among students to participate actively in the learning process and achieve defined goals.

Electronic interaction comprises two patterns:

- *Synchronous*: This is defined procedurally as using chat rooms to interact directly with the author and classmates.
- *Asynchronous:* This is defined procedurally as using an educational forum to communicate indirectly with the author and classmates at any time.

1.9.2. Collaborative Learning

Khalaf (2016) defines collaborative learning as "an instructional method of learning in a group that allows participation through sharing knowledge, resources, ideas, work, and experiences. It aims at not only learning but also constructing knowledge in a collaborative environment" (p. 218). Procedurally, it is defined as an educational pattern and strategy whereby small groups of 3–5 students interact, share information resources in an environment based on instructional anchors, and are responsible for their own learning of the required instructional design skills.

1.9.3. Instructional Anchors

Gerges (2017) defines instructional anchors as "a learning strategy based on the principles of programmed learning that, in light of Google applications, uses interactive educational tools to help students converse with each other and their teachers, access learning resources, solve problems, and undertake self-evaluation" (p. 270). Procedurally, it is defined as a learning strategy for students at the College of Education whereby they use a series of specifically designed activities in real-life situations, videos, projects, simulation models, demonstration websites, and real evaluation in collaborative learning environments that motivate learning.

1.9.4. Instructional Design Skills

According to Khamis (2003), instructional design skills are "comprehensive specifications of instructional activities and resources for a systematic application based on problem-solving, taking into account educational theories that aim at efficient and effective learning. They consist of the outputs from the design process: analysis, definition of needs, objectives, learners' characteristics, educational content, general learning strategies, tasks, and stipulations for the learning resources." (p. 92). Procedurally, they are defined as a series of writing and applied presentations that express students' abilities to complete the organizing, developing, applying, and evaluating learning activities according to their cognitive characteristics, with minimal effort and time, in an environment based on collaborative learning and instructional anchors, and using both synchronous and asynchronous interaction patterns.

1.9.5. Achievement Motivation

Abu (2006) defines achievement motivation as "a process of self-realization in achieving a difficult task. As a guided behavior, achievement leads to the development and demonstration of higher levels of ability. Thus, those wishing to succeed exhibit higher abilities, avoiding failure and a demonstration of poor ability" (112). Procedurally, it is defined as the wish and tendency of students at the College of Education to achieve tasks and acquire skills in instructional design at a proficient level to attain best design experience and skills. Evaluation is obtained from responses to the achievement motivation scale.

2. THEORETICAL FRAMEWORK

2.1. Electronic Interaction

Interaction helps to retain students' attention, promote personal ways of quickly acquiring knowledge and skills, encourage self-knowledge, and develop a mutual understanding between students in a social context. Tolba (2011) defined two interaction patterns, which will now be discussed.

2.1.1. Synchronous Interaction

Synchronous interaction refers to web-based communication that offers assistance at the time of learning. Learners interact and share knowledge and ideas with each other simultaneously through chat rooms, videoconferencing, and interactive conferences. It requires quick thinking and an ability to respond quickly and accurately (Kafafy *et al.*, 2005).

2.1.2. Asynchronous Interaction

Asynchronous interaction is indirect and can occur anytime, anywhere according to learners' circumstances: it provides assistance without the need to commit to a specific time. Asynchronous tools include e-mail and educational forums.

Kuo (2010) defines asynchronous interaction as "a pattern in which learners participate in discussions at different times. It humanizes these discussions by raising exciting questions that motivate cooperation. It is based on active collaboration, not individual work" (p. 1215).

2.2. Collaborative Learning

According to Felt *et al.* (2012), collaborative learning is a method used by students to share ideas and content with their classmates and teacher that enables them, through their participation and creativity, to achieve their educational objectives.

Thus, this is a pattern of learning based on students' social interaction: they work together in small groups on collaborative and organized activities, using online interactive services and tools, to accomplish an educational task or objective. Consequently, collaborative learning focuses on generating rather than receiving knowledge, transforming education from teacher-centered to learner-centered.

Almashiekhy (2019) and Hamad (2019) listed the following features of collaborative learning:

- It applies several educational theories, such as cooperative, intended, distributed, resource-based, and project-based learning.
- It is learner-centered, including many learning activities.
- It relies on learners' interacting with each other to collect, analyze, discuss, and interpret data to resolve problems.
- It involves individual responsibility because everyone is responsible for their own learning.
- It offers a social reward because the group is not rewarded until the task is successfully completed.
- It provides collective training in socially interactive contexts: earners are trained and motivated to use appropriate social skills.

2.3. Instructional Anchors

The term instructional anchors in relation to e-learning environments was introduced in 1990 by the Cognition and Technology Group from Vanderbilt and refer to an environment in which complex problems can be resolved through solving a series of relevant sub-problems (Mattar, 2018). As a result, e-learning environments based on instructional anchors provide students with real-life problems and the necessary research and development tools to reach a solution.

As a strategy of constructivism, instructional anchors create learning environments that facilitate the solving of potential cognitive problems. Learners acquire knowledge, facts, and skills, but they are unaware of when and how to apply that learning in real life (Vye, 2008).

2.3.1. Concept of Instructional Anchors

Instructional anchors, developed under the leadership of John Bransford, are a major paradigm for technology-based learning that create a real-life but enjoyable learning environment, which encourages active learning. Primarily, instructional anchors were developed to design complex real-life scenarios within interactive videos to motivate teachers and students to set and solve problems, respectively. As such, a significant attempt is made to attract and retain students' attention.

Baumbach *et al.* (1995) described instructional anchors as providing educational content in the form of a problem along with the background and other information required to reach a solution. The aim is to develop students' imaginative abilities in applying their experience and knowledge to various real-life situations. Further, according to Foster (2007), interactive instructional anchors combine anchored instruction, computers, and applications to design an interactive learning environment based on a set of tools instructing learners in how to solve complex problems. Heo (2007) also defined instructional anchors as providing a rich learning environment in which students can generate ideas, focus on gaining knowledge, properly define problems, and consider things from different perspectives. Meanwhile, Ruzic and O'Connell (2007) defined them as a learning model based on technological innovations that create a real-life and fun educational context to promote active learning. It is a strategy of learning and discovery in an educational environment that includes activities based on real-life situations that teach learners how to solve problems. Kumar *et al.* (2009) similarly defined instructional anchors as "a learning model based on solving complex problems through active participation in real-life situations and sharing ideas and critical opinions" (p. 14). As a result, learning takes place through involvement and collaboration in large-scale, real-life contexts, which enable students to understand problems over a period of time and from different perspectives, with guidance from teachers (Mattar, 2018).

More recently, Alhadedy and Aljazzar (2012) defined instructional anchors as an "educational approach that helps students acquire knowledge while solving problems through such means as videos, real-life situations, projects, recall, simulation models, and evaluation" (p. 43). Chapman (2014) agreed that instructional anchors embedded learning in meaningful contexts to stimulate students' interest in defining and viewing problems from different perspectives. Simultaneously, Alghoul (2014) described them as a learning model based on the application of modern technology and interactive methods to design problem-solving activities, such as real-life situations, projects, videos, simulation models, interactive tasks, and support websites, whereby learners can successfully achieve their objectives. Finally, Algharbyi (2017) defined instructional technology as adopting programmed learning principles and using interactive methods, in light of Google applications, to help students interact with each other and their teacher, access resources, solve problems, and undertake self-evaluation.

In conclusion, this study understands instructional anchors to:

- Help learners acquire knowledge through solving real-life problems.

a. Comprise stories, videos, real-life scenarios, simulation models, or projects.

- Provide technology-based activities.
- Facilitate meaningful learning.

2.3.2. Objectives of Instructional Anchors

Love (2004), Chen (2011), and Mattar (2018) put forward the following objectives of instructional anchors:

- Overcoming potential learning problems by creating environments in which students can persist with their inquiries with their teachers to understand types of problems, consult experts in different fields, and identify the tools needed for problem-solving.
- Helping students to acquire and apply new skills and knowledge positively and flexibly to solve educational and real-life problems.
- Creating a real-life and fun educational context to motivate active learning.
- Encouraging students to develop critical thinking skills to effectively solve educational problems.
- Providing the opportunity for cooperative learning.

In addition, this study considers other objectives: enabling students' interaction with theirs teachers and classmates, providing meaningful learning, and developing substantial understanding.

2.3.3. Advantages of Instructional Anchors

Crews *et al.* (2007) and Alhadedy and Aljazzar (2012) reported the advantages of instructional anchors as:

- Continuous active learning.
- Continuous and self-directed learning.
- Applying acquired knowledge to daily life.
- Providing guidance to learners.
- Real-life contexts.

- Meaningful learning.

In addition, Shyn *et al.* (2002), Wright (2010), Wojtowicz (2011), Sener (2013), and Shehata (2015) reported the following:

- Developing students' positive attitudes toward learning materials.
- Enhancing continuous and self-directed learning.
- Stimulating students' interest in and supporting their efforts to become active learners.
- Developing students' problem-solving, reflective learning, and critical thinking skills.
- Providing teachers with innovative designs for simulation models.
- Augmenting cognitive processes.

Furthermore, Mahdi (2018) stated that that using instructional anchors in educational contexts is invaluable for learners, for the following reasons:

- As a learner-centered strategy, it affects their ongoing participation, cooperation, and interaction.
- Learners acquire many skills, including continuous, self-directed, and cooperative learning.
- Learners are given the opportunity to apply their knowledge in real-life scenarios.
- Learning is made meaningful.
- Learners receive guidance, support, and feedback.
- The positive effects include facilitating and quickening the application of learning in the real world.

2.3.4. Features of Instructional Anchors

Lee and Franks (2002), Heo (2007), and Anwar (2017)highlighted the following features of instructional anchors:

- They are learner-centered and construct knowledge effectively and positively, with learners comparing both newly and previously acquired knowledge.
- They help learners to understand, retain, and actively apply knowledge and skills.
- They develop learners' positive attitude toward self-directed learning.
- They encourage learners to consult a variety of learning resources.
- They help in the design of various types of learning activities.
- They enable evaluations to be based on different perspectives.
- They design an attractive and enjoyable learning environment.

Ruokamo (2001) stressed the effectiveness of instructional anchors in developing learners' problem-solving skills. Following an experiment at Queensland University of Technology in which instructional anchors were integrated into CS Tutor to help the students learn programming languages effectively and in an enjoyable way, Hartanto and Reye (2013) recommended their use in education. Shehata (2015) also concluded that instructional anchors were effective in e-learning environments following an investigation into the impact of different interaction patterns on developing vocational diploma students' skills with interactive simulation software.

It is therefore argued that instructional anchors could help learners achieve the principles of social learning as well as self-actualization through real-life educational experiences and contexts: learners develop a range of cognitive and design skills, including instructional design and interaction. In addition, instructional anchors provide diverse learning resources that offer many opportunities to students.

Finally, Elsayed (2019) emphasized the effectiveness of e-learning based on instructional anchors in developing digital video production skills, learning engagement, as well as the cognitive, abilities, emotional intelligence, and proficiency of educational technology students. This was demonstrated by such basic features as a linear sequence of tasks and a range of interactions.

In conclusion, this study posits that instructional anchors should be planned and designed properly and based on real-life problems to facilitate learning. Moreover, multidirectional interaction between tasks, classmates, teachers, or contents provides learners with many cognitive challenges.

2.3.5. Design Principles of Instructional Anchors

Mahdi (2018) defines the design principles of instructional anchors as including:

- *Generative learning*: Open-ended narratives are presented to creating a meaningful context, and students must actively identify and solve the problems.
- *Video-based presentation*: Videos facilitate students' understanding of complex and interrelated problems better than those presented textually, especially among students with learning disabilities.
- *Narratives*: Videos are designed to include information about the setting, character traits, background, and events; the challenge is conveying the need to solve a real-life problem.
- *Transfer learning*: Opportunities are provided for students to use and reuse the information and knowledge already acquired in various contexts; hence, students can apply their skills in new contexts.
- *Links to the curriculum*: Every narrative in the videos not only includes sufficient information for tackling the challenge and solving the problem but also content that relates to other curricular topics.

Alhadedy and Aljazzar (2012) reported the impact of the interaction between the design of instructional anchors and field-dependent/independent cognitive styles () on Web 3.0 skills in an electronic educational context. They therefore argue that learners' cognitive styles should be considered in the design of instructional anchors. Could (2002) further reported that instructional anchors in interactive environments should be complex and offer several potential solutions, be based on a learning model, and provide an opportunity for collaborative learning with other students.

Consequently, this study suggests the following points should be considered in the design of instructional anchors:

- *Planning*: instructional anchors should be mapped before initiating a task.
- *Sequence*: Content should be displayed in a sequential, logical, and progressive form—from easy to difficult).
- *Interaction*: Multidirectional interaction among learners, as well as with their teachers, the content, activities, and problems, should be incorporated into the design of instructional anchors.
- *Authenticity*: Real-life tasks and problems should be created.
- *Unity*: instructional anchors should comprise one idea and one topic using multiple basic and semantically enriched resources.

2.4. Instructional Design Skills

Instructional design is a relatively new field in education. It motivates the development of education, experience, learning environments, and demonstrates the best educational methods for achieving the desired outcomes; it describes the actions involved in selecting the educational material to be designed, analyzed, organized, developed, and evaluated in accordance with learners' characteristics; and it also outlines appropriate programs and strategies, and defines relevant tools and methods.

Proper instructional design is vital to any educational program (Azmy, 2001), providing a systematic approach to development in direct education, including the content, objectives, evaluation tools, and feedback for both students and teachers, as well as the selection of effective teaching and learning strategies. It relies on highly trained and specialist designers creating educational materials in accordance with measurable learning objectives (Azmy, 2014a, 2014b).

Instructional design is a bridge between the theoretical (theories of general psychology and especially learning) and applied science (modern learning methods and techniques). In other words, it aims to systematically apply educational theory to the design of educational content, using various learning styles, to improve educational practices (Yunus, 2011).

Many studies have investigated instructional design. For example, Pearson (2002) identified the essential elements in designing and developing inclusive online courses, revealing that most failed to consider the criteria and specifications required for instructional design. Moreover, a lack of instructional design skills was found due to the neglect of learners' needs. At-Taran (2009) also discovered that design and production skills for educational software was also lacking among students at the College of Education of Mansoura University. Online interaction models and strategies were therefore recommended to train students in such design and production skills.

Meanwhile, Khalil (2009) defined the quality standards for the design and production of educational software and concluded that most online educational courses lacked any standards, even the basic standards required on design and publishing courses. It was recommended that the resources used to teach instructional design skills could be beneficial. Tolba (2009) revealed the different group sizes involved in e-learning projects that employ interactive techniques and the impact on developing instructional design skills, critical thinking, and positive attitudes toward participation among educational technology students. Based on the findings, in-service training was recommended for teachers because of the difficulty with workplace (or on-the-job) training.

Thus, this study concludes that instructional design skills develop student abilities and keep pace with technological innovations. Moreover, it applies theoretical knowledge and findings from scientific research to ensure education becomes more cohesive, coherent, and accurate in presenting information, facts, and ideas to students, which leads in turn to more effective learning. Moreover, there is an urgent need to raise interest in instructional design skills for educational software in general and e-learning courses in particular.

3. METHODOLOGY

3.1. Tools

3.1.1. Inventory of Instructional Design Skills

An inventory of the instructional design skills required was produced, independently reviewed, modified, and verified for validity and reliability. The final version comprised 5 basic skills and 26 sub-skills.

3.1.2. Achievement Test

a. Objective:

This test aimed to evaluate the cognitive aspect of learning instructional design skills on the Educational Technology and Communication Course. It comprised 44 items: 22 true/false and 22 multiple-choice questions. (Appendix (1): Instructional design skills test.)

b. Control:

Validity: Verification was conducted by submitting the test to the opinions and modifications of a group of educational and information technology specialists.

Reliability: Reliability was checked by using SPSS to calculate Cronbach's alpha coefficient. After the 40-item achievement test was piloted among a sample of 50 participants, a value of 0.68 was calculated, which approved the test.

3.1.3. Observation Card

An observation card comprising 5 basic skills and 26 sub-skills was produced. One mark was awarded to a skill that was performed and zero for any not performed; a total score of 26 was recorded.

The card was reviewed by a group of curriculum and instructional and educational technology specialists in terms of formulation, clarity, and accuracy. After incorporating their recommended modifications, validity was confirmed.

Once the card's reliability was also verified, the final version of the observation card was decided. This enabled the performance of fourth-level students in implementing the skills learned to be evaluated. (Appendix (2): Observation card.)

3.1.4. Evaluation Card

An evaluation card was prepared to assess the instructional design skills of students at the College of Education in Dalam and its validity and reliability checked. Comprising 15 items, with a possible total score of 60, each was scored as either above average (4 marks), average (3 marks), below average (1 mark), or very poor (0 marks). (Appendix (3): Evaluation card.)

3.1.5. Achievement Motivation Scale

Based on a literature review, 24 items were selected. Validity was tested by peer review, logical, and factorial validity), with most of the item–test correlation coefficients being statistically significant. A high level of reliability was also confirmed through test–retest correlation (0.56–0.72), Cronbach's alpha coefficient (0.40–0.65), split-half testing (0.56–0.72), and internal consistency method).

3.2. Instructional Design of a Learning Environment Based on Collaborative Learning and Instructional Anchors

Several instructional design models were reviewed (e.g., Ryan, 2000; Gad, 2001; Zaher, 2009; Alhadedy and Aljazzar, 2012; Aldesouki, 2015) and certain common features identified in the general framework, which comprised analysis, design, production, testing, and evaluation stages. A model with the following stages was then developed for this study:

a. *Analysis*: The overall objective of the learning environment, students' characteristics and needs, as well as educational resources were examined.

b. *Design*:

Instructional Anchors:

- Video: A series showing the instructional design and models adopted.
- Interactive activities: Tasks in which students interact actively with the content and receive feedback.
- Website: Provision of scientific material to study students' cognitive abilities and proficiency.

Collaborative Learning Model:

- Via Google Sites, each group of five students opened the educational to access the materials and play the videos.
- The students shared the information required and necessary worksheets to accomplish the tasks.
- The students submitted their answers to their teacher.
- Each group collaborated on the activities.

c. *Production*:

Instructional Anchors:

- Video: A series of YouTube clips explaining the instructional design and its integration into the content.
- Interactive activities: To enable collaboration, interactive activities were designed using MS PowerPoint 2010 and Microsoft Mouse Mischief, which allowed several mice to be connected to a single computer.
- Website: The pages of educational content were created using Google Sites.
- A link was provided from the course home page on Blackboard to the educational content and assignments.

d. *Evaluation*: The learning environment was initially adjusted following a review by a group of specialists and experts in educational technology. It was then piloted with a sample of students at the College of Education to not only assess whether the modules were appropriate for their characteristics and needs but also to garner their opinions. The learning environment was modified accordingly and the final version developed.

e. *Publication and use*: Students were allowed access to the website and testing started: its impact on the acquisition of the required skills was identified. Students clicked on a link to visit the website, entered their username and password, and then worked through the content of each module form any location.

f. *Testing:*

Pretest:

Cognitive achievement in instructional design skills, the observation card, and the achievement motivation scale were pretested as follows, and the results were statistically analyzed:

- Participants were introduced to the nature and objectives of the study and the learning environment explained.
- Students were asked whether they were familiar with chat rooms and forums, with instructions given to those who were not.
- The computers and Internet connection at the College of Education were checked, as was whether participants possessed such electronic devices as personal computers, mobile phones, or laptops connected to the Internet.
- Each student entered their Blackboard username and password to access and interact with the educational content.
- The students studied the required modules, taking notes and raising questions about the difficult concepts. They were monitored and support provided.

Posttest:

The evaluation card in addition to cognitive achievement in instructional design skills, the observation card, and achievement motivation scale were posttested, and again, the results were statistically analyzed.

4. RESULTS

1. *Q1* was answered in Section 2.4.
2. *Q2* and *H1* were answered and verified, respectively, by the statistical analysis, using SPSS, of the post-achievement test results from both experimental groups.

Table-1. T-values and statistical significance of the post-achievement test mean scores for each experimental group.

Statistical data / Test	Number	Arithmetic mean	Standard deviation	Degrees of freedom	Tabulated (T) value 0.05	Tabulated (T) value 0.01	Calculated (T) value	Significance level	Effect size (d)
First experimental group	25	31.25	16.55	24	2.00	2.61	9.88	0.01	2.13
Second experimental group	25	37.38	14.72						

Source: This data were extracted and analyzed using SPSS.

As can be seen from Table 1, the calculated (T) value was higher than the tabulated (T) value at both the 0.05 and 0.01 levels (i.e., 9.88 compared with 2.00 and 2.61, respectively), which, along with the high values for degrees of freedom (24) and effect size 2.13, suggests a statistically significant difference between the mean scores in favor of the second experimental group. *H1* is thus disproved.

3. *Q3* and *H2* were answered and verified, respectively, by the statistical analysis, using SPSS, of the observation card posttest results from both experimental groups.

Table-2. T-values and statistical significance of the observation card posttest mean scores for each experimental group.

Statistical data / Test	Number	Arithmetic mean	Standard deviation	Degrees of freedom	Tabulated (T) value		Calculated (T) value	Significance level	Effect size (d)
					0.05	0.01			
First experimental group	25	20.28	14.15	24	2.05	2.16	9.51	0.01	2.00
Second experimental group	25	24.30	10.12						

Source: This data were extracted and analyzed using SPSS.

Table 2 shows that the calculated (T) value was higher than the tabulated (T) value at both the 0.05and 0.01 levels (i.e., 9.51 compared with 2.05 and 2.16, respectively, which, along with the high values for degrees of freedom (24) and effect size (2.00), suggests a statistically significant difference between the mean scores in favor of the second experimental group. *H2* is thus disproved.

4. *Q4* and *H3* were answered and verified, respectively, by the statistical analysis, using SPSS, of the evaluation card posttest results from both experimental groups.

Table-3. T-values and statistical significance of the evaluation card posttest mean scores for each experimental group.

Statistical data / Test	Number	Arithmetic mean	Standard deviation	Degrees of freedom	Tabulated (T) value		Calculated (T) value	Significance level	Effect size (d)
					0.05	0.01			
First experimental group	25	11.57	14.00	24	2.15	2.56	13.18	0.01	2.11
Second experimental group	25	14.63	12.32						

Source: This data were extracted and analyzed using SPSS.

Table 3 indicates that the calculated (T) value was higher than the tabulated (T) value at both the 0.05and 0.01 levels (i.e., 13.18 compared with 2.15 and 2.56, respectively), which, along with the high values for degrees of freedom (24) and effect size, suggests a statistically significant difference between the mean scores in favor of the second experimental group. *H3* is thus disproved.

5. *Q5* and *H4* were answered and verified, respectively, by the statistical analysis, using SPSS, of the achievement motivation scale posttest results from both experimental groups.

Table-4. T-values and statistical significance of the achievement motivation scale pretest–posttest mean scores for each experimental group.

Statistical data / Test	Number	Arithmetic mean	Standard deviation	Degrees of freedom	Tabulated (T) value		Calculated (T) value	Significance level	Effect size (d)
					0.05	0.01			
First experimental group	25	66.57	14.05	29	2.15	2.72	42.22	0.01	16.61
Second experimental group	25	16.55	32.08						

Source: This data were extracted and analyzed using SPSS.

As shown in Table 4, the posttest mean scores exceeded those of the pretest (i.e., 66.57). In addition, the calculated (T) value was much higher than the tabulated (T) value, suggesting a statistically significant difference between the mean scores of the experimental groups in the pretest–posttest achievement motivation scale in favor of the posttest. *H4* was thus disproved.

5. DISCUSSION

The results revealed that a learning environment based on collaborative learning and instructional anchors was effective in developing instructional design skills and achievement motivation among students at the College of Education of Prince Sattam bin Abdulaziz University. Furthermore, by adapting modern technology to education, synchronous and asynchronous interaction patterns can be combined and special tools and different functions offered in accordance with a variety of students' needs. By taking into account specific needs and capabilities, learning can be improved. These findings agree with those of other studies, including Harb (2013), Alghoul (2014), and Azzahrany (2019). This study suggests that tools offering asynchronous (24/7) interaction greatly benefited the second experimental group. In addition, despite students' individual differences, all were able to select an appropriate interactive tool and actively participate. The following points proved helpful:

- Students' wish to master the required skills.
- Interactive patterns appropriate for all students.
- Cooperative and social features enriching students' learning.
- Instructional anchors facilitate the simple presentation of educational content.

6. RECOMMENDATIONS

Based on these findings, it is recommended that:

- A standard instructional design is used to develop software and online courses, learning environments, and e-strategies.
- All instructional design models are explained sufficiently to facilitate the various electronic production processes for students.
- Effective instructional methods and strategies for developing skills should be investigated.
- The role of instructional anchors should be introduced to students at an early stage.

7. FURTHER STUDIES

The following investigations are suggested:

- Impact of fixed and flexible online support patterns in a flipped learning environment on the development of online course production skills.
- Impact of concise and detailed feedback in a ubiquitous learning environment on the development of instructional design skills and student participation.
- Effectiveness of a learning environment using instructional anchors in developing e-content design skills and an appropriate attitude among students.

Funding: This project was funded by the Deanship of Scientific Research at Prince Sattam Bin Abdulaziz University under research project 10383/02/2019.
Competing Interests: The author declares that there are no conflicts of interests regarding the publication of this paper.

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