

Doi:

<https://orcid.org/0000-0002-3678-3436>

# The Development of Instructional Considerations for Using Augmented Reality (AR) in Light of the Principles of Constructivism Learning Theory in Social Studies Classrooms

Dr. Huda S. Alazmi<sup>1</sup>

Dr. Ghader M. Alemtairy<sup>2</sup>

College of Education – Kuwait University  
State of Kuwait

## Abstract

**Objectives:** There is a growing interest in embedding virtual technology such as Augmented Reality (AR) into social studies classrooms. Unfortunately, many social studies teachers struggle with technology in general, including AR-aided learning. **Method:** To help them learn how to employ AR technology effectively, this study used the ADDIE model to develop a set of AR instructional considerations based upon constructivist learning theory. **Results:** The authors validated this work via two rounds of expert panel review in four different domains: instructional design and development, technology-based theory in social studies classrooms, AR technology and education, and teaching social studies. In all, twelve experts reviewed the considerations, answering detailed, open-ended survey questions in round 1, and completed a

---

1 Assistant professor in Social Studies Education in Curriculum and Instruction Department. **Research Interests:** Professional development, Social studies curriculum, Inquiry-based learning, Technology enhanced learning.  
**e-mail:** [huda.alazmi@ku.edu.kw](mailto:huda.alazmi@ku.edu.kw)

2 Assistant professor in Instructional Technology in Curriculum and Instruction Department. **Research Interests:** Technology enhanced learning, Higher education, Professional development, Instructional design, Online learning.  
**e-mail:** [Ghader.alemtairy@ku.edu.kw](mailto:Ghader.alemtairy@ku.edu.kw)

- Submitted 30/4/2023, Accepted 14/6/2023.

rubric in round two. **Conclusion:** The resulting consideration set, should provide useful guidance for social studies teachers to integrate AR technology into their classroom practice.

**Keywords:** AR, constructivism, virtual technologies, social studies education, considerations.

## Introduction

Augmented Reality (AR) is a trending educational technology with great promise for improving the ways we learn. It offers tools, which may mitigate some of the traditional, yet ineffective, social studies teaching methods (Braun et al., 1998; Brush & Saye, 2009; Garzón, 2021; Krutka et al., 2020; Whitworth et al., 2003). Indeed, a growing body of work promotes integrating such technology into social studies educational practices to support teaching and student learning (Cai et al., 2020; Shafi et al., 2022; Lim & Lim, 2020; Wang et al., 2022). For example, Challenor and Ma (2019) analyzed a literature review to better appreciate how AR affects long-term memory, emotional awareness and complex learning experiences in history education, revealing a positive impact upon both student cognitive and emotional learning. Whereas Raghaw et al. (2018) developed (and successfully demonstrated) an augmented historical video model to engage students with inquiry and boost interest for content.

However, integrating AR experiences within traditional instruction does not guarantee more effective learning (Valtonen et al., 2022). Palloff and Pratt (1999) noted that “Technology does not teach students; effective teachers do” (p. 4). Effective teaching, therefore, is not related directly related to technology, but rather in how well it is integrated and applied. Too often, social studies teachers fail to design lessons, which best employ a given technology’s strengths, thus precipitating suboptimal instruction (Diem, 2002). Researchers claim that most social studies teachers have little knowledge or experience about the development of technology-based theory and pedagogy instruction (Doolittle & Hicks, 2003; Hicks et al., 2014). Furthermore, they argue that a teacher’s ability to successfully employ technology in a classroom correlates directly to their understanding of the relationships between this technology and pedagogical theory.

Doolittle and Hicks (2014) indicated that effective instructional technology depends upon a pedagogical rationale guiding how best to apply said technology in an educational setting. Their research asserted that constructivism provides a good avenue and guidelines for incorporating technology in social studies classrooms (Hicks, Doolittle, & Lee, 2002). Indeed, integrating technology, with constructivist learning theory as its pedagogical base, likely benefits student learning and engagement. Moreover, researchers argue that many social studies teachers fail to integrate AR effectively into their instruction due to the lack of clear implementation guidelines based on theory (Salira et al., 2022; Tiede et al., 2023). Therefore, this study developed a set of instructional considerations for social studies teachers to best integrate AR technology-based on constructivism learning theory into their classroom practices. Its primary goal is the development of constructivist-based instructional considerations to help social studies teachers integrate AR effectively into their practice. The researchers built these considerations by operationalizing AR affordances and constructivist learning principles for maximal technology use in social studies classrooms. Elements of the ADDIE model helped ensure the instruction's systematic design for achieving this goal.

## **Background of The study: Overview of the Problem**

The imperative need for integrating technology into educational practice demands that teachers design learning experiences grounded in well-established learning theory. However, in social studies education there is a lack of well-established instructional considerations for integrating AR technology affordances into learning. Therefore, the following literature review will discuss these affordances and the appropriate theoretical basis for using such technology in social studies classrooms. Results from this review helped shape the desired set of AR instructional considerations.

### **Point 1: AR Technology in Education**

Augmented Reality (AR) has gained much attention in recent years. In the educational field, researchers define AR features and affordances through the lens of optimizing real world experiences (Garzón, 2021; Wu, et al, 2013). Therefore, this research conceptualizes AR beyond the actual technology

itself. Carmigniani and Furht (2011) defined AR as: “A real-time direct or indirect view of a physical real-world environment that has been enhanced/augmented by adding virtual computer-generated information,” (p.1). For either definition, AR functionality demands strong alignment between physical and digital objects. As such, Hugues, Fuchs and Nannipieri (2011) formed an AR taxonomy based upon its functionality in two dissimilar environments, with one correlating to augmented perceptions of reality, and the other to the creation of an artificial environment. Employing AR technology as an instructional medium once required both a computer and an output device, but this is no longer the case; a smartphone can now perform both roles (Wasko, 2013). Wu et al. (2013) defined AR as the bridge between Virtual Reality (VR) and reality itself. They saw viewed AR as enhanced reality with compelling features for educational purposes.

AR technology has two primary affordances: (a) the ability to overlay digital information (text, images, videos, 3D models, sounds, etc.) on a real world environment, and (b) the ability to do this anywhere (Chang et al., 2022; Wasko, 2013). Typically, a user can access AR content by scanning a marker or Quick Response (QR) code with their communication device’s camera, although usefulness of such symbols depends upon their real-world viability. Even so, overlaying the real world with virtual elements can provide engaging learning experiences if design and developmental strategies employ learning theory effectively (Drljevi, Wong & Boticki, 2017). Wu et al. (2013) reviewed AR affordances based upon a systematic literature review, examining AR as an educational concept. They identified five crucial affordances: (1) learning content in 3D perspectives, (2) ubiquitous, collaborative and situated learning, (3) learner sense of presence, immediacy, and immersion, (4) visualizing the invisible, and (5) bridging formal and informal learning. Each of these affordances can enhance both instructional and learning approaches when operationalized via well-established learning theory (inquiry).

However, the literature shows that there is still a lack of understanding for how to implement AR technology to support educational processes in general, and for the social studies field, in particular (Crocco, 2001). Hicks and Doolittle (2003) argue that actual transformation of the process for

teaching and learning social studies demands redirection of the vision for integrating technology into classroom instruction. This requires a theoretical and philosophical understanding for the active implementation of technology to achieve desired social studies educational objectives. Bednar et al. (1992) stated that: “Effective design is possible only if the developer has developed reflexive awareness of the theoretical basis underlying the design.” Moreover, several researchers argue that a teacher’s ability to successfully employ technology in a classroom correlates directly to their understanding of the relationships between this technology and pedagogical theory (Hew et al., 2019; Okojie et al., 2006). Thus, there is a need to increase teacher awareness and knowledge regarding the importance of the pedagogical rationale guiding how best to apply said technology in an educational setting.

## **Point 2: The Theoretical Base for Best Using Technology in Social Studies Instruction**

The National Council for the Social Studies (NCSS) has supported a “vision of powerful social studies teaching and learning” which calls for “meaningful, integrative, value-based, challenging, and active learning” (NCSS, 1994, p.162). The NCSS believes that an interactive learning environment cannot occur via traditional instructional methods, but the integration of technology into social studies classrooms could produce such a result (Whitworth & Berson, 2003). Technology helps students communicate, to obtain knowledge, and to participate as informed citizens (Bennett, 2002). NCSS guidelines for using technology assert that it must “demonstrate the technology’s power as a tool for learning” (National Council for the Social Studies 2006, para. 7). However, Doolittle and Hicks (2012) stated that if the using of technology in social studies classrooms means nothing more than fostering the “traditional delivery system of social studies content, where laptops replace notebooks, where PowerPoint slides replace handwritten overheads, where e-textbooks replace hard copy textbooks, then we will be no closer to the NCSS vision of transformative, powerful social studies instruction,” (p.75). In summary, the integration of technology within a traditional instructional model cannot achieve NCSS goals. An effective framework for integrating the technology into social studies instruction is

therefore needed, they say, where the technology is not the key itself, but rather “how technology can be used as a developmental tool to encourage responsible citizenship,” (p. 87).

Therefore, a paradigm shift in pedagogical strategies must occur before substantial, positive change can be observed in the classroom. The NCSS (2016) made conceptual changes regarding the best teaching methods for social studies classrooms, asserting that the application of technology within a constructivist teaching approach could be an effective way to create a powerful learning environment. Doolittle and Hicks (2014) argued that this integration must start with “implementing an aligned constructivist philosophy, theory, and pedagogy in pursuit of the development of critically minded global citizens,” (p. 97). Indeed, technology seems ideally suited to constructivist learning approaches (Ayas, 2006; Doolittle & Hicks, 2003; Rice & Wilson, 1999; White, 1998; Heafner & Friedman, 2008). Thus, using technology steeped in constructivist principles could provide effective guidance for social studies teachers.

Learning theories are the lens that educators use to unpeel the advantages and possibilities of all technological innovations and developments and how to adapt this technology to achieve learning outcomes, and develop learners’ experiences and knowledge. AR is one of the technologies that have been explored through learning theories. Learning theories emphasized on the potentials of the AR technology to enhance learning through the process of design and development of instructions and learning experiences by utilizing the immersive, interactive, and engaging features of the AR technology.

For instance, Constructivism theory of learning is one of the learning theories that is commonly used to design and develop experiences associated with AR affordances. For example, Najmi et al. (2023) explored the unique features of the AR technology to design and develop a sustainable environment based on AR technology within educational facilities to orient adult learners about the dangers of online gaming. To design this AR environment, the authors focused on the constructivist theory because of the possibilities which make the learners in a state of constant activity of building their knowledge through the activities provided by the AR application (Najmi et al., 2023). Another

example comes from Zhao et al. (2023) who provided an empirical evidence on how to utilize the affordance of AR based mobile photography to improve learning and reduce cognitive load to achieve better emotional state. Zhao et al. (2023) provided a thorough literature review of the cognitive learning theory as a window to utilize the AR technology. Furthermore, Wang (2022) wrote a chapter on how to design and develop full interactive experiences for digital learning exhibit and engaging students to achieve learning outcomes through utilizing social learning instructional principles.

Therefore, learning theories are the umbrella under which educators can design and develop instructional strategies and learning experiences by aligning the affordances of the chosen technology and the targeted learning outcomes. In this study, the authors decided to design and develop instructional considerations through the lens of constructivism theory because it aligns with our study objectives to create an effective learning environment. It is important to highlight that there is no learning theory better than another to explore the AR technology; it depends on the goals (learning outcomes) of the study.

Technology can be integrated with constructivism via collaborative problem-solving, linking learning to learner experiences, and encouraging student construction of knowledge and meaningful learning (Berson et al., 2000; Doolittle & Hicks, 2012; Ray, Faure, & Kelle, 2013; Doolittle, 2001). Furthermore, the NCSS suggested (NCSS, 1994) that integrating technology into a social studies classroom is a practical way to involve learners with authentic problem-solving/decision-making contexts. Research evidence also shows that technology can successfully develop higher-order thinking skills, such as authentic problem definition, information evaluation, problem-solving, and drawing suitable deductions (Valtonen et al., 2022; Laney, 1990).

### **Decision Point: Channeling the Literature Review to Develop AR Instructional Considerations**

Reflecting upon the issues above, the researchers decided to address the perceived gap in the literature by developing a set of AR instructional

considerations, based upon constructivist learning principles, to assist social studies teachers with their integration of technology into their educational practice. To achieve this goal, they carefully reviewed AR technological affordances, along with the theoretical bases for applying such technology, and funneled that knowledge into the developed considerations. This paper aims to provide a clear pathway for implementing AR technology, from a pedagogical perspective, in support of student learning. In this section, we review constructivist learning principle selection and discuss AR affordances.

In order to determine the theoretical guidelines for optimal technology use in social studies classrooms, we analyzed the literature review, selecting ten key constructivist principles (see Table 1) to apply.

**Table 1**

*Key constructivist principles for optimizing classroom technology use*

#	Principle	Description	Supported Studies
1	Inquiry	Using technology as a tool for critical social studies inquiry.	Saye & Brush, 1999; Doolittle & Hicks, 2012; Berson et al., 2000 Liu & Zhu, 2008; Ayas, 2006; Acikalin & Duru, 2005; Ray, Faure, & Kelle, 2013; Crocco, 2001; Doolittle, 2001
2	Critical Thinking	Technology must offer opportunities for students to demonstrate critical thinking.	White, 1999; Rice & Wilson, 1999; Heafner & Friedman, 2008 Berson et al., 2000; Ayas, 2006 Crocco, 2001; Ray et al., 2013
3	Construction of Knowledge	Technology should facilitate construction of knowledge by building links between new and existing knowledge.	Rice & Wilson, 1999 Doolittle & Hicks, 2012 Heafner & Friedman, 2008 Liu & Zhu, 2008 Ray, Faure, & Kelle, 2013 Doolittle, 2001

**Cont. Table 1***Key constructivist principles for optimizing classroom technology use*

#	Principle	Description	Supported Studies
4	Authentic Experience	Using technology to provide students with real world contextual experience; achievable via (a) authentic inquiry, and (b) authentic materials.	Doolittle & Hicks, 2012; Berson et al., 2000; Liu & Zhu, 2008
5	Collaboration	Technology is used in group-based, cooperative learning activities.	Rice & Wilson, 1999; Berson et al., 2000; Doolittle & Hicks, 2012 Ray et al., 2013; Doolittle, 2001
6	Communication	Technology must facilitate different communication modes (verbal, written, audio,..)	Heafner & Friedman, 2008; Berson et al., 2000; Ray et al., 2013; Doolittle, 2001
7	Multiple Perspectives	Technology must provide opportunities for students to socially interact with others to view multiple perspectives of people and events.	Doolittle & Hicks, 2012; Liu & Zhu, 2008; Ray et al., 2013
8	Feedback	Technology must provide opportunities for students to assess constructed knowledge.	Heafner & Friedman, 2008; Doolittle, 2001
9	Autonomous	Technology should encourage students to be academically independent - i.e. to think and act autonomously.	Berson et al., 2000; Doolittle & Hicks, 2012; Ayas, 2006; Acikalin & Duru, 2005; Ray et al., 2013
10	Student-Centered Learning	Teachers are facilitators of knowledge rather than transformers.	Rice & Wilson, 1999; Hicks, Doolittle, & Lee, 2004; Heafner & Friedman, 2008; Ayas, 2006; Acikalin & Duru, 2005 Ray et al., 2013; Crocco, 2001

In this literature review, the second author learned that Wu et al. (2013) had performed an analysis of AR affordances based upon an extensive literature review, and their results fitted this study's purpose. It should be noted here that the analysis which Wu et al. (2013) performed consolidated results into just five AR affordances. However, the authors of this study chose to tease some of those groupings apart to more precisely fit their chosen constructivist principles, yielding the eight affordances summarized in Table 2.

**Table 2***AR Affordance Summary*

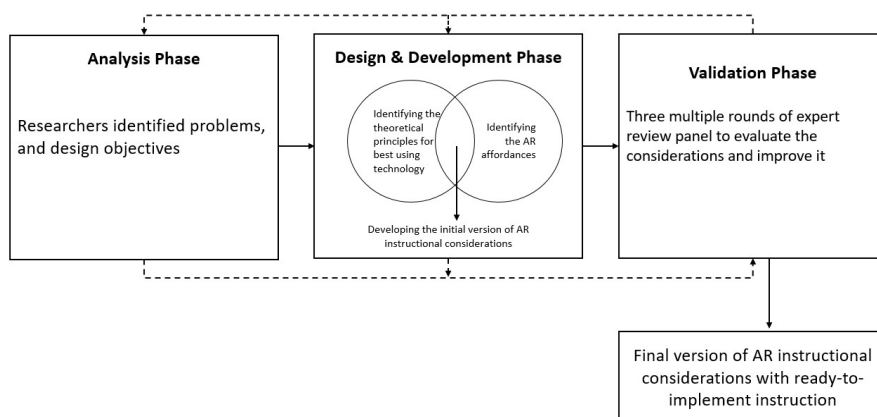
#	Affordances	Description
1	Learning Content With 3D Perspectives	AR enables students to interact with synthetic 3D objects
2	Ubiquitous Learning Opportunities	Students can use their handheld device (e.g. a smart phone) with an internet connection to access AR materials almost anytime and anywhere.
3	Collaborative Learning	Students share identical virtual experiences, enabling teachers to facilitate their social interaction by encouraging students to collaborate in discussion and task completion.
4	Situated Learning	AR allows students to interpret information in an authentic learning context and construct their own knowledge.
5	Sense of Presence and Immersion	AR provides a subjective feeling, and a perception of being both physically and emotionally in a non-physical world. AR provides students with a sense of being in a virtual community.
6	Sense of Immediacy	AR can include real-time feedback and provide verbal and nonverbal cues to foster student sense of immediacy.
7	Visualizing the Intangible	AR can visualize concepts, unobservable phenomena, and historical events.
8	Bridging Formal and Informal Learning	AR connects science inside the classroom to the virtual learning experiences AR offers.

## Methodology

This study adopted ADDIE instructional design model (Richey & Klein, 2007) to develop a set of considerations for social studies teachers to integrate AR technology within their classroom activities (see Figure 1). The descriptive analytical approach was used in all steps of the research. Research involving instructional design is classified as either: a) model development, b) model validation, or c) model usage. The authors employed both (a) and (b) as follows:

**Figure 1.**

### *Research methodology*



## Procedures

The researchers applied the ADDIE model to construct their AR instructional considerations. The following passages outline this process:

### Analysis Phase

The researchers began by first defining the problem and subsequent need for this study. As mentioned before, many social studies teachers fail to integrate AR effectively into their instruction due to the lack of clear implementation guidelines (Salira et al., 2022; Tiede et al., 2023). Therefore, this study developed a set of instructional considerations for social studies teachers to best integrate AR technology based on constructivist learning principles into their classroom practices.

## Design and Development Phase

This stage involved the following three steps:

**Step 1: Identify appropriate constructivist learning principles.** The first author reviewed the literature to find the best theoretical basis for applying technology in a social studies classroom. Constructivism proved ideal and, with this established, the first author then selected which constructivist learning principles would best form a theoretical foundation for developing AR instructional considerations.

**Step 2: Identifying AR Affordances.** In this phase, the second author analyzed the literature review to identify AR affordances, finding that Wu et al. (2013) provided a succinct description.

**Step 3: Operationalization.** Both authors then endeavored to blend the identified AR affordances with constructivist principles to develop an initial set of AR instructional considerations. The authors included a sample instruction embodying their work to help social studies teachers understand how to apply the considerations effectively in their practice.

## Validation Phase

The authors chose the expert review method to disseminate their work; this widely applied technique is useful for evaluating and revising a test instruction to improve its effectiveness (Richey & Klein, 2007). This study employed two evaluation rounds, with experts providing comments/suggestions to improve the considerations after each iteration.

In total, twelve experts (see table 3) reviewed the initial AR instructional considerations, with equal numbers specializing in one of the following four domains: 1) instructional design and development, 2) using technology-based theory in social studies classrooms, 3) AR technology and education, and 4) teaching social studies. The three instructional design experts focused on guideline design quality and how/whether it met intended purposes. The technology-based theory experts evaluated whether the guidelines meshed well with constructivist theory. The AR experts delved into how well the guidelines accommodated the affordances, benefits, and limitations related to

teaching with AR. And finally, three social studies teachers provided feedback regarding guideline understandability and whether they could reasonably apply them when developing instructions.

**Table 3***Expert Profiles*

Expertise Area	Expert	Gender	Years of Experience	Degree	Specialization
Instructional design and development	Expert 1	M	11	PhD	Instructional design and technology
	Expert 2	M	20	PhD	Application of learning theories to instructional products
	Expert 3	F	8	PhD	Developing technological materials and products
Technology-based theory in social studies classroom	Expert 4	M	29	PhD	Social constructivism theory, technology, and social studies
	Expert 5	F	10	PhD	Technology integrated learner-centric pedagogical approaches & social studies education
	Expert 6	M	21	PhD	Social Constructivism and social studies education
AR technology and education	Expert 7	M	7	PhD	Integration of AR technology in education
	Expert 8	F	12	PhD	Developing AR instruction
	Expert 9	M	15	PhD	Applying AR technology to support student achievement.
Social Studies Teaching	Expert 10	F	12	BA	History teacher for grades 10-12
	Expert 11	F	18	BA	Geography teacher for grades 10-12
	Expert 12	M	23	BA	Social studies teacher for grades 6-9

**Evaluation protocol.** The evaluation protocol consists of two phases, as the follow:

**Phase 1.** The researchers e-mailed potential reviewers, inviting their participation. Each expert received a study overview, the AR instructional considerations, and a survey weblink. After reviewing the consideration set, the experts completed the online open-ended survey.

For confidentiality, the researchers assigned each participant a pseudonym and thoroughly masked potential identifiers. The survey's design evolved from the ten constructivist theory principles plucked from the literature review. Further, the survey was carefully carried out to avoid limiting responses solely to each participant's identified area of expertise, thus capturing as much practical data as possible during the review process. The survey comprised two major sections. One focused on how effectively each constructivist principle was adapted within the considerations and how AR affordances supported these principles (e.g. do you think the following considerations help to facilitate collaboration? If not, why? And if so, in what ways?), while the other asked reviewers to assess the overall design and applicability of said considerations (e.g. Do you think the previous considerations are clear and understandable for teachers?").

**Data Analysis.** Following participants' survey completion, the researchers proceeded to analyze the feedback and revise the consideration set accordingly. The researchers employed the constant comparative analysis method (Glaser & Strauss, 1967) to analyze the data, allowing for a systematic comparison of each reviewer's comments and suggestions with other relevant data.

**Phase 2.** The researchers distributed the revised AR instructional considerations to reviewers via a survey link that consisted of two sections, following a rubric format. The first section prompted experts to rate the extent to which the AR instructional considerations facilitated constructivist learning principles. The second section sought ratings on the design and language of the considerations. By utilizing a rubric, an objective method was employed to assess the quality of the final version of the AR instructional considerations. This approach provided clear and structured criteria for evaluating the considerations,

saving time, and mitigating the risk of overlooking crucial aspects during the evaluation process.

***Rubric Analysis.*** The analysis of the rubric involved employing two methods: 1) basic descriptive statistics, and 2) one-way ANOVA. Basic descriptive statistics were used to calculate the mean, mode, and standard deviation of the numerical scale responses (ranging from 1 to 3) provided by each expert. This allowed for a mathematical examination of the differences between the experts' responses, following logical reasoning (Morrell & Carroll, 2010). Additionally, the one-way ANOVA test was utilized to compare the means of each criterion across different groups, including instructional design experts, technology-based social studies experts, AR technology in education experts, and social studies teachers.

### ***Validity and Reliability***

To ensure the validity and reliability of the data obtained from experts, several techniques were employed. First, a comparative analysis method was utilized to analyze the open-ended questions. This approach helped to identify similarities and differences among the experts' input and provided a comprehensive understanding of their perspectives. Second, analytic memos were used by the researchers to record their reflections on the different phases of AR instructional considerations development. These memos served as a tool to track the researchers' thoughts, insights, and progress throughout the research process. Third, a rubric was employed to ensure the quality of the revised AR instructional considerations. The use of a rubric made the evaluation process transparent by explicitly outlining the criteria for assessment and communicating the objectives of the AR instructional considerations to the evaluators.

## **Results**

### **Findings from the Analysis Phase**

The authors analyzed the literature review to identify the problem and subsequent need for this study. As mentioned, this need emerged from AR's demonstrated significant potential for improving the way we learn and teach.

Indeed, AR can make social studies instruction interactive, fun, and engaging - thus improving student outcome. However, many social studies teachers fail to integrate AR effectively into their instruction due to the lack of clear implementation guidelines (Salira et al., 2022; Tiede et al., 2023). Therefore, this study developed a set of instructional considerations for social studies teachers to best integrate AR technology-based on constructivist learning principles into their classroom practices.

### **Findings from Design and Development Phase**

Once they had identified a problem and selected the model development approach to address it, the researchers then created an initial set of AR instructional considerations. Development of these considerations arose from a comprehensive academic literature review covering both AR affordances and constructivist principles for optimal technology application in social studies classrooms. The researchers identified ten constructivist principles (see Table 1) and eight AR affordances (see Table 2) which then allowed them to build the AR instructional considerations to demonstrate their use.

### **Findings from Evaluation Stage**

The expert review panel evaluated and provided feedback for the AR instructional consideration set. The evaluation stage consisted of two rounds, as follows:

#### ***Expert Review Round I***

The researchers sent their initial set of AR instructional considerations to the review panel, where the experts read them carefully before filling out a related open-ended survey form online. The reviewers, then, provided detailed answers, as represented in Table 4.

**Table 4***Expert feedback from Round 1*

Themes	Feedback	Statement
<b>Consideration Design</b>		
<b>Layout</b>	Reorganize the table	“Start with constructivist principles, then AR affordances...”
	Reorder the considerations	“I think you need to re-order the considerations to start with inquiry, construction of knowledge, ...”
	Use one table for considerations	“Too many tables... you can merge them into one.”
<b>Consideration Content</b>		
<b>Definitions</b>	Explain each principle and affordance clearly.	“I think you need to explain each affordance and principle for teachers by adding simple descriptions.”
	Create a separate table for definitions	“The definitions of AR affordances are repeated too frequently... I suggest using a separate table to explain these affordances”
<b>Consideration Explanations</b>	Improve some considerations to better integrate AR affordances with constructivist learning principles.	“Some considerations focus on one aspect, either AR affordances or constructivist learning principles... for example the first consideration focuses on AR affordances without mentioning the inquiry principle.”
	Add collaborative learning affordance to support inquiry principle.	“there is a need to add a collaborative learning affordance to the inquiry principle”
	Add the formal and informal learning affordance to the construction of knowledge principle	“Why not add the formal and informal learning affordance to the construction of knowledge principle?”
	Add the sense of immediacy affordance to autonomy	“The sense of immediacy affordance focuses on a student’s immediate feedback via experience. This helps to improve autonomy...”

**Cont. Table 4***Expert feedback from Round I*

Themes	Feedback	Statement
	Add authentic inquiry to considerations to satisfy the authentic experience principle	“In authentic experience, there is a need to mention authentic inquiry.”
	Add learning content with a 3D perspective affordance to satisfy multiple perspectives principle	“Using content in 3D perspectives is a good way for supporting the multiple perspective principal.”

All expert reviewer’s comments and suggestions were followed, where the researchers updated the initial set of AR instructional considerations accordingly.

***Expert Review Round II***

The researchers sent the revised set of AR instructional considerations again to the experts, with an online survey link. The online survey had a rubric to evaluate revised AR instructional considerations. The rubric focused on two areas: (1) Is the design of the AR instructional considerations set clear and understandable?, and (2) Does following the AR instructional considerations set by teachers help to use AR effectively to facilitate constructivist learning? The panel then reviewed the revised document and completed the accompanying survey. The expert reviewers made score for each constructivist learning criteria from 1 to 3. Table 5 shows basic descriptive statistics for round II.

**Table 5***Basic Descriptive Statistics for Round II*

Area	Criteria	Mean	Mode	SD
Design	Layout and structure	2.16	2	0.38
	To what extent is the structure and layout of the AR instructional considerations set well-organized?			
	Language	2.25	2	0.45
	To what extent is the language of the AR instructional considerations set clear and understandable?			
	Overall	2.20	2	0.42
	Criteria	Mean	Mode	SD
Inquiry	Inquiry	2.08	2	0.51
	To what extent will the following AR instructional considerations set help teachers facilitate inquiry when using AR?			
	Critical Thinking	2.50	2	0.52
	To what extent will the following AR instructional considerations set help teachers develop critical thinking skills when using AR?			
	Construction of Knowledge	2.25	2	0.45
Content	To what extent will the following AR instructional considerations set help teachers develop construction of knowledge when using AR?			
	Authentic Experience	2.58	3	0.51
	To what extent will the following AR instructional considerations set help teachers create authentic experience when using AR?			
	Collaboration and Communication	2.41	2	0.51
	To what extent will the following AR instructional considerations set help teachers facilitate collaboration and communication when using AR?			

**Cont. Table 5***Basic Descriptive Statistics for Round II*

Area	Criteria	Mean	Mode	SD
Content	Multiple Perspectives	2.08	2	0.51
	To what extent will the following AR instructional considerations set help teachers facilitate multiple perspectives when using AR?			
	Feedback	2.25	2	0.62
	To what extent will the following AR instructional considerations set encourage teachers use feedback when using AR?			
	Autonomous and student-centered learning	2.58	3	0.51
	To what extent will the following AR instructional considerations set help teachers facilitate autonomous and student-centered learning when using AR?			
Overall		2.34	2	0.46

Table 5 shows the basic descriptive statistics for Round II. Experts rated each criteria from 1 (low) to 3 (high). It can be noted that all criteria in both areas design and content received high scores. In the design area, both the layout and language criteria received scores of 2.16 and 2.25, respectively. The mode scores for both criteria were 2, and the standard deviation was below 1.00. In the content area, all criteria received scores above 2.00, with a mode of 2.00 and a standard deviation below 1.00. The criteria of authentic experience and autonomous and student-centered learning received higher scores than the other criteria, with a mean of 2.58 and a mode of 3.00, and a standard deviation below 1.00. Overall, the scores indicate that the revised AR instructional considerations set achieved good and acceptable scores in all criteria. The results of the one-way ANOVA analysis indicate that there were no significant statistical differences (all p-values > .05) between the scores of the expert groups for all the criteria evaluated.

## Final Version of AR Instructional Considerations

The finalized set of AR instructional considerations is shown in Table 6.

**Table 6**

*AR Instructional Considerations (Final Version)*

Principle	AR Affordances	Instructional consideration
Inquiry	Situated Learning	1. Structure the AR instruction with a collaborative, inquiry-based learning approach (e.g. problem-based learning or project-based learning) in which students work together to produce new knowledge to achieve a shared goal by solving a problem, creating a project, or making an informed decision.
	Collaborative Learning	
Construction of Knowledge	Situated Learning	2. Design AR activities which require students to connect new knowledge with what they already know.
	Collaborative Learning	3. Present information learned in class in multiple authentic experience, text, audio, or image to build the pieces of information.
	Formal and Informal Learning	4. Allow learners to collaborate in the AR instruction to construct shared knowledge.
Critical Thinking	Situated Learning	5. Include AR instruction questions, such as analysis, synthesis, and inference, to encourage students to think critically in their acquisition of new knowledge via authentic experience.
	Learning Content Has 3D Perspectives	6. Include AR instruction 'sum it up' activities, which allow students to post (and listen to peers) about what they learned from 3D content.
Collaboration	Collaborative Learning	7. Provide learners with opportunities to collaborate and share related media about a subject with their peers.
	Learner Sense of Immediacy	8. Give learners an online or offline space to discuss their experiences and share their input.

**Cont. Table 6***AR Instructional Considerations (Final Version)*

<b>Principle</b>	<b>AR Affordances</b>	<b>Instructional consideration</b>
Communication	Collaborative Learning Learner Sense of Immediacy	9. Include AR design channels, which give learners opportunities to communicate with peers and teachers via face-to-face discussion or text.
Authentic Experience	Bridging Formal and Informal Learning Visualizing the Invisible Learner Sense of Presence and Immersion	11. Use AR in historical events, and some of geographical phenomena, to enable students to both physically and emotionally 'live' an experience. 12. Employ classroom-learned concepts and information in a virtual experience. 13. Use authentic inquiry (e.g. real-world issues) and allow students to explore it.
Multiple Perspectives	Collaborative Learning Learner Sense of Immediacy Learning Content Has 3D Perspectives	14. Design the learning experience in a way, which allows learners to send questionnaires, ask questions and engage socially with others in society. 15. Allow learners to discuss their thoughts with others via communication features. 16. Ask students to present their feelings, opinions, and comments about content they have seen.
Autonomous	Situated Learning Sense of immediacy	17. At the beginning, let the learners know that they are independent in this AR learning experience. 18. Include AR instruction activities, which require learners to complete self-assessment and peer review forms.
Student-Centered Learning	Situated learning	19. Work as a facilitator of knowledge and guide students to achieve their learning goals. 20. Provide learners with responsibility for their learning, so they interact with a virtual experience to solve a problem or take an informed decision.

## Discussion and Conclusion

In this study, the authors developed instructional considerations for AR to guide social studies teachers in effectively creating interactive learning environments. As previously mentioned, the researchers conducted a literature review to identify the best theoretical foundation for integrating technology in social studies education, specifically constructivist learning principles, and the affordances of AR (Doolittle & Hicks, 2003). The resulting AR instructional considerations set was then validated through two rounds of expert review panels. The findings from the validation phases helped to enhance the effectiveness of the considerations set by incorporating feedback on both constructivist learning principles and instructional design. The revised AR instructional considerations set holds great promise for facilitating constructivist learning in social studies classrooms.

By following the AR instructional considerations set, teachers can create a collaborative, inquiry-based learning environment, which is a key element of constructivism (Tiede et al., 2023). This approach encourages students to become active learners under the guidance of their teachers, who scaffold their learning through encouragement and coaching (Kyza & Georgiou, 2019). It also provides opportunities for students to construct their own knowledge and become part of a community where they share goals, interests, and ideas, while working together to collect and analyze information in authentic experiences (Saliera et al., 2022). By adhering to these considerations, students can gain new insights, interact socially, improve critical thinking skills, and reap the benefits of working towards a common goal (Brown et al., 1993). Group discussions facilitated by these considerations expose students to different perspectives and encourage debate and revision based on feedback. Further, this approach also helps students learn from their mistakes and build shared meaning. The considerations set also supports the construction of knowledge, as students work in small groups and utilize inquiry skills to solve authentic inquiries.

The present study established a set of considerations to help social studies teachers embed AR technology coherently within their instruction. The researchers developed these considerations by integrating AR affordances with

constructivist learning theory. As such, this paper offers a unique contribution to the field by forging a clear link between the theoretical principles of constructivism and the affordances of AR technology.

Moreover, this research focused mainly on the conceptual educational affordances of AR technology without delving too deeply into the technology itself, since educators only need understand its implementation based upon what it can provide, rather than focus upon its functionality as a computer scientist might. The developed instructional considerations can be used both by serving social studies teachers and faculty members working in pre-service teacher preparation programs at tertiary education institutions. These considerations provide educators with insight, based upon learning theory, regarding how to implement AR technology within their classrooms.

Findings from this study have both theoretical and practical implications. Regarding the former, the successful application of the ADDIE model with two rounds of expert review contributes directly to the knowledge base for design and developmental research (Richey & Klein, 2014). Using ADDIE within this study's research methodology aligns well with the design and development of new instructional tools and solutions. Furthermore, the model meshes with the selected theoretical framework. This application builds solid ground for future design and developmental research seeking solutions generated from a constructivist theoretical base. As for the study's practical implications, the considerations developed in this study are particularly relevant to both in-service and pre-service social studies teachers, providing practical guidance to help them integrate AR- based on constructivist learning principles in their classroom practices. Besides, these considerations will help teachers blend AR within their curricula as an appropriate and meaningful tool for building student critical thinking skills via authentic experience, rather than the technology simply serving as an amusing, but out-of-context gimmick. Moreover, policymakers and educational stakeholders can create a guidance sheet that has all these considerations to help teachers use AR in their classrooms.

Despite the positive findings this study revealed, there are some limitations, as might be expected. Firstly, these considerations have not

been tested in real-world situations to assess their effectiveness in teaching and learning. Thus, future research must measure the external validation of these considerations on students' learning. Secondly, the considerations developed were specific to the context of social studies classrooms and may not be applicable to other subjects and teaching settings. Finally, while the considerations may be well-developed; however, implementing them in classrooms can pose some challenges. For example, many factors such as availability of resources, AR content, and teacher experience may impact the successful adoption of these considerations.

### **Conflict of Interest Declaration**

None.

### **Funding**

The authors received no financial support for the research, authorship, or publication of this article.

### **References**

- Acikalin, M., & Duru, E. (2005). The use of computer technologies in the social studies classroom. *Turkish Online Journal of Educational Technology-TOJET*, 4(2), 18-26.
- Ayas, C. (2006). An Examination of the Relationship between the Integration of Technology into Social Studies and Constructivist Pedagogies. *Turkish Online Journal of Educational Technology-TOJET*, 5(1), 14-25.
- Bennett, L. (2005). Guidelines for using technology in the social studies classroom. *The Social Studies*, 96(1), 38-40.
- Berson, M., Diem, R., Hicks, D., Mason, C., Lee, J., & Dralle, T. (2000). Guidelines for using technology to prepare social studies teachers. *Contemporary issues in technology and teacher education*, 1(1), 107-116.
- Braun Jr, J. A. (1999). Ten ways to integrate technology into middle school social studies. *The Clearing House*, 72(6), 345-351.

- Brush, T., & Saye, J. (2009). Strategies for preparing preservice social studies teachers to effectively integrate technology: Models and practices. *Contemporary issues in technology and teacher education*, 9(1), 46-59.
- Cai, S., Liu, E., Shen, Y., Liu, C., Li, S., & Shen, Y. (2020). Probability learning in mathematics using augmented reality: impact on student's learning gains and attitudes. *Interactive Learning Environments*, 28(5), 560-573.
- Carmigniani, J., & Furht, B. (2011). Augmented reality: an overview. *Handbook of augmented reality*, 3-46.
- Challenor, J., & Ma, M. (2019). A review of augmented reality applications for history education and heritage visualisation. *Multimodal Technologies and Interaction*, 3(2), 39.
- Chang, H. Y., Binali, T., Liang, J. C., Chiou, G. L., Cheng, K. H., Lee, S. W. Y., & Tsai, C. C. (2022). Ten years of augmented reality in education: A meta-analysis of (quasi-) experimental studies to investigate the impact. *Computers & Education*, 191, 104641.
- Creswell, J. W., Hanson, W. E., Clark Plano, V. L., & Morales, A. (2007). Qualitative research designs: Selection and implementation. *The counseling psychologist*, 35(2), 236-264.
- Crocco, M.S. (2001). Leveraging constructivist learning in the social studies classroom. *Contemporary Issues in Technology and Teacher Education* [Online serial], 1(1), Available: <http://www.citejournal.org/vol1/iss3/currentissues/socialstudies/article2.htm>
- Diem, R. A. (2002). An Examination of the Effects of Technology Instruction in Social Studies Methods Classes.
- Doolittle, P. E. (2001). The need to leverage theory in the development of guidelines for using technology in social studies teacher preparation: A reply to Crocco and Mason et al. *Contemporary Issues in Technology and Teacher Education*, 1(4), 501-516.
- Doolittle, P. E., & Hicks, D. (2003). Constructivism as a theoretical foundation for the use of technology in social studies. *Theory & Research in Social Education*, 31(1), 72-104.

- Drljević, N., Wong, L. H., & Botički, I. (2017). Where does my Augmented Reality Learning Experience (ARLE) belong? A student and teacher perspective to positioning ARLEs. *IEEE Transactions on Learning Technologies*, 10(4), 419-435.
- Gang Zhao, Lina Zhang, Jie Chu, Wenjuan Zhu, Biling Hu, Hui He & Li Yang (2023) An Augmented Reality Based Mobile Photography Application to Improve Learning Gain, Decrease Cognitive Load, and Achieve Better Emotional State. *International Journal of Human-Computer Interaction*, 39(3), 643-658. DOI: 10.1080/10447318.2022.2041911
- Garzón, J. (2021). An overview of twenty-five years of augmented reality in education. *Multimodal Technologies and Interaction*, 5(7), 37.
- Heafner, T. L., & Friedman, A. M. (2008). Wikis and constructivism in secondary social studies: Fostering a deeper understanding. *Computers in the Schools*, 25(3-4), 288-302.
- Hicks, D., Doolittle, P., & Lee, J. (2002). Information technology, constructivism, and social studies teacher education. *In Society for Information Technology & Teacher Education International Conference* (pp. 2185-2186). Association for the Advancement of Computing in Education (AACE).
- Hicks, D., Lee, J. K., Berson, M., Bolick, C., & Diem, R. (2014). Guidelines for using technology to prepare social studies teachers. *Contemporary Issues in Technology and Teacher Education*, 14(4), 433-450.
- Hugues, O., Fuchs, P., & Nannipieri, O. (2011). New augmented reality taxonomy: Technologies and features of augmented environment. *In Handbook of augmented reality* (pp. 47-63). Springer, New York, NY.
- Krutka, D. G., Heath, M. K., & Mason, L. E. (2020). Technology won't save us—A call for technoskepticism in social studies. *Contemporary Issues in Technology and Teacher Education*, 20(1), 108-120.
- Kyza, E. A., & Georgiou, Y. (2019). Scaffolding augmented reality inquiry learning: The design and investigation of the TraceReaders location-based, augmented reality platform. *Interactive Learning Environments*, 27(2), 211-225.

- Laney, D. (1990). Micro Computers and Social Studies. *OCSS Rewiev*, 26, 30-37.
- Lim, K. Y., & Lim, R. (2020). Semiotics, memory and augmented reality: History education with learner-generated augmentation. *British Journal of Educational Technology*, 51(3), 673-691.
- Liu, S., & Zhu, X. (2008). Designing a structured and interactive learning environment based on GIS for secondary geography education. *Journal of Geography*, 107(1), 12-19.
- Morrell, P. D., & Carroll, J. B. (2010). *Conducting educational research: A primer for teachers and administrators*. Brill.
- Nadolny, L. (2017). Interactive print: The design of cognitive tasks in blended augmented reality and print documents. *British Journal of Educational Technology*, 48(3), 814-823.
- Najmi, A. H., Alhalafawy, W. S., & Zaki, M. Z. T. (2023). Developing a Sustainable Environment Based on Augmented Reality to Educate Adolescents about the Dangers of Electronic Gaming Addiction. *Sustainability*, 15(4), 3185. MDPI AG. Retrieved from <http://dx.doi.org/10.3390/su15043185>
- National Council for the Social Studies. (1994). *Expectations of excellence: Curriculum standards for the social studies*. Washington, DC: NCSS
- National Council for the Social Studies. (2006). *Technology position statement and guidelines: A position statement of national council for the social studies*. Retrieved from <http://www.socialstudies.org>
- National Council for the Social Studies. (2016). *Global and international education in social studies*. [https://www.socialstudies.org/positions/global\\_and\\_international\\_education](https://www.socialstudies.org/positions/global_and_international_education)
- Okojie, M. C., Olinzock, A. A., & Okojie-Boulder, T. C. (2006). The pedagogy of technology integration. *Journal of technology studies*, 32(2), 66-71.
- Palloff, R. M., & Pratt, K. (1999). *Building Learning Communities in Cyberspace: Effective Strategies for the Online Classroom*. *Jossey-Bass Higher and Adult Education Series*. Jossey-Bass Publishers, 350

Sansome Street, San Francisco, CA 94104.

- Raghaw, M., Paulose, J., & Goswami, B. (2018). Augmented reality for history education. *International Journal of Engineering and Technology (UAE)*, 7(2.6), 121-125.
- Ray, B., Faure, C., & Kelle, F. (2013). Using social impact games (SIGS) to support constructivist learning: Creating a foundation for effective use in the secondary social studies education. *American Secondary Education*, 60-70.
- Rice, M. L., & Wilson, E. K. (1999). How technology aids constructivism in the social studies classroom. *The Social Studies*, 90(1), 28-33.
- Richey, R. C., & Klein, J. D. (2014). Design and development research. *In Handbook of research on educational communications and technology* (pp. 141-150). Springer, New York, NY.
- Salira, A. B., Logayah, D. S., Darmawan, R. A., & Tianti, T. (2022). Development of the Augmented Reality Model (DISMUS) as Social Studies Digital Learning Media. *Heritage*, 3(2), 176-190.
- Tiede, J., Förster, K., Grafe, S., & Mangina, E. (2023). Augmented Reality in Primary Education: Teachers' Perspectives on Potential and Barriers. In *Inted 2023 Proceedings* (pp. 1283-1292). IATED.
- Valtonen, T., López-Pernas, S., Saqr, M., Vartiainen, H., Sointu, E. T., & Tedre, M. (2022). The nature and building blocks of educational technology research. *Computers in Human Behavior*, 128, 107123.
- Wang, Q.Q. (2022). Designing an Interactive Science Exhibit: Using Augmented Reality to Increase Visitor Engagement and Achieve Learning Outcomes. In: MacDowell, P., Lock, J. (eds) *Immersive Education*. Springer, Cham. [https://doi.org/10.1007/978-3-031-18138-2\\_2](https://doi.org/10.1007/978-3-031-18138-2_2)
- Wang, Y., Wu, Y., Chen, C., Wu, B., Ma, S., Wang, D., ... & Yang, Z. (2022). Inattention blindness in augmented reality head-up display-assisted driving. *International Journal of Human-Computer Interaction*, 38(9), 837-850.

- Wasko, C. (2013). What teachers need to know about augmented reality enhanced learning environments. *TechTrends*, 57(4), 17-21.
- White, C. (1998). Technology, CD-ROM atlases, and social studies. *Southern Social Studies Journal*, 23(2), 11-22.
- Whitworth, S. A., High, G. S., & Berson, M. J. (2003). Computer technology in the social studies: An examination of the effectiveness literature. *In Contemporary Issues in Technology and Teacher Education*, 2 (4). Retrieved March 6, 2004, from <http://www.citejournal.org/vol2/iss4/socialstudies/article1.cfm>.
- Willis, J., & Wright, K. E. (2000). A general set of procedures for constructivist instructional design: The new R2D2 model. *Educational Technology*, 40(2), 5-20.
- Wu, H. K., Lee, S. W. Y., Chang, H. Y., & Liang, J. C. (2013). Current status, opportunities and challenges of augmented reality in education. *Computers & education*, 62, 41-49.

# تطوير مجموعة من الاعتبارات التعليمية لاستخدام تقنية الواقع المعزز في ضوء مبادئ نظرية التعلم البنائي في تدريس مادة الاجتماعيات

د. هدى سالم العازمي<sup>1</sup> د. غدير محمد المطيري<sup>2</sup>

كلية التربية - جامعة الكويت

دولة الكويت

## الملخص

**الأهداف:** على الرغم من الاهتمام المتزايد بعملية دمج تقنيات الواقع الافتراضي في تدريس مادة الاجتماعيات، إلا أن هناك قصوراً واضحاً في معرفة كيفية دمج التقنيات الافتراضية في الفصول الدراسية؛ لذلك هدفت هذه الدراسة إلى تطوير مجموعة من الاعتبارات التعليمية التي ترشد المعلمين إلى كيفية دمج تقنية الواقع المعزز في تدريس مادة الاجتماعيات. **المنهج:** اتبعت هذه الدراسة نموذج ADDIE لتطوير مجموعة من الاعتبارات التعليمية المبنية على أسس نظرية. **النتائج:** قام الباحثون بتطوير هذه الاعتبارات بناءً على تحليل الدراسات السابقة، وللتحقق من صدق هذه الاعتبارات تم عرضها على مجموعة من الخبراء بلغ عددهم 12 خبيراً، وقد قام الخبراء بمراجعة الاعتبارات التعليمية على جولتين مختلفتين، فقد تم بالجولة الأولى الإجابة عن استبانة تتضمن مجموعة من الأسئلة المفتوحة التي تهدف إلى تقييم تلك الاعتبارات وتعديلها، وتم في الجولة الثانية تقييم الاعتبارات التعليمية بعد التعديل بناءً على مجموعة من المعايير المحددة. **الخلاصة:** يتوقع أن توفر الاعتبارات التعليمية الناتجة من هذه الدراسة توجيهات تساعد معلمي مادة الاجتماعيات على دمج تقنيات الواقع المعزز في فصولهم الدراسية.

**الكلمات المفتاحية:** الواقع المعزز، النظرية البنائية، تدريس الاجتماعيات، التقنيات الافتراضية، الاعتبارات، التعليم.

- 1 أستاذ مساعد تدريس اجتماعيات بقسم المناهج وطرق التدريس. **الاهتمامات البحثية:** التعلم القائم على الاستقصاء، التعليم المعزز بالتكنولوجيا، التطوير المهني، المناهج وطرق تدريس الاجتماعيات. **الإيميل:** [huda.alazmi@ku.edu.kw](mailto:huda.alazmi@ku.edu.kw)
- 2 أستاذ مساعد تكنولوجيا التعليم بقسم المناهج وطرق التدريس. **الاهتمامات البحثية:** التعليم المعزز بالتكنولوجيا، التعليم العالي، التطوير المهني، تصميم التعليم، التعلم الإلكتروني. **الإيميل:** [Ghader.alemairy@ku.edu.kw](mailto:Ghader.alemairy@ku.edu.kw)

- سلم البحث في 2023/4/30، أجاز للنشر في 2023/6/14.

**To Cite:**

Alazmi, H., & Alemtairy, Gh. (2024). The Development of Instructional Considerations for Using Augmented Reality (AR) in Light of the Principles of Constructivism Learning Theory in Social Studies Classrooms. *The Educational Journal*, 38(151), 15 - 46.

<http://>