# INNOVATIVE STRATEGIES FOR CRITICAL THINKING: A QUASI-EXPERIMENTAL STUDY ON EDUCATIONAL GAMES AND CONCEPT CHECKING QUESTIONS IN MOROCCO

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**Abstract:** *This research examines the impact of educational games and Concept Checking Questions (CCQs) on the enhancement of critical thinking abilities in middle school pupils in Morocco. The study, conducted at TAZI School in Casablanca, compared two student groups: one group experienced new teaching strategies, such as educational games and CCQs, while the other got conventional instruction. The findings indicated that students using educational games and Concept Checking Questions exhibited notable improvement in their critical thinking skills, whereas those in the conventional training cohort saw a deterioration. These results emphasize the need to use interactive, student-centered pedagogical approaches to improve cognitive development and engagement in Moroccan education. The research emphasizes the possibility of using creative and inquiry-based methodologies, such as educational games and Concept Checking Questions, to enhance critical thinking among middle school students, providing significant insights for educators seeking to refine classroom procedures.*

**Keywords:** *educational games, concept checking questions (CCQs), critical thinking abilities*

## 1. Introduction

Critical thinking is universally acknowledged as an essential talent that students must possess to effectively traverse the intricacies of the 21st century. It encompasses the capacity to examine data, make logical judgments, and devise innovative solutions to problems. Developing critical thinking abilities is crucial in Moroccan middle schools to provide pupils with the necessary skills to tackle academic and real-life obstacles. Nevertheless, conventional instructional techniques sometimes fail to adequately cultivate these abilities, underscoring the want for inventive ways.

Recent educational research has examined many approaches to improve critical thinking, with a notable emphasis on the utilization of educational games. These interactive tools facilitate student engagement in learning tasks that necessitate problem-solving and decision-making, therefore fostering the development of critical thinking skills. Research has demonstrated that these games can establish a captivating educational setting that stimulates pupils and improves their cognitive abilities. Nevertheless, most of this research has been carried out in Western contexts, resulting in a lack of comprehension regarding their influence on Moroccan educational environments.

Empirical research has shown that the utilization of educational games in different educational settings leads to favorable results. For instance, Papastergiou's (2009) study revealed that educational games had a substantial impact on enhancing high school students' critical thinking and problem-solving skills. According to a study by Tobias, Fletcher, and Wind (2014), educational games were found to improve cognitive skills and increase engagement among middle school pupils. The results indicate that educational games have the potential to improve critical thinking abilities. However, most of the studies on this topic have been carried out in Western environments, which limits our knowledge of their effects in non-Western settings, like Morocco.

Despite a growing collection of literature on games for education, there is a dearth of research on their impact on critical thinking skills in middle schools in Morocco. Classical Moroccan education has been dependent on the memorization of information through repetition and instruction that is centered around the teacher, which has failed to effectively foster the development of critical thinking skills. Considering Morocco's unique cultural and educational context, it is paramount to investigate the potential incorporation of educational games into the curriculum. The objective of this integration is to foster the growth of critical thinking skills in middle school students.

The primary objective of this sort of experimental research is to investigate the impact of educational activities on the development of critical thinking skills among middle school pupils in Morocco. The objective of this research is to compare the outcomes of students who receive traditional instruction with those who are exposed to educational activities to provide insights into successful instructional methods that can be implemented in Moroccan educational environments.

The study implemented a quasi-experimental design that covered pre-and post-tests to achieve this objective. The participants were divided into two separate groups. One group was given instruction using instructional games, while the other cohort received conventional instruction and functioned as the control group. The objective of the study is to evaluate the effectiveness of educational games by evaluating the ability to think critically of students both before and following the intervention. The primary question driving this investigation is: What is the influence of educational games and Concept Checking Questions (CCQs) on the enhancement of critical thinking abilities in middle school pupils from Morocco?

## 2. Literature Review

There has been a growing emphasis in educational research on the significance of cultivating critical thinking abilities in students. Essential for students to effectively examine information, make reasoned decisions, and solve issues, critical thinking is the capacity to engage in reflective and autonomous thinking. It is widely regarded as an essential component of a high-quality education, as it provides pupils with the necessary abilities to navigate a constantly evolving and intricate environment. Although traditional education systems, like those in Morocco, are widely acknowledged as important, there is a rising worry that they are not effectively developing these abilities in pupils.

An effective method for improving critical thinking skills and academic achievement is the utilization of educational games [(Alfaro-Ponce et al., 2023) (Turner et al., 2018) (Turner et al., 2018) (Bosma et al., 2020) (Flach et al., 2012) (Mao et al.,

2021) (Clegg et al., 2014)]. Educational games are interactive instruments that include students in learning activities that require problem-solving, decision-making, and strategic thinking. Studies have demonstrated that these games can establish an immersive and stimulating educational setting, which is essential for cultivating analytical reasoning abilities. (Gee, 2003) and (Prensky, 2003) conducted studies that demonstrate how educational games may replicate real-world situations, prompting students to engage in critical thinking and apply their knowledge in practical settings. These studies highlight the capacity of instructional games to enhance higher-order thinking skills.

What is more, the development of students' critical thinking skills is significantly influenced by CCQs, which ensure a profound comprehension of concepts, foster analytical thinking, and encourage problem-solving. Educators can evaluate the extent to which students understand the fundamental components of a subject by posing specific questions, thereby enabling them to engage with the material more deeply and surpass basic understanding (Brown, 2014). CCQs encourage students to assess their comprehension, apply concepts in a variety of contexts, and consider alternative viewpoints, thereby promoting critical thinking and an open-minded approach (Harmer, 2008). These questions also facilitate the development of problem-solving skills by encouraging students to implement their knowledge in practical situations and to think critically (Tharp & Gallimore, 1991). Additionally, the integration of CCQs into classroom activities fosters student engagement and active learning, thereby fostering a more analytical and reflective learning approach (Nunan, 1999). In general, CCQs are indispensable instruments for improving students' capacity to engage with intricate concepts and think critically.

Furthermore, empirical research has shown that the utilization of instructional games in different educational settings leads to favorable results. For instance, a study conducted by (Papastergiou, 2009) discovered that educational games had a substantial positive impact on the critical thinking and problem-solving skills of high school students. According to a study conducted by (Tobias et al., 2014), educational games were found to improve cognitive skills and increase engagement among middle school pupils. The findings indicate that educational games have the potential to effectively improve critical thinking skills. However, much of the research in this area has been carried out in Western settings, which creates a lack of knowledge on their influence in non-Western contexts, such as Morocco.

Furthermore, aside from the overall advantages of educational games, there have been specialized research studies conducted to investigate their influence on different cognitive abilities. For instance, a study (Annetta et al., 2009) discovered that the utilization of educational games resulted in enhanced scientific reasoning and critical thinking skills among middle school pupils. In a meta-analysis undertaken by (Wouters et al., 2013) , it was found that students who played educational games saw notable enhancements in cognitive abilities, such as critical thinking. These studies offer strong evidence supporting the cognitive advantages of instructional games.

Although these studies show promise, research is scarce on the effects of educational games in the Moroccan school setting. The Moroccan education system has historically prioritized the practice of rote learning and memorization, which failed to successfully cultivate critical thinking abilities. Introducing educational games has the potential to revolutionize the learning environment by

increasing engagement and fostering the development of advanced cognitive skills. This study seeks to fill this void by examining the influence of educational games on the development of critical thinking abilities in Moroccan middle school pupils.

Moreover, the importance of this study is in its capacity to offer empirical proof regarding the efficacy of educational games in a non-Western setting. Due to the scarcity of research on this subject in Morocco, this study aims to make a valuable addition to the expanding corpus of literature on innovative pedagogical approaches. The study intends to offer practical recommendations to educators in Moroccan middle schools on efficiently implementing educational games to promote critical thinking skills in pupils.

Prior studies have predominantly concentrated on educational contexts in the Western world, resulting in a lack of comprehension regarding the adaptation and implementation of instructional games in many cultural environments. (Anderson & Barnett, 2013) investigated the utilization of educational games in scientific education in the United States, whereas (Kebritchi et al., 2010) analysed their influence on mathematics learning in American schools. These studies emphasize the necessity of doing research that considers cultural and educational variations in various contexts. This study seeks to address this deficiency by examining the influence of educational games on Moroccan middle school pupils.

Furthermore, the study aims to investigate the tangible difficulties and potential advantages linked to the incorporation of educational games into the Moroccan curriculum. According to a study conducted by (Wu et al., 2012), the effective integration of educational games into the learning process necessitates a thorough examination of elements such as teacher preparation, alignment with the curriculum, and student involvement. This study seeks to examine the aspects involved in effectively integrating educational games into Moroccan middle schools to promote critical thinking skills.

In conclusion, the integration of educational activities is an effective way to enhance the critical thinking skills of students. While previous research has demonstrated the potential of these strategies when implemented individually, there is a dearth of studies that investigate their impact in the educational context of Morocco. The purpose of this research is to examine the incorporation of educational games as a method of improving the critical thinking abilities of middle school students in Morocco. The objective of this research is to improve educational practices and student outcomes in Morocco by providing empirical evidence and concrete recommendations.

## 3. Methodology

The study used a pre-test and post-test methodology to evaluate the critical thinking abilities of Moroccan middle school students. The pre-test assessed students' skills before the intervention, while the post-test measured any improvements after the intervention. The researcher analysed the scores using paired t-tests using SPSS software. This allowed comparison of average critical thinking scores between the pre-test and post-test stages in both control and experimental groups. The analysis provided insights into the effectiveness of the educational intervention, allowing for a comprehensive evaluation of the impact of educational games on critical thinking.

In addition, a group of fifteen second-grade students were selected for Test-Retest piloting (Thabane et al., 2010), and they were given pre- and post-test evaluations that followed the same format as the main test used in the study. The initial phase had a duration of twenty days and played a crucial role in verifying the reliability and validity of the test tool. The utilization of a representative sample resulted in enhanced evaluation consistency over a period of time (Cohen, L., Manion, L., & Morrison, 2007). The test's reliability was assessed using Cronbach's Alpha, indicating a strong level of internal consistency. The test's validity was confirmed through pilot testing conducted. The high values of Cronbach's Alpha indicate that the results obtained are reliable and accurate, as demonstrated below:

**Table 1.** *Case Processing Summary*

| | | N | % |
|---|---|---|---|
| Cases | Valid | 15 | 100,0 |
| | Excluded[a] | 0 | ,0 |
| | Total | 15 | 100,0 |

The analysis covered a total of 15 cases, which accounted for the entire dataset. All cases were included in the analysis, as evidenced by a 0% exclusion rate. Therefore, the dataset consists of a total of 15 instances, representing the whole data set at 100%. This signifies that all data points were deemed legitimate and utilized in the analysis. The application of listwise deletion, which involves removing cases with missing data across all variables, guaranteed that the results were not influenced by any missing data.

**Table 2.** *Reliability Statistics*

| Cronbach's Alpha | N of Items |
|---|---|
| ,979 | 2 |

The Cronbach's Alpha coefficient for the scale is 0.979, indicating a high level of internal consistency. The high alpha value suggests a good correlation among the items, indicating that they measure the same underlying construct with high reliability. The scale's outstanding reliability guarantees the production of consistent and predictable results. The high level of internal consistency highlights the scale's efficacy in precisely measuring the intended concept. The scale's measures are supported by this high level of reliability, which enhances its strength and credibility.

The experimental study carried out at TAZI School in Casablanca, Morocco, followed rigorous ethical requirements throughout its implementation. The teacher-researcher acquired formal permission from the school to conduct the study and took measures to prioritize privacy and anonymity, while also protecting the respect, rights, and safety of all participants. The ethical considerations of the study encompassed not just its design, but also the collecting, storage, and analysis of data, demonstrating a commitment to the highest levels of professionalism and honesty. In addition, the teacher-researcher was diligent in avoiding any bias or personal tendencies during the intervention, thereby upholding educational ethics.

The adherence to ethical principles not only upheld the fundamental values of research ethics but also reinforced the reliability as well as credibility of the academic results in the field of education. By adhering to these ethical principles, the study made a major contribution to the credibility of the educational research domain.

***Participants***

**Table 3.** *Sample of the study*

| Group | Total Students | Girls | Boys | Proficiency Level |
|---|---|---|---|---|
| **Experimental** | 25 | 16 | 9 | Pre-intermediate to Intermediate |
| **Control** | 25 | 14 | 11 | Pre-intermediate to Intermediate |

The study had a total of 50 middle school pupils, with an equal distribution of twenty-five students in both the experimental group and the control group. The experimental group consisted of 16 female and 9 male participants who were exposed to a treatment involving educational games aimed at improving their critical thinking skills. The control group, consisting of 14 female and 11 male participants, received traditional instruction without the use of educational games.
Both groups had skill levels that ranged from pre-intermediate to intermediate, ensuring a comparable starting point for evaluating the effectiveness of the instructional methods. The assignment of students to groups was determined by their existing school plans and intact classroom setups, to maintain the natural educational environment while fulfilling the institution's educational goals and limitations.

***Procedure***

This investigation entailed the allocation of second-year pupils from Tazi Middle School in Casablanca, Morocco, to an experimental group and a control group. Prior to the intervention, each participant completed a pre-test to evaluate their critical thinking abilities. The experimental group was administered a treatment that involved educational puzzles, which necessitated students to solve problems using the hints provided by the teacher. These puzzles were derived from the Portal English manual and were specifically designed for their level. Additionally, they were provided with puzzles from the story of "Huck Finn" by Mark Twain. The puzzles necessitated students to analyse the events of the narrative and vocabulary items, such as nouns, verbs, adjectives, and adverbs, thereby enhancing their analytical and problem-solving abilities.
The teacher-researcher implemented a variety of strategies during the intervention, with a particular emphasis on *Concept Checking Questions*. To foster the development of students' analytical abilities, CCQs were implemented to necessitate a profound comprehension, analysis, and application of concepts, as opposed to the casual memorization of information. In the meantime, the control group was provided with conventional instruction. The treatment was administered for a single semester, during which students in both groups were required to study for three hours each week.

**4. Results**

The findings of the study are significant in that they demonstrate the influence of educational games on the development of critical thinking skills among Moroccan middle school students, with a particular emphasis on the function of CCQs in the educational processes. To evaluate the intervention's efficacy, the analysis employed paired t-tests to compare the pre-test and post-test scores of both the experimental and control groups. The descriptive statistics for the pre-test and post-test scores of the control and treatment groups are presented in the following Table:

**Table 4.** *Paired Samples Statistics*

| | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | Pretest_C | 12,04 | 25 | 2,010 | ,402 |
| | Posttest_C | 11,80 | 25 | 1,871 | ,374 |
| Pair 2 | Pretest_E | 11,40 | 25 | 2,291 | ,458 |
| | Posttest_E | 15,92 | 25 | 2,290 | ,458 |

The control group showed a minor decline in critical thinking skills, while the experimental group showed a significant enhancement, with a mean pre-test score of 11.40 and a post-test score of 15.92, indicating that the guided intervention positively impacted their critical thinking abilities. The results of the paired samples t-tests are summarized in the following Table:

**Table 5.** *Paired Samples Test*

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | Pretest Posttest_Control Group | ,240 | ,970 | ,194 | -,160 | ,640 | 1,238 | 24 | ,228 |
| Pair 2 | Pretest_ Posttest_Experimental Group | -4,520 | 2,801 | ,560 | -5,676 | -3,364 | -8,070 | 24 | ,000 |

The study found that the control group showed no significant improvement in critical thinking skills, while the experimental group showed a significant improvement, with a mean difference of -4.520 between pre-test and post-test

scores, indicating a significant improvement in critical thinking skills. This suggests that the experimental group's skills were significantly improved.

The results were significantly influenced by the incorporation of CCQs into the educational activities. To guarantee that students comprehended the concepts elucidated in the games, CCQs were implemented. CCQs facilitated a more profound understanding and cultivated critical thinking by mandating that students analyse and apply their knowledge. CCQs substantially contributed to the observed improvements in the experimental group's scores by facilitating students' critical engagement with the material, thereby improving their problem-solving abilities.

In general, the experimental group's significant improvement emphasizes the efficacy of integrating educational activities with CCQs to promote critical thinking. The critical thinking skills of the control group, which did not receive this interactive component, failed to show any substantial alterations. This emphasizes the additional value of CCQs in the educational games' intervention, which illustrates their influence on the improvement of students' critical thinking abilities and the encouragement of the efficacy of innovative teaching methods in Moroccan middle schools.

## 5. Discussion

In recent years, there has been an increasing acceptance regarding the significance of critical thinking skills for students, particularly as they navigate the complex realities of the modern world. The present study aimed to investigate the influence of educational games on these abilities in the context of Moroccan middle schools, with a particular emphasis on whether this method could improve students' capacity to think critically and solve problems more efficiently.

The study found that the development of critical thinking skills among Moroccan middle school pupils is significantly enhanced by the combination of educational games and CCQs. The experimental group, which participated in educational games as part of their learning activities, displayed a significant improvement in their critical thinking abilities in comparison to the control group, which received conventional instruction. This outcome is in accordance with prior research that has demonstrated the efficacy of educational games in enhancing student engagement and cognitive abilities (Papastergiou, 2009; Tobias, Fletcher, & Wind, 2014; Wouters et al., 2013).

The potential of educational games to establish an interactive and stimulating learning environment is emphasized by the substantial increase in the post-test scores of the experimental group in comparison to their pre-test scores. The result is consistent with the research conducted by (Bosma et al., 2020) which underscores the advantages of incorporating educational games into teaching practices. The experimental group's results, which showed a mean post-test score of 15.92 compared to 11.40 in the pre-test, underscore the efficacy of this pedagogical approach in improving critical thinking abilities.

Furthermore, the integration of CCQs was instrumental in strengthening the advantages of educational games. Those questions are intended to evaluate and enhance students' comprehension of the subject matter, thereby encouraging a more reflective and analytical approach to learning (Brown, 2014; Harmer, 2008). The results of this study indicate that CCQs not only guaranteed students'

understanding of the game content but also promoted a more profound involvement with the material.

In contrast, the control group, which received no advantage from the interactive and engaging nature of instructional games or the structured use of CCQs, exhibited only a slight decline in critical thinking skills over the same period. This emphasizes the constraints of conventional instructional methods in the development of higher-order thinking skills and demonstrates the necessity of innovative educational strategies.

In a non-Western context, such as Morocco, where traditional pedagogical methods have predominated, the findings of this study provide valuable insights into the implementation of educational games and CCQs. The positive results that have been observed indicate that the integration of these tools into the Moroccan curriculum has the potential to considerably improve the critical thinking skills of students. This is especially pertinent considering the Moroccan education system's historical prevalence of rote learning and memorization, which have been demonstrated to be less effective in the development of critical thinking skills.

In general, the results suggest that educational games and CCQs have the potential to revolutionize the learning experience in Moroccan middle schools, providing a promising alternative to conventional teaching methods. These tools can assist students in the acquisition of critical thinking skills that are essential for their academic and personal success by promoting a more interactive and reflective learning environment.

This study highlights the potential of incorporating educational games and CCQs into Moroccan middle school curriculums to improve critical thinking abilities. By incorporating games and CCQs, teachers can create an interactive learning environment, focusing on problem-solving and decision-making activities. This approach enhances the dynamic nature of learning and encourages cognitive development. The study suggests that traditional instructional methods may not adequately develop critical thinking skills, highlighting the need for innovative teaching methods. The study suggests that educators and policymakers should consider integrating educational games and CCQs into a comprehensive approach to improve students' critical thinking and problem-solving skills.

This study explores the potential of educational games and CCQs in enhancing student engagement and critical thinking. It suggests that these tools promote active learning, creative thinking, and analytical problem-solving. The study's implications apply to Morocco's educational environment, where conventional teaching methods are becoming less effective. The study suggests a shift towards interactive, student-centred teaching practices to improve academic performance and equip students with the necessary skills for the modern world. Adopting these strategies can lead to a more effective and enjoyable learning experience for students.

## 6. Conclusion

In summary, the present study illustrates that Moroccan middle school students' critical thinking abilities are substantially improved by educational games and CCQs. These results are noteworthy because they offer evidence of effective pedagogical strategies that can be incorporated into educational practices to promote critical thinking. The research has several limitations, despite the

promising results. The study's brief duration and the sample size of 50 students may not be reflective of the broader population, which restricts the evaluation of long-term impacts. In addition, the findings' generalizability may be impacted by the fact that the research was limited to a specific school. To assess the long-term effects, future research should evaluate larger, more diverse samples and extend the intervention period. The integration of qualitative methodologies, such as student interviews, could offer a more profound understanding of the impact of educational games and CCQs on critical thinking. This study underscores the significance of integrating innovative pedagogical strategies to improve critical thinking skills for curriculum designers, policymakers, and teachers. The integration of these methods into the curriculum can have a substantial impact on the cognitive development of students and their readiness for complex problem-solving in a variety of contexts.

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