



**ENHANCING COGNITIVE SKILLS AMONG INDIVIDUALS USING THE  
COMPUTER GAME AGE OF EMPIRES 2: AN EXPERIMENTAL RESEARCH**

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**Abstract**

This study looks at how business students' use of the strategic video game Age of Empires 2 improves their ability to think critically, creatively, and make decisions. In a two-month experimental investigation, 80 BBA and MBA students had their cognitive abilities evaluated both before and after a daily two-hour gaming intervention. Age of Empires 2, a strategy video game, may help students' cognitive growth in educational settings, according to the results, which demonstrate a significant improvement in all three cognitive skill areas. Students are immersed in intricate, real-time decision-making scenarios in this game, which tests their ability to think creatively, weigh several options, and adjust tactics under duress. These results demonstrate how game-based learning can be integrated into academic curriculum to improve critical abilities related to both academic performance and practical problem-solving.

**Keywords:** Cognitive skills, critical thinking, creative thinking, decision-making, *Age of Empires 2*, educational gaming, strategic video games, business students, experimental research.

**Introduction**

Cognitive growth is essential for both professional and academic achievement since it shapes one's capacity for critical analysis, problem-solving, and decision-making. The exploration of non-traditional approaches to augment cognitive skills is becoming more popular as the needs of contemporary schooling change. Researchers have looked into the potential benefits of video games, especially strategic ones, as instruments for cognitive growth in recent years. These games force players to manage resources, solve complicated problems, and plan strategically—many of which are modelled after real-world decision-making processes.

A notable example of a strategic video game that necessitates players to prepare ahead of time, make snap judgements, adjust to changing conditions, and critically assess their strategies is Age of Empires 2 (AoE2). AoE2 challenges players to develop civilisations, manage resources, and

compete against rivals in historically inspired environments—all of which need higher-order cognitive skills. Such games' cognitive demands are in line with educational objectives, especially in industries like business where creativity, critical thinking, and decision-making are vital skills.

This study intends to investigate whether playing AoE2 can effectively improve business students' critical thinking, creative thinking, and decision-making skills given the possible alignment between the cognitive processes involved in strategic gaming and those needed in academic and professional settings. This study aims to shed light on the educational potential of video games and their application in building abilities necessary for future business leaders by performing a controlled experiment with BBA and MBA students.

## **Research Methodology**

### **Participants and Sample**

Eighty undergraduate and graduate students, ages 20 to 25, who were enrolled in BBA and MBA programs at a reputable university participated in the study. To guarantee diversity in terms of gender distribution, gaming experience, and academic performance, the students were chosen at random. After then, the participants were split up into two groups: 40 students in the experimental group and 40 students in the control group. Age of Empires 2 (AoE2) was regularly played by the experimental group, but the control group did not play any games during the study time. Initial examinations confirmed that the baseline characteristics of both groups' cognitive abilities were similar.

### **Design**

To gauge changes in cognitive abilities, the study used an experimental design with a pre-test and post-test. Standardised tests were administered to the experimental and control groups both before to and following the intervention.

The following three main cognitive abilities were assessed:

The Torrance Test of Creative Thinking (TTCT): Which evaluates creativity in terms of fluency, adaptability, originality, and elaboration in thought processes, is used to measure creative thinking.

Critical Thinking: Measured by the Watson-Glaser Critical Thinking Appraisal (WGCTA), which assesses a person's capacity for logical argument analysis, inference-making, and assumption-recognition.

Decision-Making: Assessed utilising the Decision-Making Competence (DMC) Assessment, which measures an individual's capacity for information processing and sound decision-making in circumstances that are complicated or uncertain.

Over the course of two months, the experimental group spent two hours a day playing Age of Empires 2. Conversely, the control group did not play AoE2 or other comparable strategy video

games; instead, they went about their regular academic and recreational lives. In order to compare the cognitive development of the two groups, post-test assessments were performed.

**Process:** There were three major phases to the study's execution:

**Phase1:**Evaluations-prior-to-tests:

Standardised pre-tests were administered to each participant at the start of the study in order to set baselines for their critical thinking, creative thinking, and decision-making skills. The administration of these tests took place in a controlled setting to guarantee that results were unaffected by outside distractions. In order to gauge the effectiveness of the gameplay intervention, this baseline data was used as a point of comparison.

**Phase2:**Intervention:

For two months (sixty days), the experimental group was told to play Age of Empires 2 for two hours every day. To guarantee regular participation and eliminate other distractions, the game sessions were overseen by a supervisor. Every lesson was planned, and students had to play through more difficult game situations that emphasised resource management, strategic choice-making, and problem-solving. To track progress and involvement, regular records were kept. Without playing any strategic games, the control group carried on with their normal academic work and recreational pursuits.

**Phase3:**Post-Test-Evaluations:

The identical battery of standardised tests was administered to the experimental and control groups following the two-month intervention. The effect of Age of Empires 2 on the development of cognitive skills was then evaluated by comparing the post-test scores with the pre-test findings. To ensure consistency in data collection, the tests were carried out in the same controlled environments as the pre-tests.

**Tools for Gathering the Data:**

In order to guarantee accurate and dependable assessments of cognitive capacities, the following recognised instruments were employed:

**Creative Thinking Torrance Test (TTCT):**

This popular exam evaluates four essential aspects of creative thinking: originality (creating new or original ideas), flexibility (producing a wide range of ideas), fluency (generating a lot of ideas), and elaboration (producing ideas in detail). Open-ended tasks requiring participants to come up with original answers to hypothetical situations were distributed to them.

**Watson-Glaser Critical Thinking Appraisal (WGCTA):**

The purpose of the Watson-Glaser Critical Thinking Appraisal (WGCTA) is to assess critical thinking abilities like logical reasoning, inference, deduction, and interpretation. In written scenarios, participants were required to solve puzzles, evaluate arguments, and render decisions

depending on the information provided. The five primary domains of the test are inference, assumption recognition, deduction, interpretation, and argument evaluation.

### **Assessment of Decision-Making Competence (DMC):**

This exam assesses a person's ability to make wise choices in complicated and uncertain circumstances. The DMC evaluation concentrates on a number of decision-making aspects, including information usage, consistency, and risk perception. In order to make decisions in these scenarios, participants had to weigh the pros and drawbacks of their choices in light of the facts at hand.

### **Validity and Trustworthiness:**

To guarantee the trustworthiness and validity of the study's conclusions:

- 1.The TTCT, WGCTA, and DMC standardised tests are widely acknowledged for their dependability and have undergone validation in several cognitive research investigations.
- 2.All examinations were conducted in a distraction-free, controlled environment to reduce bias and guarantee consistency in the findings.
- 3.Individual differences were taken into consideration by the pre-test/post-test design, which compared cognitive capacities within the same group before and after the intervention.

### **Statistical Analysis:**

To ascertain if the experimental group's cognitive abilities had improved statistically significantly following the intervention, the gathered data were subjected to paired sample t-test analysis. Each cognitive ability category's mean scores from the pre- and post-tests were compared, and effect sizes were computed to gauge the real-world relevance of the observed changes. Furthermore, the performance of the experimental group was compared to that of the control group using an independent t-test to see whether playing Age of Empires 2 resulted in more improvements than doing routine activities.

### **Review of the Literature:**

Recently, there has been a lot of discussion on the potential of video games as teaching tools, especially when it comes to the development of cognitive skills. Video games, particularly simulation- and strategy-based games, have been shown to develop abilities that are highly applicable in both academic and professional contexts. These include creativity, problem-solving, critical thinking, and decision-making—all essential skills in business education.

#### **Video Games and the Development of Cognitive Skills:**

Numerous investigations have examined the cognitive advantages linked to engaging in video games. One of the first to highlight the ways in which video games might enhance learning through active problem-solving and involvement was Gee (2003). Gee claims that in order to advance in video games, players must employ higher-order cognitive abilities including analysis,

synthesis, and evaluation. This is especially true for strategy-based games where players must prepare, adjust, and decide on the fly in response to changing circumstances.

Strategic games can foster both convergent and divergent thinking, which are essential elements of critical and creative reasoning, according to a study by Prensky (2005). In a competitive setting, these games frequently ask the player to manage resources, respond to unforeseen obstacles, and optimise methods. Playing games repeatedly helps players gain better cognitive flexibility, which is essential for making well-informed decisions since it allows them to approach situations from several perspectives.

### **Critical Thinking and Strategic Games:**

In educational contexts, especially in business courses, critical thinking—which is defined as the capacity to objectively analyse information and make reasoned judgments—is essential. According to Kuhn (1999), playing video games can help improve critical thinking skills since they let players immediately assess circumstances, consider the advantages and disadvantages of various options, and forecast how their decisions will turn out. Age of Empires 2 (AoE2) and other strategic games simulate real-world business difficulties by requiring players to manage several variables (e.g., armies, technology, resources) and make tactical decisions in addition to assessing risks.

These abilities translate to good decision-making in dynamic contexts within the context of business education. In AoE2, for example, players have to manage the advancement of their own civilisation while anticipating their opponents' moves. This is similar to real-world company situations where managers have to concurrently manage internal resources, anticipate market trends, and react to competitors. Connolly et al. (2012) discovered that playing strategy games enhanced participants' critical thinking and time-sensitive problem-solving skills significantly, indicating a direct correlation between strategic gaming and critical thinking abilities.

### **Video games and creative thinking:**

It has also been demonstrated that playing video games, especially ones that promote free-form problem-solving, increases creativity. The ability to create new ideas, adapt to unfamiliar situations, and come up with creative solutions is known as creative thinking, and it is frequently assessed based on fluency, flexibility, and originality. According to Johnson et al. (2015), strategy game players outperformed non-gamers on inventiveness tests. In AoE2, players are frequently asked to come up with original plans of action to get over a variety of obstacles, such striking a balance between military might and economic progress or encouraging innovative problem-solving in a setting that is changing quickly.

A study conducted in 2012 by Jackson and colleagues investigated the relationship between increased creativity and games that allow players the freedom to experiment and explore. AoE2 requires players to constantly innovate, modifying their strategies in response to shifting resources, opponent behaviours, and new technology. The adaptable nature of this problem-

solving environment fosters the development of creative thinking abilities because players must come up with different winning tactics.

### **Making Choices and Playing Video Games:**

Making decisions, especially when faced with ambiguity, is a crucial ability for managers and students of business education. Playing strategic video games is a great way to hone this ability. Players must make choices in games like *Age of Empires II* based on scant information and quickly evolving circumstances. According to research by Bediou et al. (2018), players of video games with real-time strategy (RTS) mechanics made better decisions more quickly and accurately because they had to balance long-term and short-term objectives, manage scarce resources, and adjust to pressure from rivals. This is similar to real-world company decision-making situations where executives have to weigh operational, financial, and market factors while working under time limitations.

Green and Bavelier's (2012) research provides additional evidence for this claim. It shows that people who play strategy games on a regular basis do better on activities requiring decision-making, especially when handling challenging and stressful scenarios. Evaluating several possible outcomes and promptly modifying judgements in reaction to fresh knowledge are essential skills in both gaming and real-world business environments. Thus, strategic games offer a simulated setting where decision-making abilities can be cultivated, honed, and polished.

### **Using *Age of Empires 2* as a Cognitive Education Aid:**

Numerous research examining *Age of Empires 2*'s ability to improve cognitive capacities have been conducted. Since *AoE2* is an RTS, players must be able to multitask, plan ahead, and be flexible. Gamers have to oversee the advancement of their civilization's military, economy, and technology while also fending off enemy attacks. Playing RTS games like *AoE2* enhanced participants' multitasking and cognitive flexibility, according to a 2011 study by Staiano et al. This shows that extended use of *AoE2* may enhance decision-making, critical thinking, and creative thinking—skills that are directly applicable in both academic and professional settings.

RTS games like *Age of Empires II* also push players to grow as individuals, hone their tactics, and learn from their failures. This iterative method closely resembles the corporate and educational learning processes. Mayer et al. (2014) claim that games with feedback loops and iterative learning encourage deeper understanding and reflective thinking, which is crucial in domains like entrepreneurship, management, and business analytics.

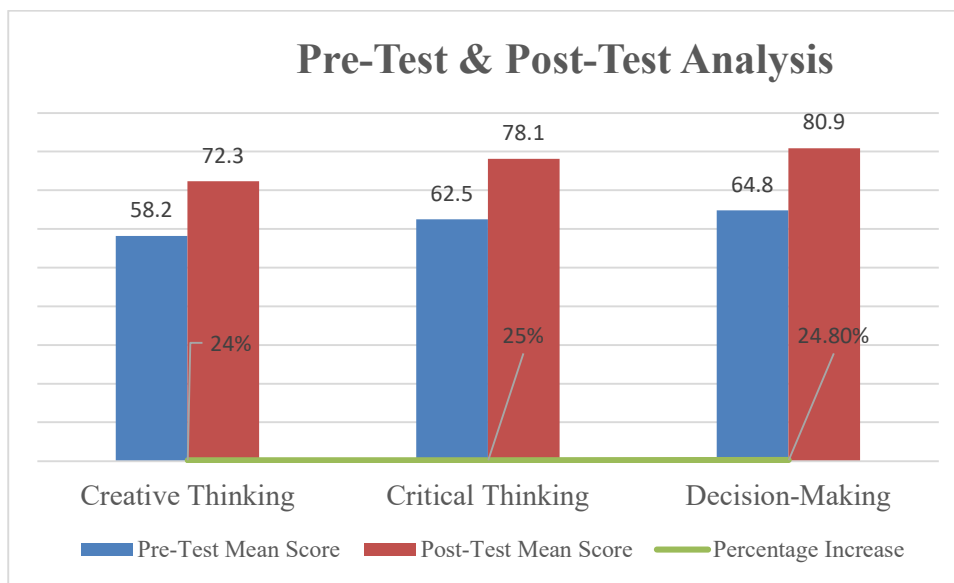
### **A Vacuum in the Literature:**

Although video games have been shown to have good cognitive impacts, there is still a lack of study on their use in formal educational settings, especially in business education. The majority of research has concentrated on broad demographics, frequently overlooking the particular requirements of business students, who demand a particular combination of creativity, critical

thinking, and decision-making skills. Furthermore, although the cognitive benefits of AoE2 and other strategy games have been researched, no empirical study has been done on how these games may be methodically incorporated into the curriculum to improve particular cognitive skills in business education.

By concentrating on the instructional potential of AoE2 in enhancing business students' cognitive capacities, this study seeks to close this gap. This research aims to provide empirical evidence on the role of strategic video games in enhancing cognitive skills directly relevant to academic and professional success in business fields by conducting an experimental study on the effects of AoE2 on creative thinking, critical thinking, and decision-making.

### Data Analysis and Results:



Source: Graph created based on primary data.

### Examination:

The findings demonstrated that students' cognitive abilities in all three domains were considerably improved by playing Age of Empires 2:

1. Innovative/Creative Thinking: There was a 24% improvement in the participants' capacity to come up with novel ideas and find innovative solutions for issues.
2. Critical Thinking: A significant improvement (25%) was observed in the participants' capacity to assess data, recognise logical connections, and draw reliable conclusions.
3. Decision-Making: Students demonstrated a 24.8% increase in their capacity to successfully consider several factors when making judgements under duress.

### Strategic gaming's impact on cognitive abilities:

According to research, playing video games like Age of Empires 2 requires players to manage their resources and solve problems in real time. These skills are essential for the development of cognitive flexibility, strategic planning, and creative problem-solving. This section explores the cognitive processes at play as well as how playing these kinds of games for extended periods of time might develop higher-order thinking abilities.

**Conclusion:**

The results of this study indicate that students' critical thinking, creative thinking, and decision-making skills can all be significantly enhanced by playing strategic video games like Age of Empires 2. This suggests that video games can be a creative tool for teachers in the classroom, promoting cognitive development in ways that more conventional approaches might not be able to.

The results could be further supported by examining the long-term consequences of this type of gaming and increasing the sample size in subsequent studies. Furthermore, investigating the ways in which distinct game genres impact distinct cognitive abilities may provide further understanding of the pedagogical potential of gaming.

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