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# The Role of Artificial Intelligence in Developing Digital Happiness and Reducing Mental Wandering Among Jordanian University Students Based on Cognitive Load Theory

Osamah Mohammad Ameen Aldalalah[1], Yousef Wardat[1], Ahmad Abdullah Al- Shraifin[2], Fuad Talafha[3]

[1]Department of Curriculum and Instruction, Faculty of Educational Sciences, Yarmouk University, Jordan

[2]Department of Counselling and Ed. Psychology, Faculty of Educational Sciences, Yarmouk University, Jordan

[3]Department of Psychology, Faculty of Educational Sciences, Mutah University, Jordan

Correspondence: Osamah Mohammad Ameen Aldalalah, Department of Curriculum and Method, Faculty of Educational Sciences, Yarmouk University, Jordan.

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**Abstract**

Given the cognitive load theory (CLT) and the integration of AI in driving digital happiness and mental wandering, this investigation aspires to analyse the role of AI in the decrease of mental wandering among Jordanian university students. The survey descriptive approach was used to analyse the influence of the independent variable (AI applications) on the dependent variables (Digital happiness and mental wandering) in the study. The sample of the study was 644 male and female students at northern Jordanian universities (Government and Private) who were electronically and randomly selected through a special link. The study instrument was two scales: digital happiness and mental wandering. The findings indicated a great deal of digital happiness among participants as well as a moderate mental wandering level. Also, a moderate number of relationships were found among the variables of digital happiness and mental wandering. The study further revealed the Mean scores on Digital Happiness Scale (DH) were significantly different as a function of student's (major, gender, and level of study) attributes, but no such differences were found in the students attribute of (University), and also, significant differences were revealed on the average responses of students to the mental wandering scale, and this was attributed to Gender. In contrast to all other variables, as none were found to differ, on all variables of University, Major, and Academic level. Given the results of the Study, the positive psychological and cognitive effects of the AI applications, the implementation of such applications in universities was recommended.

**Keywords:** artificial intelligence, digital happiness, mental wandering, cognitive load theory

## 1. Introduction

As of October 2023, Digital technologies such as artificial intelligence have caused enormous shifts in the educational sphere, as all of the relevant actors must have the pertinent digital skills to boost productivity, Learning driven by artificial intelligence is an educational paradigm where the system personalizes the educational process according to student's unique skills and styles making them learn more effectively, raising the satisfaction and motivation levels (Anu & Owusu, 2023). Transformed communication services and educational task completion systems provide students with positive, versatile engagement, digital satisfaction, and positive feelings and satisfaction. Digital satisfaction refers to the gratification of one's digital experience or the cascade of positive emotions one experiences within digital learning contexts. It is a strong impetus for students actively engage in learning and positively transform their self-efficacy in learning and problem solving (Almasri, 2024). Digital satisfaction is an important criterion for positive educational engagement and is demonstrated in educational activities through autonomy, environmental facilitation, and personal growth, interactivity, goal-directed action, and self-acceptance (Tahir et al., 2024). Mental wandering is a challenge for students in terms of concentration and performance.

This phenomenon has been characterized as a wandering type of thinking, which is not related to the current working cognitive process, particularly during long periods of concentrated effort (Fox & Beaty, 2019). The answer to the question of how to decrease this phenomenon is to rethink and reframe the design of the learning situation and task to increase students' engagement and present focus and mindfulness. This is especially the case when the teaching is based on the

information theory of teaching, such as the Cognitive Load Theory. This theory posits that working memory can only accommodate a limited load of information at one time. Thus, learning activities and experiences must be designed in such a way as not exceed the cognitive load of the working memory. When this is achieved, effective learning can take place, and the phenomenon of mental wandering can be alleviated. (Ouwehand et al., 2025).

*1.1 Artificial Intelligence*

The definition of artificial intelligence is a collection of software methods and techniques directed at the simulation of a certain type of human intelligence, which gives a computer the capacity to reason, plan, and execute actions that require a specific type of logical thinking (Fitria, 2021). It is also the intelligent system and applications that imitate human responses to the demands of a situation, enabling a high-accuracy, high-speed human-machine interface (Crompton & Burke, 2023). (See Figure 1).

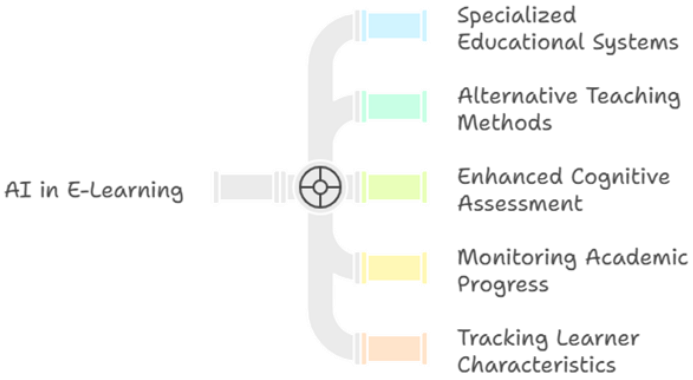



Figure 1. AI's Impact on E-Learning

According to Ng et al. (2023), AI involves machines doing tasks that, in many cases, outperform human ability. AI is classified into three types. Weak AI focuses on one small task, like digital educational games or a search engine query. Strong AI can gather and process data into information and can do more tasks, like educational simulation programs or intelligent chatbots. Finally, Superintelligence AI can do more than a human in thinking and problem-solving. Such programs can analyse a student's thoughts and emotions and know in advance what they will need (Winne, 2021). AI can assist students in critical thinking and problem-solving and in knowledge acquisition, even when they don't have all the information. This is done using information that is learned and applied to new situations. Along with this, AI makes it easier to achieve a high level of creative thinking and understand complicated problems (Karimi & Khawaja, 2024). Programs that represent knowledge and provide problem-solving capabilities through the improvement of learning from previous solutions are useful in many fields (Raisch & Fomina, 2024). In the field of education, AI is important in customizing the curriculum and learning content to fit the individual differences of students.

The process of tailoring training/teaching programs according to one's previous achievements and incremental progress involves the evaluation of an individual's performance and the determination of their strengths and weaknesses (Fabunmi et al., 2023). In addition to this, these programs can create performance metrics and a self-grading system of assessments. Additionally, these programs assist in developing and fine-tuning educational content (Louida and Adriano, 2023; Gardner, O'Leary & Yuan, 2021)

Digital Happy

A user's collective behavioural response, engendered by the positive, appropriate, and purposeful application of digital technologies, within the framework of increased efficiency and beneficial equilibrium of one's mental and social states, is gratification and psychological contentment (Mostafa, 2022). Effective technologies also enhance communications and positively construct interpersonal relationships, within the framework of privacy and digital data protection (Feleagă et al., 2022). The supportive tools aimed at moderating technology use (timers & cut-off tools), the privacy-associated tools, and the security frameworks assist the digital well-being utilization. As indicated in Figure 2 and highlighted in several consensus psychological reports published by Al-Halfawy and Tawfiq (2020), Badri et al. (2022), and Cho (2025), digital happiness comprises six critical elements.


Figure 2. Digital Happiness Factors

Based on the above, policymakers and decision-makers should work to mitigate the negative impact of digital transformation and support policies related to societal well-being and adaptation. The qualitative development brought about by the AI-driven digital revolution has led to the emergence of numerous innovative and creative applications and programs that operate at varying levels of efficiency. These are expected to achieve higher capabilities in the future, potentially reaching levels comparable to the human mind.

*1.2 Mental Wandering*

In recent years, with the passage of time and the development of the information revolution, and the different dimensions of life, the world has experienced various cognitive challenges, especially among students, which caused them to lose the ability to focus steadily during the study and learning process, and triggered the phenomenon of mental wandering. The phenomenon is Mental wandering in psychology and is defined as the imposition deviation of students' attention from the task of study at hand to a focus on their assigned goal, to focus on thoughts, or a deviation in the process of focus (Shamma, 2022; Badawi & Rajab, 2022; Barnett & Kaufman, 2020). The phenomenon in the wandering of the mind, (to the extent that it is aware, and to the extent that it is not aware), shows a deficiency in the control of cognitive operations that supply the process of focus, in a way that lends itself to distraction, and as a result to losing the ability to perform the tasks assigned and thereby the educational goals become significantly obstructed (Gong & Ding, 2018). Hence, the phenomenon of mental wandering has attracted attention in research, given its prominence in the educational process.

The presence of absent-mindedness, concentration, and detachment from reality is illustrated in several forms of mental wandering, which negatively affect the academic performance and general mood of students (Irfan, 2021). This phenomenon is related to psychological factors like depression, hyperactivity, and attention deficit, as well as disorders, such as anxiety, stress, and low motivation (Abu Zaid & Farhoud, 2023). A non-stimulating environment, digital addiction, and social and cultural factors, especially within educational environments that focus on extended periods of concentration, also contribute to mental wandering (Kieran & Roger, 2019). While mental wandering may concern the future and the educational task at hand, it is still often linked to negative outcomes like poor academic performance, traffic collisions, and losses in the industry. Psychological or neurological disorders may also be causal factors. (Abu Zaid and Farhoud, 2023; Shamma, 2022) Studies have shown two patterns of mental wandering: voluntary and conscious, where the individual, to some extent, engages external thoughts and does not appear to be negatively affected in cognitive processing. On the other hand, automatic and unconscious is characterized by a negative focus, where attention is diverted to external thoughts and not on the task at hand, which causes the emotion of surprise or anger to be activated. A strong connection exists between mental wandering and working memory.

Working memory allows one to concentrate and keep out distractions when learning. However, when the demands of the educational task are low, it is susceptible to distracting thoughts, and when higher demands are required, the likelihood of task focus decreases (Badawi and Rajab, 2022).

*1.3 Cognitive Load Theory*

The core of cognitive load theory is the information processing system of human beings, especially the working memory,

which has a limited ability to process information. Cognitive load is the working memory demands during the process of task execution. It is a function of the learner's experience, learning environment, and the characteristics of the task, such as difficulty, complexity, and the time to complete it (Paas & Sweller, 2012). For instance, the presence of poorly constructed learning environments with excessive details or long distracting text and images increases the cognitive load of the working memory, resulting in frustration, loss of interest, and reduction of learning. The theory attempts to improve learners' performance by reengineering the structure of instructional materials and teaching methods to mitigate cognitive overload and its associated consequences and improve learning (Houichi and Badis, 2020). The theory posits that ineffective learning situations often ignore the individual's information processing in working memory as it relates to the cognitive load, which is counterproductive to learning. Cognitive load is categorized into three basic forms, which are intrinsic cognitive load, extrinsic cognitive load, and learning-related cognitive load. (Leppink at el, 2013).

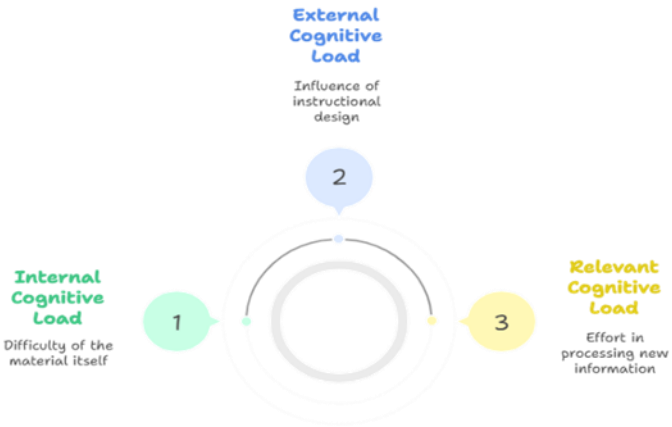



Figure 3. Cognitive Load Types

Cognitive load theory is a vital educational framework that contributes to improving teaching and learning by understanding how the brain processes information. To reduce the burden on working memory and facilitate learning, instructions should be clear and direct, breaking down material into simpler components, minimizing distractions, and allowing for focus on one source of information at a time. The theory is based on several principles (Sweller, 2024):

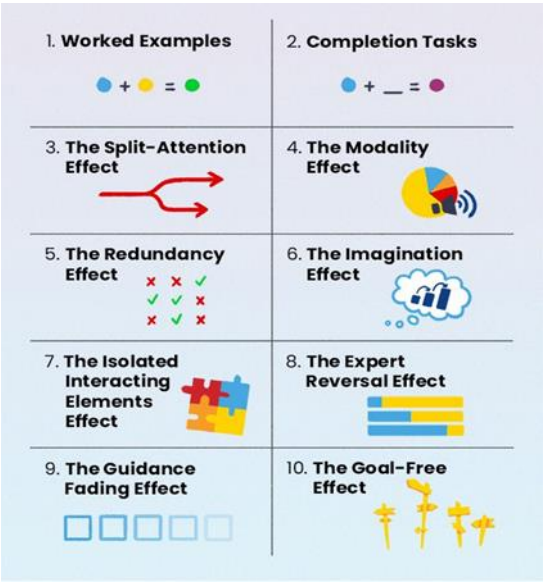



Figure 4. Principles of Cognitive Load Theory (www.innerdrive.co.uk)

Studies show that integrating information across audio and visual channels reduces the load on working memory compared to using only one channel (Huang, 2023). Because working memory has limited capacity, supporting it with clear learning media, task segmentation, and simplified digital interfaces facilitates the transfer of information to long-term memory (Sweller, 2020; Sweller, 2024).

Cognitive load theory provides an ideal lens for understanding the relationship between the variables in this study. On the one hand, well-designed AI applications are believed to reduce extrinsic cognitive load (such as the difficulty of navigating platforms or searching for unstructured information) and manage intrinsic load (the complexity of educational material) through personalization and simplification. This freedom from unnecessary load frees up cognitive resources for the student, which can lead to: Enhanced digital happiness: through feelings of accomplishment, autonomy, and control over the learning environment. Reduced mental wandering: A mind that is not overloaded is less likely to wander and become preoccupied with side thoughts. Therefore, the basic hypothesis underlying the study is that AI enhances happiness and reduces mental wandering through the primary mediator of reducing ineffective cognitive load (Yang, 2024).

*1.4 Research Problem*

The world today is witnessing an unprecedented digital transformation, where reliance on digital media and artificial intelligence applications to accomplish many tasks has become essential in the lives of individuals, especially university students. There is a need for digital transformation in education in universities, as the use of digital platforms and various educational applications is a daily behavior to obtain knowledge and communicate with others. However, despite the many benefits of this digital transformation, it may also affect psychological and emotional health (Aldalalah, 2021), which raises questions about the concept of digital happiness, which refers to a state of well-being and psychological balance achieved when digital technologies are used in a beneficial way (Badri, at el, 2022). Several studies (Feleagă, at el, 2022; Al-Halfawy, 2020; Mostafa, 2022) have indicated a relationship between the use of digital technology and psychological effects. Excessive or unconscious use of these applications can lead to negative psychological effects such as anxiety, depression, and loneliness, in addition to their impact on self-esteem. Therefore, there is a need for a deeper understanding of how digital AI applications affect university students' digital happiness, and to identify the conditions for good digital education that achieve a healthy balance for students. In this study, digital happiness is linked to the ease and convenience of performing digital educational tasks. This study builds on the results of Mostafa's (2022) study, which aimed to explore the relationship between mobile training and teachers' digital happiness and its impact on reducing mental wandering among a sample of students. Given that this study explores the psychological effects university students experience during the learning process, and through the researchers' work as instructors in Jordanian universities, they observed a lack of focus among students during lectures and various educational situations. Rather, students tend to focus on internal or external thoughts unrelated to the educational situation, whether this behavior is voluntary or involuntary. This can lead to unsatisfactory results in academic achievement and performance. The human mind is often distracted from the current task by other thoughts and feelings, negatively impacting concentration and academic performance (Irfan, 2021; Abu Zaid and Fahoud, 2023). With the proliferation of artificial intelligence applications aimed at facilitating study and increasing productivity, this may have an impact on students' mental wandering.

Therefore, this study aims to answer the following questions:

1. What is the role of artificial intelligence applications in developing digital happiness among Jordanian university students, considering cognitive load theory?

2. Are there statistically significant differences in developing digital happiness among Jordanian university students attributed to (University, Major, Academic level, and Gender)?

3. What is the role of artificial intelligence applications in reducing mental wandering among Jordanian university students, considering cognitive load theory?

4. Are there statistically significant differences in reducing mental wandering among Jordanian university students, attributed to (University, Major, Academic level, and Gender)?

5. Is there a correlation between digital happiness and mental wandering among Jordanian university students through artificial intelligence applications?

*1.5 Study Limitations and Delimitations*

This study is subject to several limitations and constraints that must be considered when interpreting and generalizing the results:

Conceptual/Topical Delimitations

- Variables: The study was strictly confined to exploring the relationship between the independent variable, Artificial Intelligence (AI) Applications, and the dependent variables, Digital Well-being and Mental Wandering (or Mental Distraction).
- Theoretical Framework: The research relied solely on Cognitive Load Theory (CLT) as the conceptual framework to understand and interpret the role of AI in achieving digital well-being and reducing mental wandering.

Sample and Geographical Limitations

- Population and Sample: The study's application was limited to a sample of male and female students from Jordanian universities in the Northern Region, specifically drawn from both public and private institutions.
- Sample Size: The sample size reached 644 students. This size inherently restricts the scope of generalizing the findings to the entire population of Jordanian university students.

Temporal Limitations

- Application Period: While the abstract did not specify a precise time frame, the results are presumed to represent the students' perspectives during the period when the data were collected. These views may be influenced by the prevailing educational and technological conditions at that specific time.

Methodological and Instrumentation Limitations

- Methodology: The study utilized the Descriptive Survey Approach. Consequently, the results describe the relationship between the variables but cannot definitively establish a cause-and-effect relationship.
- Measurement Instrument: The study depended on two Self-report Scales: The Digital Well-being Scale and the Mental Wandering Scale. Responses might be influenced by factors such as Social Desirability Bias or the students' subjective self-assessment of their own experiences.

## 2. Methodology

Considering the goals of the study, the researchers used the descriptive and analytical method, which involves the collection of data based on the phenomenon, followed by interpretation and analytical description, leading to scientifically accurate conclusions, thus providing answers to the research question.

### *2.1 Sample and Population*

The research population comprised the undergraduate students in the northern region of Jordanian universities. The sample of 644 students, both males and females, was selected via a random sampling technique, and students were enrolled in different universities, colleges, and educational levels.

The Ministry of Higher Education and Scientific Research's decision to allow students in Jordanian universities to access the Gemini service free of charge represents an extremely consequential strategic decision. It demonstrates a desire to promote the use of innovative technology in the academic setting and the enhancement of scientific research. The enhancement of this support is provided by students' access to a multitude of artificial intelligence and digital resources. These tools include language models like ChatGPT, which assist in writing and conducting analysis and discussions, and Copilot, which is highly instrumental in programming and developing software.

Other AI models, like DeepSeek, help students learn other skills. Vision AI. Canva and other design programs help students make custom professional presentations and other creative projects. Organize and simplify complex ideas with Napkin. These digital tools change learning skills. With research skills, critical skills, and creative and design skills greatly improved. It enhances the learning and academic performance of students. The improved academic performance and learning are of great quality. The students are from higher learning institutions in Jordan. The innovative tools improve learning. It is beneficial and of great help to Jordan's educational institutions. The learning is enhanced to improved levels. It is during this effort that great academic performance is noticed.

"The students primarily employed AI tools in three distinct fields. They first used them to complete tasks and assignments, then they used the tools to polish and enhance the quality of their work by editing and proofreading it more thoroughly. Second, they used AI to organize information and facilitate spaced repetition in their exam-related study. Finally, and perhaps most crucially, they used AI to develop conceptual comprehension by visualizing complex ideas and making important connections between them.

### *2.2 Instruments*

The digital happiness scale. The pole is based on previous studies. Mostafa 2022, Feleagă et al 2022, Badri et al 2022, Al Halfawi 2022. The scale contained 29 items in 6 domains. Autonomy 6, environmental empowerment 4, personal development 5, positive relationships 5, purposeful living 4, and self-acceptance 5. A Likert scale of 5 is used in each of the items. From 1 strongly disagree to 5 strongly agree."We adopted the Alfeel Scale (2019) used in the literature with the simple singular construct of mental wandering. The scale in question has ( N = 26 ) total items, with 12 items related to wandering of the mind and 14 items that relate to wandering of the mind but are unrelated to the main topic of concern. Field responses, i.e., of the scale, are indicated in 1 (never), 2 (sometimes), and 3 (always) to alternate points of the scale.

*2.3 Validity of the Study Instruments*

The instruments were presented to (9) experts from Jordanian university faculty specializing in educational technology, computer science, and psychology, and their opinions and comments were considered. The study instruments were also applied to a pilot sample of 43 Jordanian university students from within and outside the study community, to verify the correlation coefficients of the items with the total score using Pearson's coefficient. The results were statistically significant, confirming the validity of the tool. The results are shown in the following table (1):

Table 1. Correlation coefficients of the items of the Mental Wandering Scale with the total score and the scale domains.

| N | Correlation coefficient with the total score of the scale | Correlation coefficient with the domains score |
|---|---|---|
| Domain 1: Mental wandering related to the topic. During the lecture on artificial intelligence applications, I | | |
| 1 | .678** | .856** |
| 2 | .798** | .923** |
| 3 | .683* | .789** |
| 4 | .770** | .745** |
| 5 | .554 | .529 |
| 6 | .732** | .872** |
| 7 | .721** | .856** |
| 8 | .694** | .772** |
| 9 | .853** | .634** |
| 10 | .756** | .893** |
| 11 | .744** | .784** |
| 12 | .756** | .696** |
| Domain 2: Mental wandering unrelated to the topic. During the lecture on artificial intelligence applications, I... | | |
| 13 | .779** | .875** |
| 14 | .743** | .793** |
| 15 | .803** | .767** |
| 16 | .683** | .905** |
| 17 | .761** | .858** |
| 18 | .545 | .636* |
| 19 | .649** | .882** |
| 20 | .813** | .816** |
| 21 | .514 | .551* |
| 22 | .831** | .774** |
| 23 | .727** | .738** |
| 24 | .649** | .818** |
| 25 | .813** | .742** |
| 26 | .714** | .846** |

Table (1) shows that all correlation coefficients between the items and the total score, as well as with the domains of the scale, were statistically significant at the 0.05 level. They were positive and relatively high, indicating that the scale possesses good internal consistency. Based on the analysis results, only three items were deleted due to their weak correlation with the scale.

Table (2) shows that all correlation coefficients were statistically significant at the (0.05) level, and were positive and high, indicating that the scale has good internal consistency across all its items.

Table 2. Correlation coefficients of the items in the digital happiness scale with the total score and domains

| N | domains | Correlation coefficient with the total score of the scale | Correlation coefficient with the domains score |
|---|---|---|---|
| 1 | autonomy | .759** | .843** |
| 2 | | .872** | .876** |
| 3 | | .756** | .847** |
| 4 | | .766** | .868** |
| 5 | | .849* | .786** |
| 6 | | .797** | .826** |
| 7 | environmental empowerment | .854** | .879** |
| 8 | | .749** | .878** |
| 9 | | .855** | .793** |
| 10 | | .843** | .743* |
| 11 | personal development | .765** | .708** |
| 12 | | .857** | .781** |
| 13 | | .778** | .765** |
| 14 | | .864** | .795** |
| 15 | | .787** | .832** |
| 16 | positive relationships with others | .878** | .786** |
| 17 | | .845** | .754** |
| 18 | | .783** | .749** |
| 19 | | .779** | .854** |
| 20 | | .839** | .848** |
| 21 | purposeful living | .749** | .793** |
| 22 | | .849** | .867** |
| 23 | | .863** | .788** |
| 24 | | .849** | .801** |
| 25 | self-acceptance | .804** | .834** |
| 26 | | .787* | .708** |
| 27 | | .842** | .720** |
| 28 | | .764** | .776** |
| 29 | | .787** | .771** |

*2.4 Reliability of the Study Scales*

To ensure the stability of the scales, two methods were applied: Test-Retest: The two scales were distributed to a sample of (43) male and female students from Jordanian universities, then re-administered (21) days later to the same sample. Cronbach's Alpha Coefficient: To calculate the internal consistency of each axis and the total score. Table (3) shows the results of the reliability coefficients:

Table 3. reliability coefficients of the study scales and their domains

| Mental Wandering Scale | | |
|---|---|---|
| Domains | Test-Retest | Cronbach's alpha coefficient |
| Autonomy | .85 | .83 |
| Environmental empowerment | .81 | .78 |
| Personal development | .84 | .85 |
| Positive relationships with others | .82 | .85 |
| Purposeful living | .79 | .76 |
| Self-acceptance | .86 | .81 |
| Total | .82 | .81 |
| Mental Wandering Scale | | |
| Mental wandering related to the topic | .78 | .74 |
| Mental wandering unrelated to the topic | .75 | .71 |
| Total | .76 | .72 |

It is clear from Table (3) that all reliability coefficients, whether by Test-Retest or Cronbach's alpha coefficient, were high and statistically acceptable, as they ranged between (0.71 - 0.86), which confirms the validity of the study instruments for application to the research sample.

*2.5 Study Variables*

Independent Variable:

- Artificial Intelligence Applications in Education

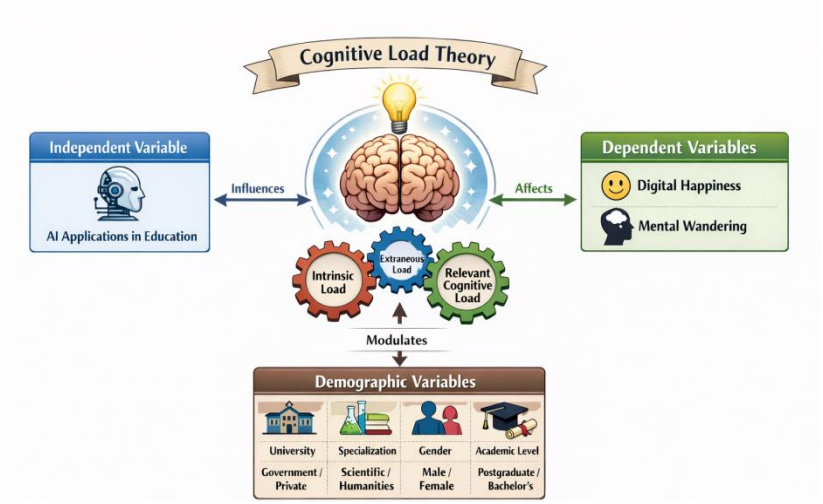
Dependent Variable:

- Digital Happiness
- Mental Wandering

Demographic Variables:

- University (Government, Private)
- Specialization (Scientific, Humanities)
- Gender (Male, Female)
- Academic Level (Postgraduate, Bachelor's)

*2.6 Theoretical Framework*




As an independent variable (IV), the diagram depicts a research model that examines the effects of artificial intelligence (AI) applications in education. The three forms of cognitive load—intrinsic, extraneous, and relevant—are thought to have this effect by acting as mediating variables (MVs). The dependent variables (DVs) of mental distraction and digital well-being are subsequently impacted by these mediators. Additionally, the model shows that the relationship between the different types of cognitive load and the learning processes and outcomes is moderated (Mod) by demographic variables (such as institution, specialization/major, gender, and academic level).

Research Procedures

- Review of Theoretical Literature and Previous Studies:
  - A comprehensive review of the literature related to Artificial Intelligence (AI) and its applications in education, the concept of Digital Happiness, the phenomenon of Mental Wandering (Mental wandering) among students, and the Cognitive Load Theory (CLT) was conducted to ensure familiarity with the theoretical and methodological framework of the study variables and their interrelationships.
- Development of Study Instruments (Questionnaires):
  - Questionnaires were constructed to measure:
    - The Role of AI Applications in the students' educational/life environment (as an independent variable).
    - The level of Digital Happiness (as a first dependent variable).
    - The level of Mental Wandering (as a second dependent variable).
  - The items were designed based on the theoretical frameworks of the variables, taking into account the concepts derived from the Cognitive Load Theory.
- Preparation of the Instruments' Initial Form:
  - The study questionnaires were prepared in an initial draft, including an explanatory introduction detailing the study's purpose and instructions for answering.
- Defining the Study Population and Selecting the Sample:
  - The study population was defined as Jordanian university students, and a representative sample of the target population was selected according to established statistical criteria.

- Verification of the Instruments' Psychometric Properties (Validity and Reliability):
  - The instruments were presented to a panel of experts for confirmation of face validity and content validity.
  - A pilot study was conducted on a sample outside the main study group to calculate reliability indicators (such as Cronbach's Alpha coefficient) and conduct factor analysis to confirm construct validity. Necessary modifications were then implemented.
- Obtaining Formal Approvals:
  - This included securing a letter of authorization from the Deanship of Scientific Research or the relevant official university bodies after the instruments were validated, in addition to approval from the Institutional Review Board (IRB) or the Scientific Research Ethics Committee.
- Application of Instruments and Data Collection:
  - The instruments were administered to the target study sample (either in hardcopy or electronically), and responses were collected accurately and systematically, with an emphasis on data confidentiality.
- Data Entry and Statistical Analysis:
  - Data was coded, entered into the computer, and analyzed using appropriate statistical packages (such as SPSS or AMOS). Relevant statistical treatments (such as descriptive statistics, T-tests, multiple regression analysis, or Structural Equation Modeling) were applied to answer the research questions and test the hypotheses.
- Drawing Conclusions, Interpretation, and Recommendations:
  - The results were presented, analyzed, and interpreted in light of the theoretical framework and previous studies, particularly the Cognitive Load Theory. Appropriate practical and scientific recommendations were then provided.

## 3. Results and Discussion

### *3.1 Question 1*

What is the effectiveness of artificial intelligence applications in developing digital happiness among Jordanian university students, considering cognitive load theory?

To answer this question, the means and standard deviations of the sample members' responses to the domains of the digital happiness scale were calculated, as shown in Table (4).

Table 4. Means and standard deviations of the study sample members' responses to the domains of the digital happiness scale.

| N | Domains | Means | Standard deviations | Arrangement |
|---|---|---|---|---|
| 1 | Autonomy | 4.045 | 0.896 | 3 |
| 2 | Environmental empowerment | 3.840 | 0.940 | 6 |
| 3 | Personal development | 3.866 | 0.880 | 4 |
| 4 | Positive relationships with others | 4.060 | 0.848 | 2 |
| 5 | Purposeful living | 3.847 | 0.859 | 5 |
| 6 | Self-acceptance | 4.090 | 0.846 | 1 |
| Total | | Total | 0.878 | |

The results showed that the use of artificial intelligence applications in the educational process had a clear positive impact on the overall development of digital happiness among Jordanian university students, with the overall mean reaching 3.958, and the arithmetic means for all scales were high.

Cognitive load theory provides a powerful explanatory framework for these results, indicating that the effectiveness of these applications is due to their ability to manage intrinsic cognitive load (the difficulty of the educational material) and significantly reduce extrinsic cognitive load (the complexity of how information is presented). In personalized educational programs, content is adapted to each user's strengths and weaknesses and is shown in a simple and well-organized way to alleviate distress arising from content that is too difficult or too easy. This alleviation of unnecessary cognitive load allows the learner to engage in focused learning and deep learning, and to improve achievement and satisfaction, the core of digital well-being and positive emotions. This cognitive load reduction also enhances digital well-being and positive emotions.

Self-acceptance also ranked the highest, suggesting that the AI applications demonstrate a high degree of clarity in the diverse opportunities that each student is offered to address educational content. AI increases self-efficacy by providing and enhancing opportunities for students to successfully engage in educational tasks, even at a minor level. Building self-acceptance also relates to positive feelings of accomplishment and mastery of the educational content, which strengthens the belief in one’s own capabilities. Building positive relationships came in the second position. AI applications can enhance

peer interaction and collaboration, especially at the university level, which is often perceived as a level of education that promotes individual learning. AI also promotes interaction among students and enhances collaboration.

The tools enable students to assign and monitor tasks as a group, which promotes effective collaboration and relationship building. Autonomy came next in rank. With the help of adaptive AI, students do not have to progress through the curriculum in a linear fashion. Rather than following a set path, students can choose to work on the ideas that they find difficult and can move on from others. The ability to choose, get feedback in real time, and control the pace of a learning experience empowers students to take responsibility for their learning and time management. The influence of university AI applications on students confirmed that the best personal growth by these applications was on self AI. The highest-ranking dimension was personal purpose, attesting to the influence of intelligent technologies. AI promotes personal growth through self-development by the provision of adaptable learning frameworks that focus on the development of life and cognitive skills. The ability to learn independently and continuously, and the enhancement of critical thinking, problem solving, digital literacy, and professional preparedness constitute the other positive contributions of AI to personal development. The fifth purpose in the life dimension signals a deeper influence that intelligent technology has on university students. The intelligent technology impacts university education in a dimension that is not confined to academic performance. By providing the appropriate skills that are future-oriented, AI adds meaning to education, thus enhancing mastery and confidence.

AI applications serve the purpose of enhancing students' efficiency in their work. In addition, their potential in promoting personal development, growing the skill sets needed for the students' academic and professional pursuits, and achieving a sense of purpose cannot be downplayed either. Environmental mastery ranked last. This result illustrates the impact of the use of AI applications in university teaching and the improvement in students' relationships with academic surroundings. With task organization, resource utilization, and planning to meet their academic objectives, students gained more control over their university experience and the academic interface they arranged to facilitate personal development and academic progress.

To conclude, AI applications have the potential to foster digital happiness for the students in Jordanian universities. Caution in their implementation and for a design oriented towards lessening academic and mental pressures ought to be observed.

### *3.2 Question 2*

Are there differences in the development of digital happiness among Jordanian university students through artificial intelligence applications attributable to differences in (University, Major, Gender, Academic level)?

To answer this question, the means and standard deviations of the study sample's responses to the digital happiness scale were calculated, as shown in Table (5):

Table 5. Means and standard deviations of the study sample's responses to the digital happiness scale

| variables | Groups | means | standard deviations | N |
|---|---|---|---|---|
| University | Government | 115.39 | 16.11 | 369 |
| | Private | 114.68 | 14.44 | 275 |
| | Total | 115.035 | 15.27 | 644 |
| Major | Scientific | 116.77 | 15.20 | 253 |
| | Humanities | 114.00 | 15.47 | 391 |
| | Total | 115.38 | 15.33 | 644 |
| Gender | Males | 117.99 | 16.30 | 125 |
| | Females | 114.38 | 15.12 | 519 |
| | Total | 116.18 | 15.71 | 644 |
| Academic level | Bachelor's | 120.06 | 12.30 | 103 |
| | Postgraduate | 114.14 | 15.77 | 541 |
| | Total | 117.10 | 14.03 | 644 |

Table (5) shows clear differences in the means and standard deviations of the study sample's responses to the digital happiness scale. To determine the statistical significance of these differences between the means, the analysis of variance (MANOVA) test was applied, and the results are presented in Table (6).

Table 6. Significance of differences between the mean scores of the demographic study variables

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| University | 80.093 | 1 | 80.093 | .337 | .562 |
| Major | 1179.251 | 1 | 1179.251 | 4.992 | .026 |
| Gender | 1307.583 | 1 | 1307.583 | 5.540 | .019 |
| Academic level | 3040.107 | 1 | 3040.107 | 13.030 | .000 |

The study's findings revealed no statistically significant differences in the level of digital happiness among Jordanian university

students that could be attributed to the type of university (Government/private). Almost all graduating students get the same education and have an equal proficiency in technological tools. The students have a basic comprehension of the main digital concepts and tools, along with a similar technological environment. Furthermore, the students have a foundational digital proficiency. I have a basic understanding of digital concepts and tools and am not sheltered from the technological environment \of the educational environment. Although the type of university may play a role in other educational or service aspects, the results in this context suggest that digital happiness, especially in the use of artificial intelligence applications, is not necessarily dependent on the type of university. More pertinent are the general personal and academic characteristics.

In contrast, there is a significant difference with respect to digital happiness in favor of the students in the sciences. The main reason would be the possession of high digital skills, a high willingness to use academic and research AI tools, and a profound sense of achievement and digital happiness. The increasing digital happiness, the incorporation of AI tools into the academic curriculum of the students, and the predominantly positive public opinion on the educational disciplines of the sciences, which are perceived to be more employment oriented.

The difference attributable to gender showed a preference for the male students. Other people suggested differences in digital happiness levels regarding social upbringing impact customs surrounding women's participation in technology. Furthermore, an academic level disparity where the results positively favored digital happiness levels of the grad students could be attributed to the nature of the graduate level as being heavily focused on scientific research and sophisticated analysis, which would require the optimal use of multiple AI tools. To help in doing this research, to acquire statistical knowledge in analysing the data, and to help provide the students with quality research that would ignite the research students to see that AI could be used positively. Other studies indicated that graduate students would be viewed as the end pseudonym to infer the actions of primary level students. Lastly, how the results would be affected by graduate-level students' experience with digital tools and technology.

We calculated the means and standard deviations of the study sample's responses to the mental wandering scale and the total scale from the sample to answer the question, presented in Table (7):

Table 7. Means and standard deviations of the study sample members' responses to the mental wandering scale and domains

| N | Domains | Means | Standard deviations |
|---|---|---|---|
| 1 | Mental wandering related to the topic | 2.26 | 0.624 |
| 2 | Mental wandering unrelated to the topic | 2.14 | 0.667 |
| Total | | 2.20 | 0.647 |

The case of integration of educational Artificial Intelligence (AI) applications in learning environments in Jordanian universities has demonstrated a low, clear, and positive effect on the students' mental wandering in learning activities. There are pedagogical and cognitive explanations for this. AI applications fostered improved student attentional focus and motivation towards learning by delivering attentional focus and motivating learning by delivering educational content through engaging, rich, and interactive educational content. This made the focus of student mental effort on the main learning-task as opposed to thinking about the mental effort on the main learning tasks and decreased wandering towards thinking about the learning task. In addition, the constructive incorporation of technologies to foster the enhancement of learning through multimedia made the positive influence of cognitive processing on the learning materials through the enhancement of internally created, active, constructive, engagement learning processes by learners through the positive incorporation of technologies to foster the enhancement of learning. The prediction of cognitive load theory explains the positive impact of AI applications on the reduction of mental wandering during learning activities. The capacity of educational applications in the reduction of learning cognitive load control. The mind of a learner will maximize and wander on the learning tasks when adequate effort is made to engage with the content. The design of the application will influence the amount of cognitive load control on, and the level of adequate motivation to learning, leading to mental wandering. In addition, mental wandering is self-regulated by the external environment, including distractions on the application, to control the impact of wandering on the learning tasks.

AI tools can recognize and assist people in managing mental wandering to create a distraction-free and focused learning situation. This has empowered educators to perform more efficiently as they construct learning experiences designed to capture students' attention and engagement at optimal levels to achieve better learning results.

In a cognitive load theory framework, the findings of the study agree with the theory that suggests controlling presentation and segmentation of information can help reduce cognitive overload. In this case, the AI applications used to explain the content also took the concept and divided it into smaller, digestible, more meaningful chunks, accompanied by audio-visual media. This reduced cognitive mapping effort and helped direct attention without the overload of cognitive processing. As has already been observed, students were more active learners, and the system reduced the cognitive overload. Feedback within the system, designed to assist students in real time, was also illustrated as a resource, and its

purpose was to elevate attention and reduce distraction. Despite these positives, the impact was moderate.

A few phenomena can elucidate this: the students and faculty's initial exposure to AI tools and applications, the sophistication and tailoring of the applications to individual students and their cognition levels, and the applications' internal and external constraints, such as anxiety and other digital distractions (social media, notifications, etc.). There are variances in students' ability to self-regulate attention, understand, and possess working memory. Consequently, the scores in terms of mitigating mental wandering testify to the accuracy of the data in hand.

On the one hand, it demonstrates that AI applications can improve attention and reduce mental wandering. On the other hand, it highlights that these applications are not a magic solution for controlling all sources of distraction. Rather, they represent a supportive tool that needs to be integrated with effective teaching practices and supportive learning environments that consider students' psychological and social aspects.

*3.4 Question 3*

Are there differences in reducing mental wandering among Jordanian university students attributable to (University, Major, Gender, Academic level)?

To answer this question, the means and standard deviations of the study sample members' responses to the mental wandering scale were calculated, as shown in Table (8):

Table 8. Means and standard deviations of the study sample members' responses to the mental wandering scale

| Variables | Groups | Means | Standard deviations | N |
|---|---|---|---|---|
| University | Government | 2.20 | 0.408 | 369 |
| | Private | 2.18 | 0.419 | 275 |
| | Total | 2.19 | 0.413 | 644 |
| Major | Scientific | 2.19 | 0.407 | 253 |
| | Humanities | 2.20 | 0.417 | 391 |
| | Total | 2.19 | 0.413 | 644 |
| Gender | Males | 2.27 | 0.465 | 125 |
| | Females | 2.18 | 0.397 | 519 |
| | Total | 2.19 | 0.413 | 644 |
| Academic level | Bachelor's | 2.23 | 0.304 | 103 |
| | Postgraduate | 2.19 | 0.430 | 541 |
| | Total | 2.19 | 0.413 | 644 |

Table (8) shows an apparent discrepancy in the means and standard deviations of the study sample members' responses to the Mental Wandering Scale. To demonstrate the significance of the statistical differences between the arithmetic means, the analysis of variance (MANOVA) test was used, as shown in Table (9).

Table 9. Significance of the differences between the mean scores of the study variables

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| University | .103 | 1 | .103 | .605 | .437 |
| Major | .014 | 1 | .014 | .082 | .775 |
| Gender | .896 | 1 | .896 | 5.286 | .022 |
| Academic level | .176 | 1 | .176 | 1.033 | .310 |

The results showed no significant differences in the level of digital mental wandering between students at private and public universities in Jordan when using artificial intelligence applications. This can be explained by the fact that most of these applications are designed according to precise standards aimed at facilitating use and providing interactive and attractive interfaces that cater to the needs of learners across different academic environments. Furthermore, university students, whether in public or private institutions, belong to a single digital generation characterized by similar abilities in managing attention, concentration, and motivation. This is due to the proliferation of the internet and smart devices, and the associated indirect training of the brain to deal with and overcome distractions. Furthermore, Jordanian universities' reliance on similar learning management systems (such as Microsoft Teams, Google Classroom, and Moodle) contributes to reducing potential differences between learning styles in the two sectors.

Results also showed there were no differences in the reduction of mental wandering by specialization (scientific/humanities). This is because mental wandering is simply a phenomenon that occurs in every person in all academic fields. However, AI applications are meant to achieve goals at a high level, such as data analysis, content writing, and decision-making. Such AI applications are created in a way to avoid losing track and focus, and so the impact is similar on both science and humanities students. In the other case, the results showed some reduction of mental wandering as a function of gender, where females were more in favor of the other. This could suggest that females do have a cognitive

bias towards more details where they are able to keep attention on a particular task for longer, especially when it is a task of a verbal/language or social nature. In contrast, males likely have more of a cognitive bias towards more abstract or high-level thinking, which is likely to increase mental wandering when they must do more mundane work or work that is not very strategic in nature. This is in sync with the educational and psychological literature that focuses on the more qualitative aspects of gender differences normative to cognitive processing. As for academic level, the results showed no differences between the mental wandering reduction of undergraduates and graduates when using AI applications.

Unified user experience design eases interaction across applications, driving operational efficiency, irrespective of the student's academic standing. Undergraduate students searching for basic info or graduate students working on scientific research, the type of applications utilized promotes similar interaction patterns focused on immediate access to answers or solutions. Also, the current student cohort across both levels has been raised in a digitized milieu, enabling the acquisition of similar modern technological proficiency, subsequently closing the gap in this respect.

### *3.5 Question 4*

Is there a correlation between digital happiness and mental wandering among Jordanian university students using artificial intelligence applications?

To answer this question, Pearson correlation coefficients were extracted to assess the extent and strength of the relationship between digital happiness and mental wandering, as shown in Table 10:

Table 10. Correlation Coefficients between digital happiness and mental wandering

| | | Digital happiness | Mental wandering |
|---|---|---|---|
| Digital happiness | Pearson Correlation | 1 | .329** |
| | Sig. (2-tailed) | | .000 |
| | N | 644 | 644 |
| Mental wandering | Pearson Correlation | .329** | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 644 | 644 |

While these results were significant and suggest that mental wandering and digital happiness are correlated, there is only a moderately significant relationship. The results are bidirectional, so mental wandering can lead to digital happiness and vice versa. When students are satisfied and happy to work, their need to engage with their environment increases. This, along with the ability to focus on a task, is where the educational interaction is immersed, and the student becomes digitally distracted. This also applies to students who feel mental wandering temporarily, filling their spatial where, and escaping digital pressures to find a temporary digital happiness in mental wandering. I think it's safe to say these students feel, if not void-triggered digital frustration, temporarily accumulated digital happiness.

Mental wandering, and hence, digital distraction, is also a positive phenomenon in the search for available content, 'consumable data mine' as we like to say. This phenomenon may also explain temporary digital happiness experienced in content consumption across digital platforms. The recent cognitive overloading, in the search for available content, is where the phenomenon of digital happiness can compromise focus on educational tasks and promote the mental wandering of students. The overabundance of content in social areas of digital platforms can also enhance the phenomenon of digital happiness and compromise focus (especially during cognitive tasks). The phenomenon also applies to platforms where educational material is available, with the cognitive overload on task to find available educational material.

On the other hand, digital happiness may at times serve the function of an escape mechanism from negative feelings or boredom present in real-life educational situations. Digital distractions make students more susceptible to mental wandering, as they ignore the educational task. Here, digital happiness is shallow and momentary (and perhaps even negative) as it ceases the moment the app interaction stops and the mind returns to negative wandering (which may involve personal matters or even distractions unrelated to the educational context). Moreover, digital disengagement may foster negative social comparisons (even image-related ones) that may strengthen the negative mental wandering patterns of anxiety and inadequacy. Therefore, it may be reasonable to assume that digital happiness certainly has an indirect role in exacerbating negative mental wandering when the happiness is derived from shallow social interaction or passive content consumption, rather than active participation in constructive educational tasks.

That said, other factors, such as individual characteristics (psychological state, motivation, attention control, etc.), learning environment conditions, and digital happiness, which is a component of mental wandering, need to be considered as well.

The connection between digital happiness and distracting thoughts is neither pre-set nor one-way; it's a multi-faceted connection that digital happiness and distracting thoughts is multi-faceted, with a variety of cognitive, social, and emotional factors influencing it. In terms of cognitive load theory, the positive correlation between digital happiness and distracting thoughts ($r = .329$, $p < .01$) points to the role of intrinsic and extrinsic cognitive load as variables attempting to explain the correlation. In terms of AI applications, the positive extrinsic load (having to navigate a complicated system)

may be a factor of mental wandering, and digital happiness is elevated. On the other hand, the positive cognitive load of learning (putting time and effort into processing) is, as other studies indicate, likely to make it positive, and that enhanced creativity is the result of positive distracting thoughts. From this, it is necessary to have AI applications that allow for adaptive functioning, for example, with real-time detection of mental wandering, aimed at reframing negative distracting thoughts for more substantive learning, as this would help make digital happiness more valuable and sustainable, rather than fleeting. In the case of Jordan, that would help explain the fewer observed gaps in gender and employment, as it allows for greater individual personalization for the differences in working memory.

## 4. Recommendations

Based on the presented findings, the following recommendations can be drawn to enhance digital happiness among Jordanian university students in general and Yarmouk University students in particular when using artificial intelligence applications in the educational process:

1. Support the use of AI applications in education and develop their infrastructure.
2. Develop training and qualification programs for faculty members and students to utilize AI applications in various educational settings.
3. Address the digital gap in the use of AI applications between undergraduate and postgraduate students.
4. Address the gender gap (male and female) in the use of AI applications in different learning situations.
5. Adapt and develop AI applications that specifically meet the needs and requirements of humanities disciplines.
6. Conduct cross-sectional studies to include larger populations, such as Jordanian universities across all regions of the kingdom.
7. Conduct longitudinal studies to track digital happiness and mental wandering over time.
8. Conduct studies that examine other psychological effects, besides digital happiness and mental wandering, while using AI in the educational process.
9. Conduct in-depth qualitative studies with a focus on personal interviews to understand students' reactions toward digital happiness and mental wandering.
10. Develop digital teaching methods to maintain the attention and focus of university students and reduce their mental wandering.
11. Link explanatory learning theories, such as cognitive load theory, to digital teaching methods.

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**Authors contributions**

Osamah Mohammad Ameen Aldalalah and Yousef Wardat conceptualized the study, designed the methodology, and supervised the overall research process. Ahmad Abdullah Al-Shraifin was responsible for data collection, analysis, and interpretation. Fuad Talafha contributed to drafting the initial manuscript and performing the literature review. All authors reviewed, revised, and approved the final version of the manuscript. All authors have read and agreed to the published version of the manuscript.

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No additional data are available.



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