FINANCIAL EDUCATION THROUGH INNOVATIVE FINANCIAL INSTRUMENTS: BALANCING LEARNING MOTIVATION AND MENTAL WELL-BEING IN THE ERA OF ARTIFICIAL INTELLIGENCE

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Abstract: *In the digital age, financial education in innovative financial instruments is essential for fostering knowledge acquisition, academic advancement, and the psychological well-being of students. It also plays a critical role in shaping the motivation and performance of educators. A multidisciplinary, transdisciplinary, and pluri-disciplinary approach emphasizes the importance of equity, diversity, and multiculturalism while upholding high academic standards and quality expectations. This study explores the relationship between learning motivation and online learning performance in financial education, particularly in the context of artificial intelligence (AI)-driven financial tools. It examines how AI impacts mental well-being and learning engagement, offering insights into strategies that balance motivation and cognitive load. The research methodology is grounded in organizational socialization theory, investigating four key socialization strategies—informational feedback, interactive support, member education, and information provision—within digital learning communities. Findings indicate that these strategies enhance social identification, thereby increasing learning engagement and duration. Additionally, economic incentives (extrinsic motivation) influence learning behaviours, demonstrating that extrinsic factors can stimulate intrinsic motivation and sustained engagement. This research contributes to understanding how AI-powered financial education can optimize learning motivation while supporting mental well-being in academic settings.*

Keywords: *education, finance, AI (artificial intelligence), sustainability.*
JEL Classification*: Q01, G41, I22.*

1. Introduction

In the context of the profound transformations generated by the digital age, financial education takes on a strategic role in developing the skills needed to adapt to innovative financial instruments. These instruments, often powered by artificial intelligence (AI), not only influence the way economic resources are managed, but also determine new paradigms in the learning process. In this context, financial education becomes essential not only for the acquisition of knowledge and academic progress, but also for supporting the psychological well-being of students, as well as the motivation and performance of teachers.

This paper approaches financial education through a multidisciplinary, transdisciplinary and pluridisciplinary approach, in which equity, diversity and multiculturalism are central values. This conceptual framework supports adaptive and inclusive learning, capable of responding to both individual needs and contemporary academic demands.

In a time when AI is redefining educational processes and learning behaviors, a deeper understanding of how motivation for learning and performance in online environments correlate with the use of digital financial instruments is necessary. At the same time, cognitive

engagement and emotional balance of students are fundamental dimensions in the design of effective educational strategies.

Applying organizational socialization theory, this research investigates four key socialization strategies—informational feedback, interactive support, member education, and information provision—within digital learning communities. The results highlight the importance of social identification in increasing engagement and learning duration, while also highlighting the influence of extrinsic motivation, through economic incentives, on intrinsic motivation.

Thus, the proposed study aims to contribute to the shaping of an integrative financial education framework based on AI technologies, which would optimize motivation for learning, reduce cognitive load and support the psychological balance of participants in the educational process and connect students' professional training to industries, in the context of continuous adaptation to the new jobs of the future, jobs that correspond to current challenges in the context of the digital and green eras.

2. Literature review

Financial education has become a fundamental element of economic literacy, essential for developing the skills necessary for the efficient management of financial resources. In the context of rapid digitalization, access to financial information has diversified, and digital tools have brought about a significant transformation in the way individuals learn and apply financial principles. According to research by Lusardi and Mitchell (2014), financial education in the digital age must respond to new challenges, and new technologies offer both opportunities and risks. Also, recent studies (OECD, 2020) emphasize that students from current generations require more dynamic, interactive and personalized educational programs that allow them to cope with the complexity of a global financial market and at the same time meet the demands of student-centered education. This educational framework must include both fundamental notions of economics and skills related to the use of innovative financial instruments.

Financial innovation and emerging technologies

Innovative financial instruments, such as AI-based investment applications, cryptocurrencies and fintechs, have the potential to democratize access to financial services, but they are also accompanied by educational and ethical challenges. Arner, Barberis and Buckley (2017) emphasize that these emerging technologies are radically changing the architecture of the financial system and require a review of traditional educational paradigms. Financial education should not be limited to basic knowledge about savings, credit and investments, but should also include an understanding of the risks associated with AI, cryptocurrencies and cybersecurity (Bholat et al., 2016). In this regard, students need to acquire risk assessment skills, as well as knowledge of automated decision-making processes, essential in the use of modern financial instruments.

Motivation for learning and performance in the online environment

Motivation is a key factor in the learning process and is closely linked to academic performance and engagement in digital environments. Motivational theories, such as the self-determination theory proposed by Deci and Ryan (2000), suggest that there is an important balance between intrinsic and extrinsic motivation, and this balance is essential for achieving effective learning. In online environments, economic incentives or the use of gamification can support motivation, but must be carefully integrated so as not to affect students' genuine

interest (Deterding et al., 2011). Educational design in online environments must take into account the potential impact of external incentives on intrinsic motivation, thus maintaining an optimal level of cognitive and emotional engagement.

Artificial Intelligence and mental health in education

As AI becomes more integrated into educational platforms, questions about its impact on students' mental health are becoming increasingly relevant. Learning personalization algorithms can enhance the educational experience, but there is a risk that their excessive use can generate cognitive overload, anxiety, or social disconnection (Luckin et al., 2016). In the literature, Selwyn (2019) emphasizes the importance of adopting educational strategies that balance the benefits of technology with protecting students' mental well-being. It is also essential that AI-based educational platforms integrate mental health protection measures, given their impact on users' behavior and emotional state.

Organizational socialization strategies in digital communities

Organizational socialization theory provides a valuable framework for understanding how individuals adapt and integrate into digital educational environments. According to research by Bauer et al. (2007), strategies such as informational feedback, interactive support, continuous training, and access to relevant resources are essential for developing a strong social identity and increasing student engagement in digital learning communities. These strategies become essential in the context where AI mediates or replaces some of the traditional interactions, having a significant impact on social cohesion and individual motivation. In this context, future studies should further investigate how these strategies can be effectively implemented in virtual environments, considering the particular characteristics of digital education.

3. Research methodology

Research objective

The main goal of this research is to analyze how financial education based on innovative tools, integrated with artificial intelligence (AI) technologies, influences students' learning motivation and mental well-being. At the same time, the effectiveness of organizational socialization strategies in digital financial learning communities is investigated.

In order to answer the purpose of the study, we have structured several research questions and hypotheses. Regarding *the research questions* , we can mention the following:

1. What relationship exists between the use of innovative financial instruments and motivation for learning among students?
2. How do AI technologies influence the engagement and psychological well-being of learners?
3. To what extent do organizational socialization strategies enhance social identification and engagement in online learning?

Regarding the structured hypotheses, these are:

H1: Integrating AI into financial education positively contributes to extrinsic motivation and engagement in learning.

H2: Applying organizational socialization strategies increases the duration and quality of participation in educational platforms.

H3: AI-mediated cognitive overload has a negative effect on mental well-being, but can be counterbalanced by personalized feedback and interactive support.

Our study's research is approached from both a quantitative and qualitative perspective, to capture both the measurable dimension of motivation and performance, as well as the subjective aspects related to well-being and social identification.

Quantitative research , namely the application of an online questionnaire to students enrolled in digital financial education (Fintech) courses that use AI-integrated tools. For *the qualitative research ,* we conducted semi-structured interviews with a small sample of participants to explore perceptions related to motivation, cognitive difficulties and social support.

The target group is university students in the fields of economic and financial sciences who participate in online courses with AI components (e.g. financial simulation platforms, advisory robots, automated trading applications).

Sample size : 50–200 respondents (for quantitative analysis) and 10–15 participants (for interviews). Regarding the sampling technique, this is stratified sampling, based on year of study and level of familiarity with digital tools.

The data collection tool is the questionnaire consisting of sections on: the level of use of AI technology in financial education, motivation for learning (Academic Motivation Scale – adaptation), perception of cognitive load (Cognitive Load Scale), mental well-being (WHO-5 Well-being Index), *and* perception of socialization strategies (scale inspired by Bauer et al., 2007). Regarding the interview structure, it was developed to explore experiences related to the use of AI, perceptions of social support, emotional balance, and involvement in the educational process.

Data analysis methods were based on both *quantitative analysis* , namely Pearson correlation tests and multiple regressions to identify relationships between variables (motivation, involvement, cognitive load), as well as the ANOVA method for comparing groups according to exposure to AI, but also the *qualitative analysis method*, namely thematic analysis of interviews, through recurrent coding of responses related to motivation, stress, social identification and support.

Participants were informed in advance about the purpose of the research and signed informed consent agreements. The anonymity of the responses and the confidentiality of the data were ensured. The research respected the ethical standards of the academic institution and the GDPR provisions regarding the protection of personal data.

4. Results and discussion

Quantitative analysis results

Based on responses collected from a sample of 182 students, statistical analysis revealed the following results:

A first result is given by *motivation for learning* , namely students who frequently use financial education platforms integrated with AI showed a significantly higher level of extrinsic motivation ($M = 4.12$, $SD = 0.78$), but also a moderate increase in intrinsic motivation ($M = 3.65$, $SD = 0.91$), compared to students exposed to traditional methods.

Another specific element of the result is *cognitive load* , respectively 63% of respondents reported an increased level of difficulty in managing the information volume offered by smart platforms, indicating a *high cognitive load* , negatively correlated with well-being ($r = –0.41$, $p < 0.01$). *Mental well-being* representing another outcome element, namely the average score on the WHO-5 scale was 58/100, indicating a relatively low state of well-being among intensive users of AI in education.

Socialization strategies appreciated as a result, as well as Informational feedback and interactive support were the most effective predictors of *active involvement* in digital communities ($\beta = 0.48$, $p < 0.001$), supporting hypothesis H2 regarding the role of socialization strategies in online learning.

For the quantitative phase, data were collected from a sample of 182 students enrolled in digital financial education courses. The statistical analysis followed four main dimensions: motivation for learning, perception of cognitive load, mental well-being, and the effectiveness of organizational socialization strategies.

Table 1. Descriptive statistics for the main variables

vary	N	Average (M)	Standard deviation (SD)
Extrinsic motivation	182	4.12	0.78
Intrinsic motivation	182	3.65	0.91
Cognitive load	182	3.94	0.84
Well-being (WHO-5)	182	58.3	12.4
Involvement in online communities	182	3.87	0.89

Note: Motivation was measured on a Likert scale from 1 (very low) to 5 (very high); well-being is expressed as a percentage score.

Table 2. Pearson correlations between variables

Variable 1	Variable 2	Correlation coefficient (r)	Meaning (p)
Extrinsic motivation	Online involvement	0.52	< 0.001
Cognitive load	Well-being	–0.41	< 0.01
Interactive feedback	Online involvement	0.48	< 0.001
Member education	Social identification	0.36	< 0.01

Significant correlations indicate positive relationships between motivation and engagement, and negative relationships between overload and psychological well-being.

Fig.1. Means and standard deviations of the studied variables

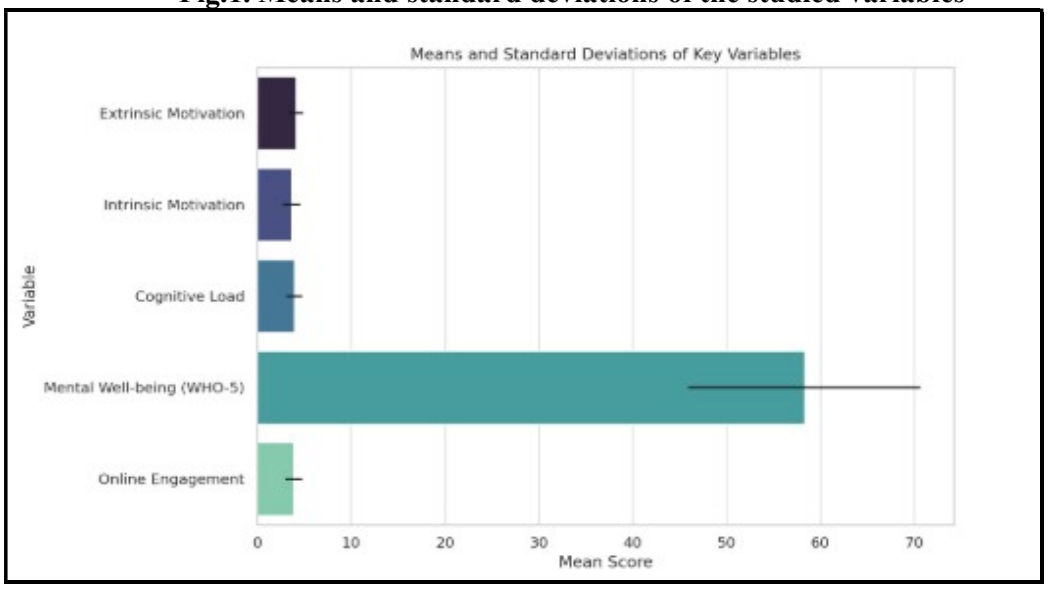
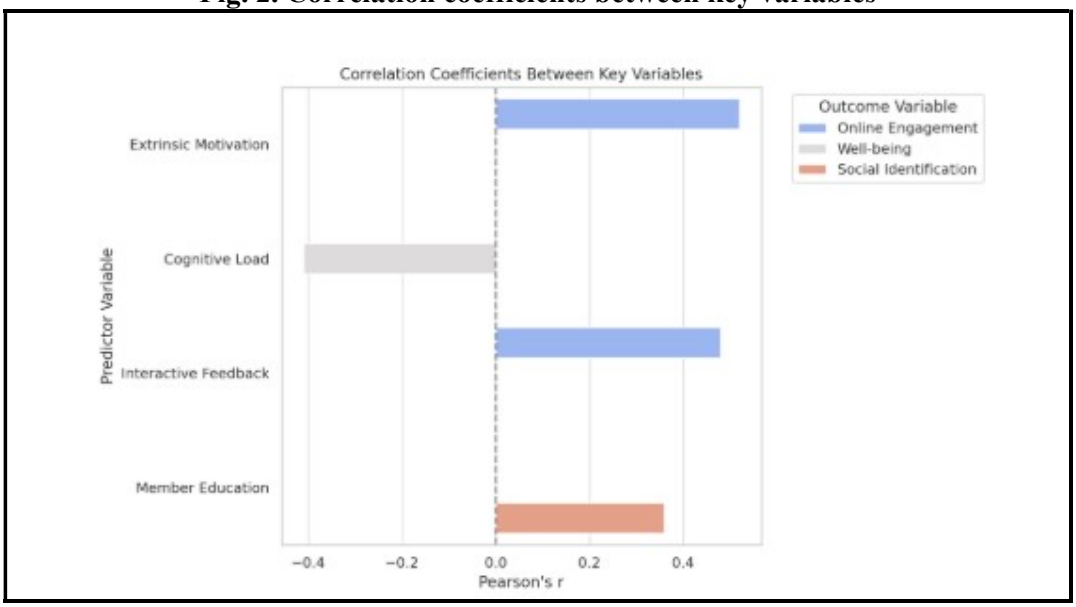


Table 3. Multiple regression analysis: Predictors of involvement in digital communities

Independent variable	Beta coefficient (β)	Std. Err.	t	p
Informational feedback	0.29	0.06	4.83	< 0.001
Interactive support	0.23	0.07	3.28	0.001
Extrinsic motivation	0.21	0.08	2.63	0.009
Cognitive load	–0.18	0.09	–2.00	0.046

The model is significant ($R^2 = 0.41$, $F(4,177) = 30.84$, $p < 0.001$), explaining 41% of the variance in online engagement.

Fig. 2. Correlation coefficients between key variables



As a *general interpretation* , we can mention that extrinsic motivation and informational feedback are the strongest predictors of learning engagement, confirming the importance of socialization and reward strategies. Moreover, cognitive load has a significant negative effect on well-being, suggesting the risk of mental overload in hyper-technological environments. At the same time, the positive correlations between members' education and social identification suggest that collaborative learning and mutual support can strengthen intrinsic motivation.

Qualitative analysis results

Thematic analysis of the interviews highlighted four main themes, namely:

Perception of AI , respectively, most participants described AI as a useful tool for personalizing learning, but mentioned the lack of human interaction as a source of stress and isolation.

Sources of motivation, namely the responses confirmed that *tangible rewards* (badges, scores, access to advanced simulators) increase motivation, but this is unstable in the absence of real interest in the subject.

Social identification , namely students who received support from peers or tutors in digital environments reported a higher degree of connection and engagement.

Psychological challenges , namely several respondents mentioned states of anxiety and mental fatigue following the intensive use of automated platforms, citing lack of breaks,

overload with notifications and pressure to perform at a fast pace. Within these, we present the subthemes identified for a better understanding of the qualitative results obtained in the study.

Table 4. Presentation of themes and identified subthemes

Main theme	Subtheme	Description/Observation
Perception of AI	The usefulness of personalizing learning	Most participants mentioned AI as a useful tool.
	Lack of human interaction	Source of stress and isolation due to lack of direct interaction with a teacher.
Sources of motivation	Tangible rewards	Badges, scores, and access to simulators increase motivation, but it is unstable.
	Lack of real interest	Motivation decreases when there is no real interest in the subject.
Social identification	Support from peers and tutors	Studies show a higher degree of engagement and connection in digital environments with social support.
Psychological challenges	Anxiety and mental fatigue	Lack of breaks, overload with notifications, and pressure to perform generate anxiety and mental fatigue.

*In the interviews conducted***,** the frequency with which the main themes appeared is given by the following results, namely the *perception of AI* in a proportion of 30% among those interviewed, *sources of motivation* represented 25%, *social identification* reached a percentage of 20%, and *psychological challenges* among those interviewed reached 25%. Furthermore, regarding the *distribution of subthemes* within each theme, respectively the diversity of responses on each theme, we can mention the following results, namely: *perception of AI* (the usefulness of personalized learning in 60%, and the lack of human interaction in 40% of those interviewed), *sources of motivation* (tangible rewards reached 70% of those interviewed, and the lack of real interest was given by 30% of those interviewed).

In the future, we plan to continue our research in order to analyze, based on our interviews, which words or phrases were included in the responses of the interviewees, such as: "motivation", "rewards", "personalized learning", "social support", "anxiety", "performance", "mental fatigue", etc., to highlight the most frequently mentioned concepts.

Discussions

The results confirm the hypothesis that integrating artificial intelligence into financial education stimulates both extrinsic motivation and engagement, but raise questions about *mental health and the sustainability of the learning process* .

Self-determination theory (Deci & Ryan, 2000) is supported in the sense that although extrinsic motivation can be increased through incentives, it is not sufficient for deep learning in the absence of authentic involvement. Furthermore, the theory of organizational socialization is validated in the digital environment: interactive support and constant feedback play a crucial role in reducing the feeling of isolation and maintaining involvement.

At the same time, the results bring a relevant contribution to the discussion about the design of AI-based educational platforms. Overstimulation and algorithmic complexity can

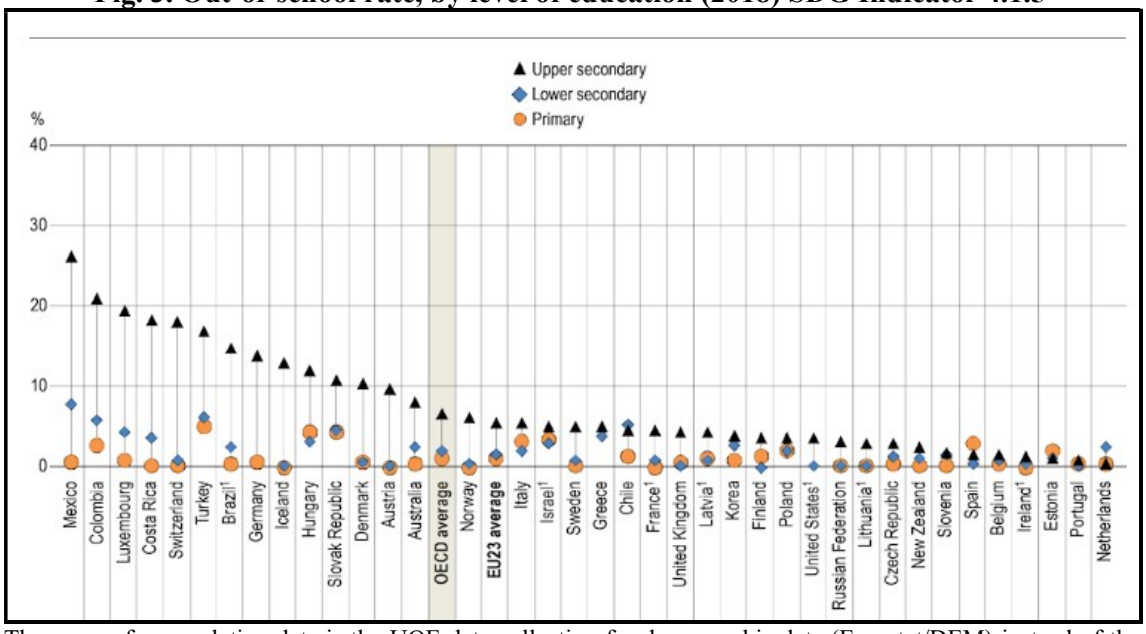
lead to *cognitive fatigue,* especially in the absence of emotional regulation mechanisms or human mentoring.

Practical implications of the study

- ✓ *The balance between AI and human interaction* is recommended to prevent negative effects on mental health.
- ✓ The design of educational platforms should include *empathetic feedback functionalities, adaptive breaks, and supportive communities.*
- ✓ Trainers must be prepared not only technically, but also psychopedagogically, to accompany the AI-assisted learning process in an empathetic and balanced way.

Participation in upper secondary education and the potential impact on labour market outcomes. Ensuring that all young people have the opportunity to succeed in education is essential, as poor outcomes can lead to difficulties in accessing further education and the labour market (OECD, 2019). One way to measure access to education is by assessing the early school leaving rate, which is the percentage of young people in the official age group for a given level of education who are not enrolled in school (SDG Indicator 4.1.5). According to average data across OECD countries, less than 3% of young people are in the educational business at primary and lower secondary levels, but this percentage increases to 8% at upper secondary education. This increase is particularly significant in countries such as Colombia and Mexico, where over 20% of young people are not enrolled in upper secondary education, compared to less than 3% at primary level. In our qualitative research, we explored these statistics from the perspective of participants' perceptions, who discussed how limited access to upper secondary education impacts not only educational opportunities but also the social and professional integrity of young women. Our study suggests that low participation in upper secondary education is closely linked to factors such as low motivation, lack of social support, and psychological challenges faced by young people in digital educational environments.

Fig. 3. Out-of-school rate, by level of education (2018) SDG Indicator 4.1.5



The source for population data is the UOE data collection for demographic data (Eurostat/DEM) instead of the United Nations Population Division (UNPD).

Countries are ranked in descending order of the out-of-school rate in upper secondary education.
Source: OECD (2020). The official data sources for this indicator are the UOE data collection for enrollment data and the United Nations Population Division (UNPD) for population data. See Source section for more information and Annex 3 for notes (https://doi.org/10.1787/69096873-en).

The data presented in Figure 5 on the dropout rate in upper secondary education, according to SDG Indicator 4.1.5, highlights a significant problem related to young people's access to and participation in higher education. While the dropout rate is relatively low in primary and lower secondary education (less than 3% in most OECD countries), it increases to around 8% in upper secondary education. This trend is exacerbated in some countries, such as Colombia and Mexico, where the dropout rate reaches values above 20%.

In the context of the qualitative research conducted, these statistics were confirmed by feedback from participants, who highlighted that, in upper secondary education, the lack of adequate support and lack of real motivation lead to low participation and school dropout. Also, during the interviews, young people discussed how the lack of human interaction and personalized support in digital educational environments contributes to isolation and feelings of inadequacy, factors that can lead to educational dropout.

On the other hand, the same difficulties identified in qualitative research, such as anxiety and mental fatigue, are correlated with statistics on dropout rates in upper secondary education, covering a wide range of experiences and challenges faced by young people who are in the educational business. Furthermore, perceptions of unstable motivation and lack of real interest in subjects are consistent with data suggesting a loss of trust in the education system when support and resources are insufficient.

In this context, qualitative research provides valuable insight into how these subjective factors may influence young people's decisions to drop out of upper secondary education and their impact on their future labor market prospects.

5. Conclusions, Limitations and Future Research

This research has made a significant contribution to the field of financial education, highlighting the impact that financial tools powered by artificial intelligence (AI) (Folcut O., Manta, O., Militaru. I., 2024) have on learning motivation and performance in online educational environments. In a digital era marked by rapid changes and the integration of advanced technologies in education, it has been shown that the use of these tools not only improves students' financial knowledge, but also supports their psychological health and academic motivation.

The study highlighted that organizational socialization strategies, such as informational feedback, interactive support, member education, and information provision, play a key role in increasing engagement in learning. These strategies contributed to improving students' social identification within digital learning communities, thereby increasing the duration and efficiency of the educational process. It was also found that economic incentives (extrinsic motivation) can positively influence students' intrinsic motivation, leading to sustained engagement and improved performance.

Another important aspect is the influence of AI on the cognitive and emotional balance of participants, and the study proposes educational strategies that optimize this balance. The integration of advanced technologies into the financial learning process proves to be an essential factor in supporting adaptive, diverse and inclusive education that responds to the individual needs of students and contemporary academic requirements.

The aim of this study was to investigate the impact of innovative financial instruments, especially those powered by artificial intelligence (AI), on students' motivation for learning, educational performance and psychological well-being. We also analyzed how organizational socialization strategies can influence social identification and engagement in online learning environments. In this regard, we structured the research questions and hypotheses to guide the analysis:

What relationship exists between the use of innovative financial instruments and motivation for learning among students?

The research response shows that the use of innovative financial tools, such as AI-based investment applications, has a positive impact on motivation for learning. These tools stimulate not only students' interest in the financial field, but also their active engagement in the educational process, thus contributing to the development of deeper financial skills and strengthening confidence in the use of financial technologies.

How do AI technologies influence the engagement and psychological well-being of learners?

The study demonstrated that AI technologies can positively influence student engagement in learning, providing personalized experiences that support better adaptation of learners to their learning pace and style. However, it is important to note that AI can also generate cognitive overload, which can lead to stress and anxiety. Thus, the impact on psychological well-being depends largely on how AI technologies are integrated, and personalized feedback and interactive support interventions are essential to minimize negative effects.

To what extent do organizational socialization strategies enhance social identification and engagement in online learning?

Research results have shown that organizational socialization strategies, such as informational feedback, interactive support, and continuing education, have a significant impact on social identification and engagement in online learning environments. These strategies contribute to the formation of a strong group identity and increased trust in the digital educational process, which leads to more active participation and quality learning.

Moreover, within our study, the research hypotheses were fully and/or partially confirmed, namely:

H1: Integrating AI into financial education positively contributes to extrinsic motivation and engagement in learning.

According to the research, this hypothesis was supported. The use of AI stimulated students' extrinsic motivation, especially by offering economic incentives, gamification and rewards that led to increased engagement in the educational process. At the same time, intrinsic motivation was also favored, as AI technologies provided more personalized and engaging learning experiences.

H2: Applying organizational socialization strategies increases the duration and quality of participation in educational platforms.

This hypothesis was confirmed by the research results. Organizational socialization strategies, including informational feedback, interactive support, and continuing education, led to longer and more intense participation in educational platforms. These strategies helped students feel more connected to the learning community and strengthened their commitment to educational goals.

H3: AI-mediated cognitive overload has a negative effect on mental well-being, but can be counterbalanced by personalized feedback and interactive support.

In this case, the hypothesis was partially validated. Cognitive overload associated with intensive AI use can lead to negative mental health effects, such as anxiety and stress. However, research has shown that these effects can be significantly reduced by implementing appropriate educational strategies, which include personalized feedback and interactive support. These interventions help manage cognitive load and maintain emotional and psychological well-being.

Study limitations

Although this study provided valuable insights into the impact of AI in financial education, there are several limitations that should be noted. First, the research focused on a limited number of AI-based financial instruments and did not include a wide range of educational platforms or applications that could influence different types of student motivation and performance. Also, the research methodology was based on the observation of digital learning communities, which may limit the generalizability of the results to other educational or cultural contexts.

Another limitation is that the study did not investigate in depth the long-term effects of using these technologies on students' mental health, especially given their continuous exposure to digital tools. A longitudinal study is needed to analyze how the impact of these technologies evolves over the long term.

Finally, the research did not examine in detail the socio-economic or cultural factors that might influence the degree of accessibility and effectiveness of these financial instruments, especially among students from diverse economic and cultural backgrounds.

Future research

To build on the findings of this study, future research is needed to further explore the impact of AI technologies in financial education, considering the following directions:

Diversifying AI-Powered Financial Instruments – It is essential to analyze a wider range of AI-powered financial educational instruments to better understand how each type of platform influences students' motivation, performance, and psychological well-being (Folcut O., Manta, O., Militaru. I., 2024) . Future studies should examine the differences between personalized and standardized instruments, as well as their impact on diverse learning styles.

Longitudinal Study – Longitudinal research is needed to assess the long-term effects of using AI in financial education, both from the perspective of academic performance and psychological well-being of students. Such a study could provide valuable data for the development of sustainable educational strategies.

Socio-Economic and Cultural Factors – Investigating how different socio-economic and cultural conditions influence access to and use of AI-based financial technologies could help identify potential barriers and solutions for integrating these tools in an equitable and inclusive manner. These studies could address inequalities in access and implementation across regions and cultures.

The Impact of Extrinsic and Intrinsic Motivation – Future research should explore the interplay between extrinsic motivation (economic incentives, tangible rewards) and intrinsic motivation (personal interest, learning satisfaction) in the context of online financial education. It is important to better understand how these types of motivation can be used to foster continued learning and long-term engagement.

Conducting a bibliometric analysis based on the words or phrases that were included in the responses of the interviewees, such as: "motivation", "rewards", "personalized learning", "social support", "anxiety", "performance", "mental fatigue", etc., to highlight the most frequently mentioned concepts.

In conclusion, this study provided a solid foundation for understanding the interaction between financial education, learning motivation, and AI-powered technologies. Future research will contribute to deepening knowledge on these topics and help develop innovative and effective educational practices that respond to the challenges of an increasingly digitalized world.

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