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Personality traits and digital tool integration for quality education: a mixed-methods study on sustainable learning and psychological outcomes

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This mixed-methods investigation aims to explore the potential of implementing a multimedia-supported instructional design that integrates accessible digital tools and is sensitive to the diverse HEXACO personality traits of students within a teacher education context. This personality-sensitive approach to digital tool integration seeks to enhance the quality of education, which is a fundamental aspect of Sustainable Development Goal 4. Grounded in Self-Determination Theory and the HEXACO personality model, the study examines how this personality-sensitive approach may relate to multidimensional engagement, the fulfillment of basic psychological needs, and potential contributions to sustainable learning. The methodology combined quantitative pre-test/post-test analysis to measure changes in psychological needs, correlation analyses to assess relationships between personality traits and engagement metrics, and qualitative thematic analysis to explore the depth of student experiences. Quantitative analyses indicated a significant increase in students' basic psychological need satisfaction and a significant decrease in need frustration following the instructional design. Additionally, specific personality traits showed significant associations with class attendance, the perception that using multimedia as a teaching tool positively affected learning, and the perceived increase in professional identity awareness. Qualitative thematic analysis identified four main themes in students' reflective feedback: enjoyable learning, positive evaluation, perspective change, and learning effectiveness. These integrated findings suggest that the implemented instructional design, by using films and animations to concretize abstract concepts and providing flexible multimedia options, is positively associated with cognitive, emotional, and behavioral engagement. Overall, this multimedia-supported instructional design enriched with accessible digital tools may support multidimensional student engagement, help address basic psychological needs, and contribute to the broader objectives of sustainable learning and Quality Education.

KEYWORDS

digital tools, higher education, mixed method, personality traits, quality education, student engagement, sustainable learning

1 Introduction

Technological developments and the rapid entry of digital technologies into our lives are increasing the challenges faced by educators, especially in the field of higher education. In today's world, where information is easily accessible from anywhere, acquiring information through the internet has become easier than ever. Modern lifestyles, particularly the overuse of smartphones, are causing a significant decline in students' attention and focus. Constant digital distractions weaken sustained attention, diminishing the quality of learning (Newport, 2016). This suggests that designing learning environments that minimize cognitive overload and encourage deliberate focus is increasingly important in the educational context. Universities, often characterized by long histories and distinct academic cultures and relatively traditional structures, must innovatively develop their teaching methods and course contents, including compulsory curricula, in order to maintain their relevance and increase student participation and engagement. An effective strategy for combating common problems such as shortened attention spans and digital distraction is to use technology not as a distraction but as a tool for deeper engagement. This engagement requires diversifying instructional materials through multimedia, such as movies and animations (Barron, 2006). Integrating these visual tools effectively requires a clear pedagogical strategy (Godwin, 2003), an approach that closely aligns with contemporary filmic pedagogies (Barker, 2025), where films are utilized not merely as passive entertainment, but as structured mediums for active reflection and meaning-making. Recent studies highlight that such blended learning modes in the digital era significantly promote active participation and self-directed interactions (Joshi et al., 2023), while visualization tools help bridge abstract concepts with concrete outcomes (Lu and Hu, 2025). This diversification of instructional strategies is effective in capturing students' attention, engaging them emotionally, and facilitating the complex task of connecting theoretical concepts in the course content to real-life experiences (Mayer, 2009; Shernoff, 2013). Participation refers to students' observable behavioral involvement in lessons, including attending class, contributing to discussions, or completing assignments. However, the broader concept of student engagement extends beyond mere participation. It is a multidimensional construct where individuals are actively involved across behavioral, emotional, and cognitive dimensions (Fredricks and McColskey, 2012; Skinner and Pitzer, 2012). Contemporary research underscores that digital immersion cultivates these multidimensional engagement layers (Lin et al., 2024).

Today, educational settings face increasing diversities, making personalized learning approaches essential to accommodate students' individual differences (Chen and Wang, 2021). There is also an increasing need for inclusive digital environments that respect the diverse needs of all learners (Guspian et al., 2025). These global shifts make it essential to understand individual psychological profiles to ensure that any digital tool genuinely supports student engagement.

Within the broader educational field, this multidimensional construct is identified as a primary driver of academic success and graduation rates (Fredricks and Eccles, 2006; Fredricks et al., 2004; Kahu, 2013; Maskell and Collins, 2017; Zepke and Leach, 2010). Beyond academic achievement, sustained engagement is linked to a significant reduction in risky behaviors, including criminal activity, substance use, depression, and dropout (Henry et al., 2012; Joyce and Early, 2014; Li and Lerner, 2011; Wang and Fredricks, 2014). This critical construct is shaped not only by individual factors but also by social elements such as classroom climate and specific instructional methods (Fredricks, 2015). Consequently, learning success is significantly strengthened in environments that encourage autonomy and positive teacher-student interactions (Han, 2021).

As education increasingly integrates digital environments, technology's impact on these engagement dimensions becomes essential for optimizing both learning outcomes and the overall classroom climate (Lin et al., 2024). Recent structural modeling reinforces that the ultimate effectiveness of digital tools is heavily mediated by the depth of student engagement and the quality of their learning experience (Zhang et al., 2024). Within this framework, engagement functions as the primary connecting factor in technology-based learning; it not only leverages digital tools to improve student competence and motivation (Aslan and Imelda, 2025) but also supports well-being and inclusive participation within the school community (Bocconi et al., 2020). Consequently, the successful integration of educational technology is closely linked to its ability to sustain this level of engagement.

The concepts of school engagement and disengagement are commonly identified by instructors. The most common difficulty encountered in classrooms is seen to be students' disinterest, and studies on this show that more than half of the students have symptoms of disinterest (Yazzie-Mintz and McCormick, 2012). Engagement is a multidimensional construct encompassing students' thinking, behavior, and emotions. Increasing participation in school means decreasing disengagement. This is of critical importance for educators, as it is their responsibility to develop specific prevention and instructional strategies to advance learner engagement. In this context, a positive school climate has a significant impact on students' academic achievement and other positive outcomes (Wang and Degol, 2016). Recent research indicates that while face-to-face settings may promote higher levels of performance engagement compared to virtual environments, integrating technology in these classrooms is a common practice to support student involvement (Teoh et al., 2025). Additionally, integrating visual digital tools helps reduce students' cognitive load by making abstract concepts concrete, which directly stimulates deeper engagement (Lu and Hu, 2025). Therefore, both improving the quality of educational environments and ensuring technology integration may support engagement at multiple levels and the effectiveness of educational processes.

Today, simply bringing technology into the classroom is not enough. The United Nations (2025) reports that while digital access has expanded globally, learning outcomes are actually

Abbreviations

SDT, self-determination theory; HEXACO, honesty-humility, emotionality, extraversion, agreeableness, conscientiousness, openness; BPNSFS, basic psychological need satisfaction and frustration scale; ESD, education for sustainable development; SDG 4, sustainable development goal 4.

declining, highlighting a significant gap between mere access and effective learning. This decline indicates that generic digital applications often fail to genuinely engage students. While educators sometimes rely on visual or verbal learning styles to personalize content, empirical research indicates this does not improve learning (Massa and Mayer, 2006). Instead, effective multimedia must deeply engage a student's underlying motivation (Mayer, 2014).

This study addresses this gap by examining how different multimedia materials meet these distinct psychological needs. True inclusive education requires addressing the diverse needs of all learners rather than using a single method (Tonegawa, 2023). Indeed, Quality Education (SDG 4) cannot be achieved through rigid, standardized recipes that ignore human diversity (Ydesen and Elfert, 2023). By offering a diverse selection of multimedia options, this study suggests how learning environments sensitive to individual identities avoid these standardized traps, potentially fostering genuine engagement and supporting the advancement of SDG 4, particularly within a teacher education context.

2 Theoretical background

2.1 Self-determination theory (SDT)

SDT is a theory developed over the last half century that is effective in explaining student engagement in the classroom (Deci and Ryan, 2000). The theory states that resources like intrinsic motivation and psychological needs are the basis for high-quality learning environments and positive school lives (Jang et al., 2016; Ryan and Deci, 2000). Autonomy, competence, and relatedness are the three basic needs that students can develop and be supported within the classroom. When these needs are supported, they positively affect student motivation and well-being (Ryan and Deci, 2000). The teacher is responsible for stimulating and multiplying these internal resources (Reeve and Halusic, 2009). This can be done with course content that is enriched and well-structured. According to SDT, student engagement happens because of the interaction between the student's internal resources and the supportive classroom climate (Reeve, 2012).

Students' constructive contributions to the instructional flow, achieved through personalizing the course and improving learning conditions, are conceptualized as agentic engagement. Alongside traditional behavioral, emotional, and cognitive dimensions, this form of participation serves as a important driver for constructive motivation and success (Reeve and Tseng, 2011). Especially in multimedia-supported environments, students should not remain passive consumers of content. Fostering "digital student agency" empowers learners to actively engage with and make meaning of these materials, rather than merely receiving them (Stenalt, 2021). This shows that student participation is not limited to visible actions, but includes psychosocial and structural contributions. It is essential to understand student engagement in a holistic way with both social-environmental and individual-psychological aspects (Kahu and Nelson, 2018; Kassab et al., 2024).

Contemporary SDT research emphasizes that psychological needs operate on a dual continuum: learning environments can either actively support these needs (leading to need satisfaction, which fuels intrinsic motivation and engagement) or actively thwart them (resulting in need frustration, which leads to disaffection and burnout) (Vansteenkiste et al., 2020). Therefore, measuring both satisfaction and frustration is essential to fully capture the psychological impact of any instructional design.

2.2 Educational interface model: a framework for student engagement

The educational interface model, developed by Kahu and Nelson (2018), describes the dynamic space where the interactions between students and institutions occur. This model helps us understand how student factors (such as personal characteristics and experiences) and institutional factors (such as teaching methods and policies) intersect to influence student engagement. The interface concept highlights four key mediating mechanisms that affect academic engagement: self-efficacy, belonging, emotional state, and well-being. It reflects the ever-changing nature of learning experiences, recognizing that engagement varies with each student, interaction, and task. The model emphasizes the need for institutions to adopt flexible, supportive, and student-centered approaches to activate these mechanisms and enhance student participation and engagement.

In line with this framework, this study maps SDT's needs for relatedness and competence directly onto the model's belonging and self-efficacy mechanisms, respectively, to examine how multimedia tools foster these psychological pathways.

2.3 Global context and rationale: quality education and sustainable development goals

The global agenda for Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education), provides an essential framework for instructional reform in higher education. Higher education institutions serve as essential centers for knowledge and innovation, playing a critical role in advancing global sustainability goals (Leal Filho et al., 2025). The aim of SDG 4 goes beyond simply ensuring access to education; it emphasizes the importance of learning outcomes that promote critical thinking, creativity, global citizenship, and skills for meaningful employment. A key aspect of the SDG 4 mandate is Education for Sustainable Development (ESD), which requires education to cultivate essential sustainability competencies (Rieckmann, 2018; UNESCO, 2015). These competencies, which include systems thinking, anticipatory skills, and action competencies, transcend traditional knowledge transfer and prepare learners to tackle complex, real-world sustainability challenges (Rieckmann, 2018). Achieving this quality of education necessitates instructional designs that are not only effective in maximizing cognitive retention but also inclusive and adaptable—a design philosophy known as sustainable education. This approach calls for a shift toward transformative and action-oriented teaching approaches that promote behavioral, socio-emotional, and cognitive learning objectives central to ESD (Rieckmann, 2018).

2.4 Digital tools, multimedia learning, film-based pedagogy, and sustainable education: an integrated theoretical approach

The integration of digital tools, particularly multimedia, significantly contributes to the realization of "Quality Education" by transforming traditional lecture-based methods into student-centered, experiential learning experiences, as advocated by ESD (Rieckmann, 2018). The theoretical basis for multimedia use is the Cognitive Theory of Multimedia Learning (CTML) (Mayer, 2009), which posits that students who engage with both audio and visual channels simultaneously process information more effectively, leading to deeper comprehension and retention. This approach, called the dual-coding process, aligns with the need for instruction that addresses shortening attention spans in the digital age. This perspective parallels the multilayered theoretical framework of this study.

Today, providing personalized experiences that meet unique student needs is a priority in education. However, the success of educational technology does not come from its complexity. Advanced digital tools often struggle to fit into formal classrooms due to infrastructure and pedagogical challenges (Samala et al., 2024). Instead, effective adoption depends on human-centered designs that truly understand learners' needs and fit the instructional context (Topali et al., 2025). Considering the need for more focused efforts to reach the 2030 goals (United Nations, 2025), this study suggests that integrating accessible multimedia is a highly practical and human-centered approach to achieving inclusive quality education. This integrated perspective suggests that technological power is most effective when it builds learner agency (Kahu and Nelson, 2018) and develops key competencies within the socio-emotional domain (Rieckmann, 2018).

To move beyond the general scope of digital learning, the instructional approach in this study integrates the principles of film-based pedagogy into its broader theoretical framework. In academic contexts, film is a broad umbrella term that includes both traditional movies and animations. However, simply showing a movie in class is not enough; educators need a deliberate strategy to make these visual tools effective and meaningful for students (Godwin, 2003). Building on this foundation, contemporary literature increasingly refers to this inclusive educational practice as filmic pedagogies (Barker, 2025). In this context, films act as a shared "third space" that bridges abstract theories with concrete experiences, creating an ideal environment for transformative learning (Li, 2021). Within this pedagogical framework, utilizing movies in education effectively engages the affective domain, allowing students to link theoretical concepts to real-life experiences (Shankar, 2019). When integrated strategically as a formal teaching tool rather than mere entertainment, feature films offer valuable insights into social and humanistic values (Baños and Bosch, 2015). The use of movies in higher education provides an accessible and emotionally resonant pathway to rational reflection and professional identity development (Blasco et al., 2015). Furthermore, integrating reflective film assignments and classroom discussions about these narratives stimulates students to explore multiple perspectives, supporting narrative learning, empathic understanding, and deep reflective thinking (Rueb et al., 2024).

Furthermore, multidimensional student engagement is a key variable for achieving quality and sustainability in education. Digital tools used in a personality-sensitive manner help meet SDG 4 by moving away from a one-size-fits-all model and prioritizing individual requirements (United Nations, 2015). Within this framework, multimedia materials serve as powerful digital vehicles that bridge innovative technical delivery with the specific psychological and engagement needs of the learner. By accounting for these individual differences, this study directly supports the cognitive, socio-emotional, and behavioral learning goals at the heart of sustainable development (UNESCO, 2015, 2017).

2.5 The HEXACO model: a six-dimensional framework for personality structure

The HEXACO model was developed by Ashton and Lee (2007) and was presented as an alternative to the traditional "Big Five Model" in explaining personality structure and was expanded to include six basic factors. The HEXACO model aims to understand personality traits more comprehensively and in depth, and each of the factors is defined in a way that better explains the behaviors and attitudes of individuals: Honesty-Humility (H) (fairness, sincerity, modesty; a tendency not to exploit others); Emotionality (E) (empathic concern, attachment, harm-avoidance); eXtraversion (X) (sociability, liveliness); Agreeableness (A) (forgiveness, tolerance); Conscientiousness (C) (organization, diligence); and Openness to Experience (O) (intellectual curiosity, creativity).

In this context, the HEXACO model was chosen because it allows for a broader understanding of students' behavior and interactions within the classroom from a personality perspective. By going beyond the traditional "Five-Factor Model" and adding the honesty-humility dimension, it allows for a more comprehensive assessment of students' cooperative tendencies, sense of responsibility, and academic honesty tendencies (Ashton and Lee, 2007). This dimension's relevance to sustainable engagement is central to this study. The honesty-humility dimension, in particular, helps explain students' cooperative and responsible behavior in classroom interactions; it is highly relevant to students' participation sustainably, a key concept in this study. In this sense, recent discussions state that the future of education should address the diversity of learners' personality traits (Arar et al., 2023), and accommodating these differences through technological tools is now considered essential for building inclusive and sustainable educational environments (Guspian et al., 2025).

2.6 Present study

The primary reason for considering personality traits in this study is to emphasize that each student participates in the learning process uniquely and has different motivational orientations. Recognizing this diversity is particularly vital within a teacher education context, where future educators are actively developing their professional identities. This uniqueness

in the educational environment suggests that the same course content may not have the same impact on all students. Hence, it is important to enrich course content to ensure that students with diverse personality profiles can engage in the learning process and express themselves. In this context, a course curriculum was designed by integrating key theoretical perspectives—SDT, the educational interface model, and the HEXACO personality framework—to create an engaging, student-centered learning environment.

This integrated approach allows for a clearer understanding of how personality traits interact with the learning environment and shape the motivational orientations highlighted by SDT. Within this approach, HEXACO facilitates understanding of individual differences and personality dispositions; SDT explains how students' basic psychological needs (autonomy, competence, and relatedness) can be supported; and the Educational Interface Model describes the dynamics that influence engagement at the intersection of individual and institutional factors. Together, these three frameworks help provide a holistic explanation of both students' individual dispositions and how the learning environment interacts with these dispositions.

In summary, this design guided the selection of course materials, activities, and assessments to increase student motivation and academic achievement, with the desired outcome of creating a classroom climate that would increase engagement and create a sense of comfort and security. The inclusion of multimedia-based activities (films, animations, reflective writings/papers) caters to both different learning styles and motivational needs, providing a more inclusive learning environment where each student can realize their potential. In this context, attention was paid to diversity in the film selections, including not only classic films but also animations with different narrative styles. This approach appealed to students with different audiovisual preferences and aimed to include an element that would attract the attention of every student by providing a variety of content and formats.

The course design and its components that are based on these theoretical perspectives are visually summarized in Figure 1. It emphasizes how films, animations, and interactive classroom activities are incorporated into the course to increase student motivation and engagement. The goal was to create multiple connection points for different HEXACO traits, allowing each student to engage with the material through their own unique personality orientation rather than being forced into a single, standardized learning method.

In line with these rationales, this study developed a research model to examine how multimedia-enriched course content interacts with students' personality profiles and motivational tendencies and shapes their engagement levels. Accordingly, the research questions guiding this study are as follows:

1. To what extent does the multimedia-supported instructional design change students' levels of basic psychological need satisfaction and need frustration?
2. What are the relationships between the HEXACO personality dimensions and students' attendance, the number of assignments completed, their attitudes toward multimedia use, the perception that using multimedia as a teaching tool positively affected learning, relating theory to real life, and the perceived increase in professional identity awareness?
3. How do multimedia-supported course applications relate to students' cognitive, emotional, and behavioral engagement?
4. What themes emerge in the qualitative data regarding students' multimedia-supported learning experiences, and how do these themes contribute to the course process?

3 Materials and methods

3.1 Research design

Mixed methods research was chosen to address research problems that could not be fully explained by a single method. There is a need for multiple perspectives when dealing with issues that a single approach cannot fully capture (Plano Clark and Ivankova, 2016). The study utilized a quasi-experimental design with a pretest-posttest approach to quantitatively examine the changes in students' psychological needs following a multimedia-supported course. For this purpose, a concurrent mixed methods design was selected to achieve triangulation and complementarity (Creswell and Plano Clark, 2018; Greene et al., 1989). Adopting this approach aims to generate a methodological yield by combining the strengths of both data types (McCrudden et al., 2019). While quantitative metrics can indicate numerical shifts in psychological needs, relying solely on them might leave the underlying reasons for these changes relatively unexplored. Similarly, qualitative data alone might lack the statistical context needed to observe broader patterns. Integrating both strands helps to build a more comprehensive understanding of the learning experience than either method might provide on its own (Hanson et al., 2005). While the quantitative strand tracked shifts in students' needs through pretest and posttest measures, qualitative data and personality traits (HEXACO) were collected concurrently during the posttest phase. The integration of both types of data was performed during the interpretation stage following established procedures (Ivankova et al., 2006). This process aimed to create meta-inferences to ensure that conclusions are consistent across both methods and to explore how personality-sensitive digital tools support sustainable learning (Corrigan and Onwuegbuzie, 2020).

3.2 Participants

This study was conducted in accordance with the ethical standards outlined in the 1964 Helsinki Declaration and its subsequent amendments. Professional ethical principles were strictly adhered to at all stages of the study. Before participation, all individuals were informed about the purpose, procedures, and voluntary nature of the study, and their written informed consent was obtained. Participation was entirely voluntary, and confidentiality and anonymity were ensured at all stages of data collection and analysis. No foreseeable ethical risks were found, and all procedures were approved by the Arel University Ethics Committee (Reference Number = BSA4YC8PBP).

The sample consisted of 126 undergraduate students (2nd and 3rd-year, from various teacher education programs) enrolled in the faculty of education of a public university in Istanbul. Of the

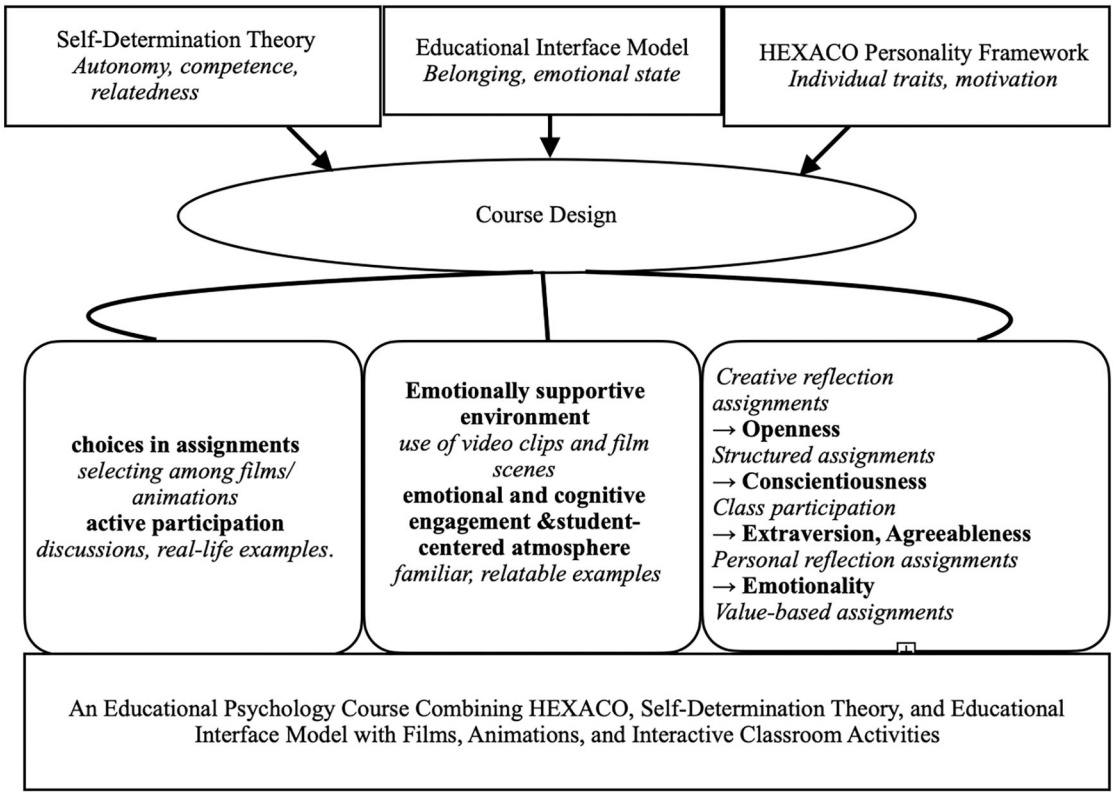

FIGURE 1
Theoretical integration and course components in educational psychology course.

participants, 69 were female (54.8%), and 57 were male (45.2%). The ages of the participants ranged from 18 to 23 ($Mage = 19.12$, $SD = 1.45$). All participants volunteered to participate in the study.

3.3 Study procedures

The course program designed within the scope of this study was prepared based on the SDT (Ryan and Deci, 2000) and the educational interface model (Kahu and Nelson, 2018), which aim to support students' motivation, engagement, and psychological well-being. These theoretical frameworks allow for a holistic understanding of students' in-class experiences and attitudes towards learning.

Data collection was conducted in two phases to measure the effectiveness of this design: a pre-test administered at the beginning of the semester to assess baseline psychological need states using the BPNSFS, and a post-test conducted at the end of the semester to evaluate changes following the multimedia-supported instructional design.

In order to take into account the individual differences of the students, the HEXACO-24 personality inventory was applied to examine the relationships between personality traits, motivational tendencies, and course participation/engagement levels. The HEXACO model was chosen because it allows for a broader and more detailed examination of the connections between personality constructs, motivational needs, and learning engagement by measuring six core personality dimensions.

The research was conducted as part of a semester-long Educational Psychology course. This course, which typically focuses on theoretical content, was enriched with the addition of multimedia materials (films and animations) to help students connect theoretical knowledge to real-life situations and engage more actively in the course.

3.3.1 Course design

The educational psychology course was designed and conducted to integrate theoretical explanation with optional film and animation-based reflective activities. Each week, the main topic of the course was directly explained by the instructor. During these lectures, the instructor integrated short, self-contained narratives or briefly explained scenarios from well-known films to concretize abstract psychological concepts. This approach was designed to help all students grasp the metaphors and examples regardless of their prior cinematic knowledge. Building on these accessible in-class examples, a list of thematically related films was provided for deeper exploration. Watching these full films outside of class was not mandatory; however, students who were interested or wanted to earn extra points were encouraged to watch a movie or animation they chose from the list and write a short reflective essay in which they related the content to theoretical concepts. These evaluation essays were collected by the instructor and discussed in class from time to time, thus aiming to establish a bridge between theory and life experiences. Then, the next week's topic moved on.

This structure, which focuses on developing awareness, values, and transformative behaviors through multimedia, was informed by educational best practices outlined in contemporary SDG teacher resource materials (López et al., 2018). Building on these principles, the instructional design was strategically conceptualized to move beyond a standardized, one-size-fits-all approach by prioritizing learner diversity. Great care was taken to provide a diverse learning environment where theoretical articles were supported by familiar cinematic examples to make the learning process more permanent and relatable. Rather than relying on abstract explanations alone, multiple connection points were established by linking academic content with films that resonated with students' own experiences. In the structure of the course, care was taken to avoid confining the educational process to a single instructional or evaluative mold; instead, a flexible pedagogical space was opened. Through the intentional provision of diverse multimedia options and optional paths to earn credit toward their final grade, an inclusive assessment process was established. This allowed for theoretical engagement that respected individual inclinations and offered students alternative ways to demonstrate their competence. Providing these different assignment options reflects the core idea of differentiated instruction (Tomlinson, 2014). When students are allowed to choose tasks that fit their own personalities and preferences, their engagement in the learning process tends to increase.

This structure provided an enriched learning environment that maintained the traditional teaching flow while encouraging more active student participation in the process. In order to make the general structure of the course and the weekly content more understandable, the educational psychology course program supported by movies and animations was presented in a table format (see Table 1).

TABLE 1 Instructional framework of the multimedia-supported educational psychology course.

Week	Topic	Suggested Films/ Animations
1	Introduction & Orientation *Course syllabus, introduction to film-based assignments, evaluation criteria*	*Inside Out*, *Soul*, *Coco*
2	Introduction to Educational & Developmental Psychology	*Wild Child*, *Angela's Ashes*
3	Developmental Psychology: Basic Concepts & Life Periods	*The Tree of Life*, *Boyhood*
7	Introduction to Learning Psychology	*Dead Poets Society*, *Mona Lisa Smile*, *The Emperor's Club*, *3 Idiots*, *Taare Zameen Par (Like Stars on Earth)*, *Dangal*
9	Behavioral Learning Theories: Classical & Operant Conditioning	*Les Choristes (The Chorus)*
12	Cognitive Learning Theories	*Pursuit of Happyness*, *A Beautiful Mind*, *October Sky*
13	Humanistic Approaches (Maslow, Rogers)	*Freedom Writers*, *The Theory of Everything*, *Rudy*, *Coach Carter*, *McFarland USA*
14	Final Evaluation	General reflection and Q&A

This table includes a selection of films used in the course; it does not represent the full course content.

Students were provided with multiple film options and encouraged to select one for their reflective writing, linking theoretical concepts with cinematic representation. These assignments were optional and served as a means of deeper engagement and formative assessment.

The course design was informed by Self-Determination Theory (SDT) and the Educational Interface Model, aiming to foster sustained student engagement. The multimedia elements (films, animations, and optional reflective assignments) were specifically chosen to promote:

Autonomy: By offering a choice in film selection for optional assignments.

Competence: By using engaging visuals (CTML) to simplify complex theoretical concepts.

Relatedness: By creating shared discussion points through real-life contextualization.

3.4 Data collection procedures

To enable the pre-test/post-test analysis, data collection was organized in two stages: a baseline measurement at the beginning of the semester and a final measurement at the end. Data were collected via an online survey administered via Google Forms. Although the course was conducted face-to-face, data collection was conducted electronically.

A control group was not included in this study primarily to preserve ecological validity and maintain the natural, authentic learning environment (Kihlstrom, 2021; Orne, 1962). The research was conducted in a single-section course. Methodologically, dividing a natural classroom into experimental and control groups would artificially disrupt the instructional dynamics and peer interactions. Therefore, a single-group structure was maintained to accurately observe engagement within an undisturbed, real-world educational setting.

Crucially, the post-test was conducted after the final course grades had been submitted and announced to prevent any perception of coercion. As the researcher was also the instructor, an independent research assistant managed the data collection process to ensure impartiality, and the instructor had no access to the raw data until the grading was complete. Before participation, students were informed of the purpose, confidentiality, and voluntary nature of the study, and their written informed consent was obtained.

The pre-test consisted of the BPNSFS scale. The post-test was comprehensive; the survey included demographic information, the HEXACO-24 personality inventory to quantitatively assess personality traits, and additional Likert-type items related to the course. Also, the second administration of BPNSFS was included to measure changes. For the qualitative data, open-ended questions were included to gather participants' detailed opinions and experiences about the educational psychology course enriched with multimedia.

Considering the time available to the participants, the HEXACO-24 short form was chosen to keep the measurement process as short as possible. Furthermore, the literature indicates that the short form is widely used in academic studies and yields valid results (Ashton and Lee, 2009).

3.5 Instruments

3.5.1 Demographic data and participation details

The demographic section of the form asked participants for their gender, current department, and whether this was their first time taking the course. Additionally, to reflect behavioral engagement in the course process, students were asked to provide numerical data on their attendance rate (as a percentage) and the number of optional film assignments they completed, out of a maximum of seven. This provided complementary data on students' basic engagement with course content and their interest in multimedia-supported activities.

3.5.2 Basic psychological needs satisfaction and frustration scale (BPNSFS)

BPNSFS (Chen et al., 2015) is a 24-item measure designed to assess the three core needs posited by SDT: autonomy, competence, and relatedness. Unlike traditional measures, this scale evaluates need satisfaction and need frustration as distinct constructs rather than opposite ends of a continuum. In the original study (Chen et al., 2015), internal consistency coefficients ranged from 0.64 to 0.89. The scale comprises 8 items for each need (4 for satisfaction and 4 for frustration), and participants rated these items on a 5-point Likert scale ranging from 1 to 5.

The Turkish adaptation and psychometric properties of the BPNSFS were established in a pilot study by Selvi and Bozo (2020). Confirmatory factor analysis supported the original six-factor structure (three satisfaction factors and three frustration factors). Internal consistency (Cronbach's alpha) coefficients for the six factors in the Turkish version ranged from 0.74 to 0.88, demonstrating high reliability for the current study sample. To provide clarity on the scale's content as used in this study, representative sample items from the Turkish adaptation include: "I feel a sense of choice and freedom in the things I undertake" for need satisfaction, and "I feel pressured to do too many things" for need frustration (Selvi and Bozo, 2020). This indicates that the BPNSFS is a reliable instrument for separately measuring both the positive (satisfaction) and negative (frustration) dimensions of students' psychological experiences.

3.5.3 24-item brief HEXACO personality inventory

The Brief HEXACO Inventory (BHI; de Vries, 2013), consisting of 24 items, was used to assess students' personality traits across the six dimensions established by the HEXACO model (Ashton and Lee, 2007): honesty-humility, emotionality, extraversion, agreeableness, conscientiousness, and openness to experience. In the original development of the long-form inventory, internal consistency coefficients for the six factors were reported to range from 0.77 to 0.84 (Lee and Ashton, 2004). For this study, the 24-item Brief HEXACO Personality Inventory was used, as adapted and psychometrically validated by Tatar and Çamkerten (2023). Internal consistency reliabilities for the six factors in the 24-item Turkish form were reported to range from 0.27 to 0.51 (Tatar and Çamkerten, 2023). While these values may appear low, they are consistent with the original development of the Brief HEXACO Inventory (BHI) and subsequent literature (de Vries, 2013), where relatively low alpha coefficients are expected due to the small number of items per factor and the intentional structural heterogeneity of the items. Test-retest reliability results, reported in an earlier study, also supported the stability of the measure over time (Tatar, 2018). To provide clarity on the scale, a sample statement for the conscientiousness dimension is, "I want to make sure that things are in the right place", while an example for the honesty-humility dimension is, "I find it difficult to lie".

3.5.4 Researcher-designed survey form and qualitative section

The survey form of the research was designed by the researcher to collect additional information about students' attitudes towards course content and their perceptions of the use of multimedia in learning. This form included both quantitative and qualitative sections. The quantitative section contained four separate items, each assessed independently, assessing: attitude towards the use of multimedia, the perception that using multimedia as a teaching tool positively affected learning, and relating theory to real-life situations. Participants rated these items on a 5-point Likert-type scale. These purpose-built items were treated as individual variables rather than a composite scale, as they were preferred instead of a standard scale to ensure direct alignment with the specific research questions and the unique context of the course.

The qualitative section's questions were carefully prepared and open-ended to capture the depth and richness of students' personal experiences and perceptions. They were designed so that participants could write their answers more freely without any guidance. Specifically, the following questions were directed to the participants: "*What was meaningful to you regarding this course and the instructional method utilized? Looking back, what kind of impression did it leave on you?*" and "*Please share any thoughts, feelings, criticisms, and suggestions regarding the Educational Psychology course*". These questions encouraged participants to reflect on and express their opinions about the educational psychology course, focusing especially on the integration of multimedia (e.g., watching selected films and animations, following examples and discussions about them in class, and optionally earning additional points by completing short reflection assignments on these materials) as teaching tools. The questions aimed to provide insights in terms of both learning and personal development. This qualitative approach allowed for detailed feedback to be collected on how the multimedia elements related to their emotional and cognitive engagement, motivation, and understanding of the course material. The qualitative data were then analyzed thematically to reveal common themes and individual insights that enriched the quantitative results.

3.6 Data analysis

Before conducting correlation analyses, the normality of the quantitative data was assessed using the Shapiro–Wilk test.

To evaluate the effectiveness of the course, the changes in participants' psychological need satisfaction and frustration levels (data from BPNSFS) between the pre-test and post-test measurements were analyzed. Since the change scores violated the assumption of normal distribution, the Wilcoxon signed-rank test, a non-parametric test for dependent samples, was employed.

Since most variables did not meet the assumption of normal distribution, Spearman's rank-order correlation coefficients were calculated to examine the relationships between HEXACO personality dimensions, attendance rates, assignment completion numbers, and Likert-type items assessing attitudes towards the course and the use of multimedia as an educational tool.

All quantitative analyses, including descriptive statistics, normality tests, Wilcoxon signed-rank tests, and Spearman's correlations, were performed using the jamovi (v.2.3.28) statistical software.

Qualitative data from the open-ended questions were analyzed through thematic analysis, starting with a careful line-by-line reading of all participant responses. This detailed approach allowed for the identification of meaningful codes and recurring statements directly from the students' own words. While the MAXQDA 2022 program was used to organize and manage the dataset, the actual identification of themes was performed manually to maintain a deep, interpretive focus on the findings. This process continued until the data reached a level of saturation where no new themes emerged and the students' experiences were clearly and fully captured. To ensure the reliability of these interpretations and to prevent researcher bias, a peer debriefing process was followed. An independent colleague reviewed the extracted codes and themes, and any differences in interpretation were discussed until a complete consensus was reached. This collaborative step confirmed the inter-coder reliability and ensured that the final themes were consistent and objective (Komor and Grzyb, 2023).

4 Results

In this section, the results of the quantitative analysis will first be presented. The effectiveness of the multimedia-supported instructional design was evaluated through the pre-test and post-test scores of the BPNSFS. Following this, the relationships between personality traits (HEXACO) and engagement levels were examined. Finally, the qualitative data derived from reflective feedback were analyzed to provide a deeper understanding of the learning experience.

4.1 Normality, descriptive statistics, and pre-post change in basic psychological needs

To address the first research question regarding the effectiveness of the multimedia-supported instructional design, the descriptive statistics and normality test findings for the BPNSFS pre-test and post-test scores were analyzed, as detailed in Table 2.

The analysis revealed that all scores were non-normally distributed (Shapiro–Wilk; $p < .001$), necessitating the use of non-parametric tests. Descriptively, there was an increase in total need satisfaction scores, while total need frustration scores significantly decreased.

To assess the statistical significance of these changes, a non-parametric Wilcoxon Signed-Rank Test was applied to the six sub-dimensions. The analysis, detailed in Table 3, revealed that the multimedia-supported instructional design was associated with statistically significant changes across all dimensions ($p < .05$). Specifically, a statistically significant increase in median scores was observed across all three need satisfaction dimensions (autonomy, competence, and relatedness). Conversely, a statistically significant decrease in median scores was observed across all three need frustration dimensions. The observed rank-biserial correlations ranged from $|r| = 0.23$–0.37. Furthermore, the frequency distributions (Negative Ranks, Positive Ranks, and Ties) indicated that while the majority of the students experienced the expected shifts in the respective dimensions, a subset of the sample exhibited no change or shifts in the opposite direction.

4.2 Relationships between HEXACO traits and educational outcomes

To address the second question, Spearman's rho was preferred for correlation analysis (Supplementary table 1). Supplementary table 1 shows that there are significant and strong positive correlations among key variables such as attitudes towards the use of multimedia, the perception that using multimedia as a teaching tool positively affected learning, and relating theory to real life. Demographic variables were also included in the analyses, but were not reported in the results table because they did not show a significant relationship.

The honesty-humility variable from personality traits showed a statistically meaningful and positive relationship with perceived increase in professional identity awareness ($r = 0.240$, $p = .007$). Conscientiousness showed considerable positive relationships with the perception that using multimedia as a teaching tool positively affected learning ($r = 0.263$, $p < .01$), relating theory to real life ($r = 0.208$, $p < .05$), and perceived increase in professional identity awareness ($r = 0.308$, $p < .001$).

Attendance rate was found to have weak but significant positive correlations with perceived increase in professional identity awareness ($r = 0.188$, $p < .05$), honesty-humility ($r = 0.276$, $p < .01$), emotionality ($r = 0.276$, $p < .01$), and conscientiousness ($r = 0.178$, $p < .05$).

Overall, the variation in these relationships reveals that students did not react to the multimedia content uniformly. The observation that some personality traits show significant associations with educational outcomes, while others show weak links or no relationship, highlights this situation. Rather than a passive viewing experience, students displayed a level of engagement that aligns with their individual personality traits. For example, the positive relationships of honesty-humility and conscientiousness specifically with perceived increase in professional identity awareness indicate that these students internalized the material to support their professional development. Similarly, the link between conscientiousness and

TABLE 2 Descriptive statistics and normality tests for pre- and post-test scores of BPNSFS.

Variables	*N*	Mean (*M*)	Median	SD	SEM	Skewness	Kurtosis	*W*	*p*
Pre-test-Total — Need Satisfaction	126	3.45	3.50	0.68	0.06	−0.75	0.42	0.932	<.001
Post-test-Total — Need Satisfaction	126	4.14	4.22	0.55	0.05	−1.10	1.85	0.895	<.001
Pre-test-Total — Need Frustration	126	2.63	2.58	0.72	0.06	0.82	0.35	0.941	<.001
Post-test-Total — Need Frustration	126	1.78	1.67	0.54	0.05	1.65	3.90	0.820	<.001

BPNSFS, basic psychological need satisfaction and frustration scale; *W*, Shapiro–Wilk test statistic.

TABLE 3 Wilcoxon signed-rank test results comparing pre-test and post-test scores on BPNSFS.

BPNSFS dimension	Pre-test Median (IQR)	Post-test Median (IQR)	Negative Ranks	Positive Ranks	Ties	Wilcoxon W	*p*	Effect size (Rank *r*)
AS	14.0 (5.75)	18.0 (5.00)	35	66	25	1,975	.008	−0.30
CS	14.0 (7.50)	18.0 (6.00)	37	62	27	1,874	.036	−0.24
RS	14.0 (8.00)	18.0 (6.00)	33	71	22	1,731	.001	−0.37
AF	11.5 (7.00)	7.50 (7.75)	62	38	26	3,129	.038	0.24
CF	11.5 (10.5)	7.50 (9.00)	66	37	23	3,423	.014	0.28
RF	11.5 (10.5)	7.50 (9.00)	61	38	27	3,048	.046	0.23

AS, autonomy satisfaction; AF, autonomy frustration; CS, competence satisfaction; CF, competence frustration; RS, relatedness satisfaction; RF, relatedness frustration; BPNSFS, basic psychological need satisfaction and frustration scale. Negative Ranks indicate the number of participants whose scores decreased in the post-test, Positive Ranks indicate an increase, and Ties indicate no change. The effect size is represented by the Rank biserial correlation (*r*). A high |*r*| value indicates a large effect size.

relating theory to real life shows that the content was actively processed. Ultimately, these results suggest that the process goes beyond merely adding a movie to the course curriculum. This interaction between multimedia materials and different personality traits is exactly what differentiates these findings of personality-driven participation from standard film use in educational settings.

4.3 Multimedia learning activities and student engagement

To address the third research question, further dimensions of the correlation matrix presented in Supplementary table 1 were examined.

To elaborate further, the table results show that there is a strong and meaningful relationship between attitude towards using multimedia and the perception that using multimedia as a teaching tool positively affected learning ($r = 0.596$, $p < .001$). Similarly, high correlations were found between relating theory to real life and attitude towards using multimedia ($r = 0.611$, $p < .001$) and the perception that using multimedia as a teaching tool positively affected learning ($r = 0.775$, $p < .001$). Moderately positive relationships were observed between the variable of perceived increase in professional identity awareness and attitude towards using multimedia ($r = 0.379$, $p < .001$), the perception that using multimedia as a teaching tool positively affected learning ($r = 0.422$, $p < .001$) and relating theory to real life ($r = 0.477$, $p < .001$).

There were important but weaker positive correlations between the number of completed optional film assignments and attitude towards using multimedia ($r = 0.291$, $p < .001$), the perception that using multimedia as a teaching tool positively affected learning ($r = 0.317$, $p < .001$) and relating theory to real life ($r = 0.269$, $p < .01$).

Overall, these findings reveal how the multimedia-supported design simultaneously appeared to support the activation of various dimensions of student engagement. The strong correlations between the perception that using multimedia positively affected learning and relating theory to real life serve as indicators of cognitive engagement, while variables such as number of completed optional assignments and attendance represent behavioral engagement. Additionally, positive attitudes and perceived increase in professional identity awareness reflect the emotional dimension of this involvement. Moving beyond the mere addition of film to a curriculum, these results suggest that integrated multimedia use functions as a holistic and multidimensional structure that simultaneously may foster diverse forms of student engagement.

4.4 Qualitative findings: themes, engagement, and SDG 4 alignment

In relation to the fourth research question regarding students' multimedia-supported learning experiences, thematic analysis of students' reflective feedback revealed four main themes: enjoyable learning, perspective change, learning effectiveness, and positive evaluation. These themes align with the needs for autonomy, competence, and relatedness of SDT and the dimensions of belonging and emotional state (Educational Interface Model) in such a model. Detailed theoretical connections and sample student comments are presented in Supplementary table 2. Crucially, these qualitative themes were systematically mapped onto the multidimensional structure of

student engagement. Enjoyable learning and positive evaluation reflect emotional engagement, while perspective change and learning effectiveness highlight cognitive engagement. Behavioral engagement (such as high attendance and assignment completion rate) is supported by these themes, reflecting a holistic involvement in the course.

- The most frequently mentioned theme was enjoyable learning ($n = 96$, 76.2%). Many students emphasized the emotionally engaging nature of the courses, particularly the instructor's use of movies and examples that supported autonomy and relatedness in learning.
- The second most prominent theme, positive evaluation ($n = 82$, 65.1%), reflected students' strong emotional connection to the course, intrinsic motivation, and overall satisfaction with the course.
- Perspective change ($n = 44$, 34.9%) represented students' perceptions of how using multimedia and discussions expanded their thinking, analytical abilities, and psychological understanding of the students.
- Finally, learning effectiveness ($n = 44$, 34.9%) emerged as a theme that emphasized students' perceived learning outcomes, including increased understanding, skill development, and real-life applicability of course content. Students appreciated how the course structure facilitated sustained learning, enhanced their understanding of educational and psychological concepts, and supported personal and academic development. (See Supplementary table 2 for sample comments).

The qualitative themes revealed through students' reflections provide valuable insights into the achievement of the multidimensional learning goals set forth by Rieckmann (2018) for SDG 4. The themes perspective change and learning effectiveness directly align with the cognitive learning goals (e.g., critical thinking, deeper understanding), suggesting that students not only retain knowledge but also develop psychological insight. Most importantly, the themes enjoyable learning and positive evaluation strongly reflect success in achieving the socio-emotional learning goals (e.g., fostering a holistic approach, identifying intrinsic value) as they reflect increased intrinsic motivation and emotional connection. Collectively, these results indicate that a personality-sensitive, multimedia-enriched environment successfully appears to operationalize the socio-emotional and cognitive dimensions necessary for quality education and sustainable human development.

To further understand students' views on multimedia use, film and animation selections, and related assessment assignments, open-ended responses were analyzed using descriptive content analysis. In this process, recurring and thematically similar student statements were grouped and synthesized into representative statements, which were then quantified according to their frequency of occurrence (see Figure 2).

Figure 2 shows the distribution of recurring opinions according to their frequencies obtained as a result of the descriptive analysis of qualitative data collected from students within the scope of the educational psychology course. The opinion with the highest frequency emerged with the statement "the movie selection was very good" ($n = 106$; 83.97%), indicating that the students were quite satisfied with the content selection. This was followed by the statements "the movie selection was very good in the context of general culture" ($n = 89$; 70.63%) and "the theoretical explanation was supported by daily life examples" ($n = 95$; 75.40%). These findings show that the students found the support of theoretical information with concrete examples and especially multimedia-based materials useful in terms of learning. On the other hand, statements regarding extra assignments were expressed with a relatively lower frequency, indicating that student experiences in these areas varied.

4.5 Integration of quantitative and qualitative findings

The course design (Section 3.3.1) aimed to support student autonomy through flexible film options. It also used relatable narratives to build competence. To explore how students actually experienced these features, a joint display was created (Table 4). This table connects the initial teaching goals with both the qualitative themes and the statistical results. Combining these data sources makes it possible to infer how the instructional design worked in practice, which helps explain the quantitative outcomes.

Overall, the integrated results in Table 4 suggest that the statistical improvements in student engagement and psychological needs are closely tied to their qualitative experiences. By combining these datasets, it appears that specific choices within the multimedia-supported instructional design, such as flexible multimedia options and relatable narratives, likely contributed to these positive outcomes.

Beyond the dimensions outlined in the joint display, this synthesis highlights the broader potential value of digital tool integration and educational diversity. As supported by the descriptive feedback (Figure 2), the high student satisfaction with the varied film options (83.97%) and real-life examples (75.40%) points to the value of stepping away from a rigid, one-size-fits-all curriculum. The quantitative data further indicated that positive attitudes toward using multimedia were positively associated with both perceived cognitive outcomes and behavioral participation (e.g., the number of completed optional assignments). By offering a rich variety of instructional materials to accommodate different personality profiles (*learner diversity*), the design appears to have supported an inclusive and emotionally secure environment. Ultimately, this personality-sensitive approach to digital tool integration seems to align well with the inclusive, transformative objectives of Quality Education (SDG 4). Consequently, these integrated findings suggest that sustainable learning may rely heavily on pedagogical flexibility and human-centered design, providing a solid foundation for the detailed discussion in the following section.

5 Discussion

This study employed a mixed-methods design because simply showing numerical correlations would be insufficient to understand all dimensions of the learning experience. Quantitative findings indicated significant relationships among

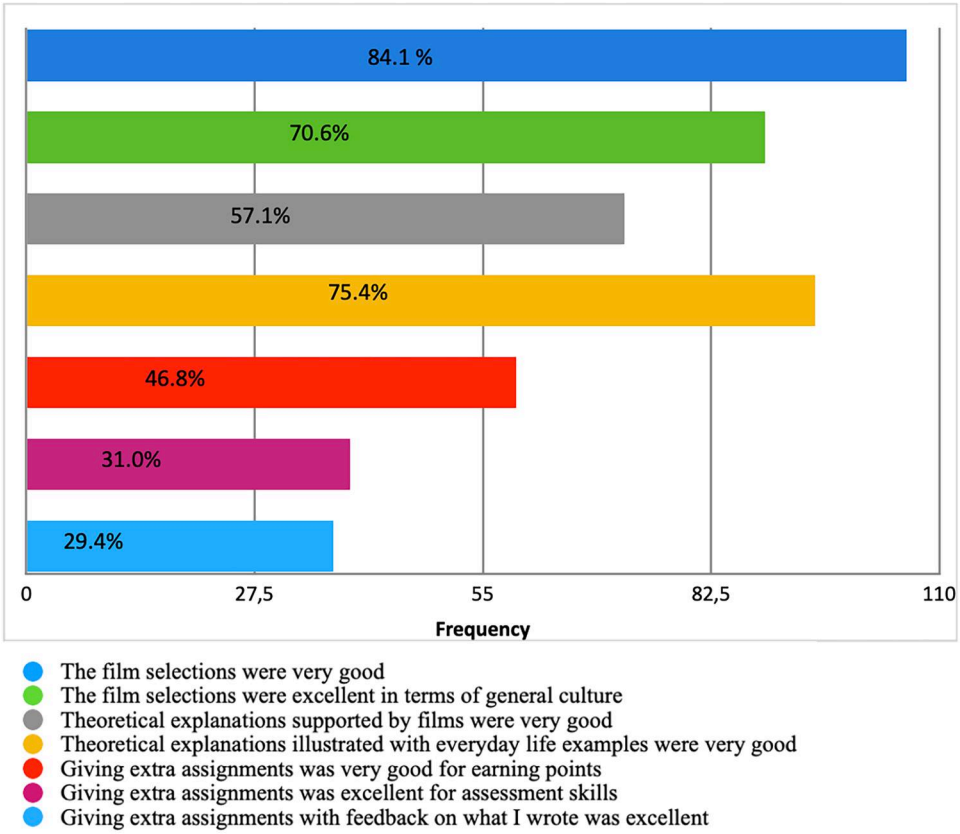

FIGURE 2
Frequencies of synthesized student expressions in the educational psychology course. Note: The statements visualized in the figure are representative expressions synthesized from recurring student responses collected through qualitative forms. Frequencies are based on a multiple-response analysis.

personality, attitude, and engagement variables, while qualitative data explored how students experienced these relationships and the themes they interpreted. Combining these two data sets (quantitative and qualitative) yielded meta-inferences, moving beyond surface-level correlation to provide a richer, contextual understanding of the learning process and student experiences.

5.1 Changes in basic psychological needs

The most important finding of this study, in response to the first research question, is that instructional design was positively associated with positive changes in students' basic psychological needs and a reduction in their levels of frustration. Additionally, these findings highlight the potential of multimedia-supported instruction in creating a psychologically supportive learning environment. The 14-week course design used in this research appears to offer the temporal depth needed for reflective engagement and the stable development of psychological awareness, as course duration is a critical determinant for the maturation of a learning community (Akyol et al., 2011). While experiential elements are often linked to short-term formats (Mena-Guacas et al., 2023), such methods remain applicable in long-term structures where multimedia tools strengthen the subjective quality of the learning experience (Davis and Frederick, 2020). Recent systematic reviews in the digital education context argue that adapting educational practices to students' needs and creating personalized learning environments requires a fundamental focus on fulfilling these core psychological needs to sustain student well-being (Morfaki and Skotis, 2023).

An analysis of the frequency distributions (Negative Ranks, Positive Ranks, and Ties) reveals a natural variance among students. While the majority experienced the expected shifts, the presence of those with no change or contrary shifts reflects the individualized nature of psychological engagement. Nevertheless, the overall positive trend observed across all dimensions suggests a probability of social desirability bias or demand characteristics. Several contextual factors likely contributed to this outcome. First, the academic content of the course was inherently centered on the concepts of educational psychology. Because the participants were education students actively learning about the exact psychological needs the scales were measuring, they likely anticipated the expected outcomes. Second, the shared academic background of this highly homogeneous sample further amplifies this potential for bias. Therefore, while the overall changes point to the potential effectiveness of the multimedia-supported course content, these self-reported shifts should be interpreted with caution.

Despite this probable bias, the overall trend still provides a basis for discussion alongside existing literature. SDT emphasizes that supporting three basic psychological needs forms the foundation for effective and high-quality learning,

TABLE 4 Joint display integrating quantitative findings and qualitative themes.

Quantitative findings (statistical results)	Qualitative themes (student reflections)	Mixed-methods integration (meta-inferences)
Changes in Psychological Needs: Significant increases in basic psychological need satisfaction sub-dimensions (Autonomy: $p = .008$; Competence: $p = .036$; Relatedness: $p = .001$) and significant decreases across all need frustration sub-dimensions ($p < .05$).	"Enjoyable learning" ($n = 96$, 76.2%) & "Positive evaluation" ($n = 82$, 65.1%)	Explains: The qualitative data offers clues about how these needs were met: • As planned, offering a diverse selection of films to match different preferences (accommodating *learner diversity*) appears to support autonomy. • Explaining theories through everyday examples likely supported competence. • This emotionally supportive setting seems to explain the drop in need frustration.
Cognitive and Emotional Engagement: Significant positive correlations of conscientiousness with the perceived increase in professional identity awareness (*emotional*), the perception that using multimedia as a teaching tool positively affected learning (*cognitive*), and relating theory to real life (*cognitive*). Additionally, *attitude towards using multimedia* strongly correlated with the perception that using multimedia as a teaching tool positively affected learning ($r = .596$, $p < .001$) and relating theory to real life ($r = .611$, $p < .001$).	"Perspective change" ($n = 44$, 34.9%) & "Learning effectiveness" ($n = 44$, 34.9%)	Extends: The course design helps explain these multidimensional statistical links: • Conscientious students likely used the films as structured tools to critically process abstract theories (*cognitive engagement*). • The rich variety of instructional materials (diverse film narratives and real-life examples) nurtured positive attitudes, helping students successfully bridge abstract theory with real-life scenarios. • Students with higher honesty-humility scores (reflecting sincerity and modesty) were likely more open to evaluating their own assumptions. As the "perspective change" theme reveals, this sincere reflection on how to approach students psychologically appears to have deepened their professional identity awareness (*emotional engagement*).
Behavioral Engagement: Significant positive correlations between class attendance rates and specific personality traits: honesty-humility ($r = .276$, $p < .01$), emotionality ($r = .276$, $p < .01$), and conscientiousness ($r = .178$, $p < .05$). Furthermore, *attitude towards using multimedia* significantly correlated with *the number of completed optional assignments* ($r = .291$, $p < .001$).	"Enjoyable learning" ($n = 96$, 76.2%) & "Positive evaluation" ($n = 82$, 65.1%)	Complements: The qualitative themes reveal the emotional drivers of behavioral engagement: • Conscientiousness generally drives attendance as a duty. • However, providing flexible multimedia options (e.g., optional reflection tasks on self-selected films) added an intrinsic motivation. • This enjoyable, high-emotion connection likely made attendance more meaningful and naturally drove voluntary participation (completing optional assignments).

The quantitative findings come from the descriptive statistics (Table 2), Wilcoxon signed-rank tests (Table 3), and correlation analyses (Supplementary table 1). The theoretical links and student preferences supporting the meta-inferences are based on the instructional design (Figure 1), the thematic mappings (Supplementary table 2), and the student feedback frequencies (Figure 2).

positively influencing students' motivation and well-being (Deci and Ryan, 2000; Jang et al., 2016). The observed changes across all six sub-dimensions of the BPNSFS indicate increased satisfaction and decreased frustration, which reflects the dual continuum of SDT (Vansteenkiste et al., 2020). However, these positive shifts should not be solely attributed to the effectiveness of the multimedia-supported instruction; they might also reflect the students' growing academic familiarity with the psychological concepts they were actively learning. The notable median increases in satisfaction of psychological needs, particularly in terms of autonomy, provide support for the "belonging" and "emotional state" mechanisms within the Educational Interface Model. Recent studies point to autonomy support as a key factor in strengthening students' sense of belonging and improving their adaptation to the learning process in a university environment (Li, 2025; Wu and Dong, 2024). These improvements can go beyond making content easier to understand; when structurally integrated, they can enhance feelings of agency and psychological security. This finding is consistent with the SDT principle that engagement arises from the interaction between students' intrinsic resources and a supportive learning environment.

5.2 Relationships between personality traits and learning outcomes

The findings related to the second research question indicate that there are significant correlations between students' HEXACO personality traits and their attendance rate, their

perception that using multimedia as a tool in classes positively affects learning, relating theory to real life, and their professional identity awareness. This interplay between intrinsic personality structures and learning behaviors offers crucial insights for designing differentiated and inclusive multimedia-supported instructional environments, a prerequisite for achieving quality education (SDG 4) goals in higher education. Recent literature highlights that effective integration of digital media in education systems depends heavily on human-centered designs that foster multidimensional engagement (Lin et al., 2024; Topali et al., 2025). By demonstrating how intrinsic personality traits interact with these learning experiences, the present study provides a concrete framework for building personalized, well-being-oriented educational practices (Li, 2025).

It should be noted here that personality dimensions such as honesty-humility and conscientiousness indicated significant relationships with perceived increase in professional identity awareness, while these traits, along with emotionality, were linked to class attendance. The findings of this study largely coincide with previous studies that have revealed the effects of personality traits on both academic achievement and professional development (Ashton and Lee, 2007; Chamorro-Premuzic, 2016; Poropat, 2009) and reinforce literature identifying personality traits as critical mediators of students' motivation and approaches to learning (Jensen, 2015). Consistent with Jia et al. (2022), higher achievers at the university level tend to display high levels of honesty, a pattern that mirrors the positive engagement observed in the present research's sample. This is further supported by studies emphasizing that personality traits are vital for successful adjustment to digital learning environments and that individual differences affect both achievement levels and learning engagement (Komarraju et al., 2011; Morfaki and Skotis, 2023). The findings of the present study align with current research identifying conscientiousness as a stronger predictor of success and cognitive engagement in digital-supported learning (Cao et al., 2025; Yu, 2021).

The dimensions of conscientiousness and honesty-humility showed positive relationships with students' class attendance and active participation in classes. This result suggests that these personality traits may support not only individual success but also behavioral engagement in learning environments (Noftle and Robins, 2007; Roberts et al., 2009). While diligence and a sense of responsibility drive these foundational behaviors, emotional sensitivity is also significantly linked to class attendance and emotional engagement (Costa and McCrae, 1992).

Furthermore, some nuances were noted regarding traits like extraversion and openness to experience. While Hasanah et al. (2022) report positive effects of these personality traits, the present study did not find significant correlations for openness and extraversion. Previous research indicates that overly standardized digital platforms can limit creative exploration which typically engages open individuals, meaning that cognitive engagement also relies heavily on the course design (Cao et al., 2025). However, a critical interpretation of the present null findings suggests that the independent film viewing and reflective writing tasks were predominantly solitary. Consequently, these structured activities may not have provided the collaborative interaction or creative freedom necessary to fully engage extraverted and open students. Additionally, while class attendance was linked to several traits, the number of optional assignments completed showed no significant relationship with any personality dimension. This suggests that personality traits do not equally explain all academic and attitudinal variables. It is also important to consider the structural constraints of the 24-item Brief HEXACO Inventory when evaluating these results. The low internal consistency coefficients indicate that the personality dimensions were captured with limited precision. This inherent measurement error inevitably weakens the statistical robustness of the correlations. Consequently, rather than viewing these findings as definitive links, they should be cautiously interpreted as preliminary trends. Even with these measurement constraints, however, the overall pattern indicates that personality may play an important role in supporting students' cognitive, emotional, and behavioral engagement with learning.

Consistent with the literature, these results highlight that personality traits are not the only factors that are associated with the learning process. The quality of the learning environment, the teaching strategies used, and the affective-cognitive richness of the materials foster students' interest in the course and their learning experiences (Mayer, 2009; Shernoff, 2013). In fact, the multimedia-based learning activities implemented in this study provided a learning environment that appealed to different personality profiles by increasing students' participation at both cognitive and affective levels. This finding indicates that the learning experience is sensitive not only to the content but also to the presentation style (Barron, 2006). According to Greenspan et al. (2025), digital platforms in higher education serve as essential drivers of critical thinking and encourage social interaction, bridging the gap between theoretical knowledge and professional practice.

5.3 Multimedia-supported learning practices and student engagement

The findings concerning the third research question indicate that multimedia-enriched course practices are positively associated with students' cognitive, emotional, and behavioral engagement. The structure of the course was planned based on the integration of theoretical knowledge and experiential learning. Allowing students to choose thematically related films and animations and then write reflective papers relating these contents to theory facilitated the integration of personal experience and academic knowledge. This observation aligns directly with recent research on filmic pedagogies, which demonstrates that offering autonomy and choice in film review assignments increases motivation and helps students effectively bridge abstract theoretical concepts with real-life situations (Barker, 2025). While recent studies use digital tools to bridge abstract theories with concrete outcomes (Lu and Hu, 2025), this study achieves this simply through student-selected films. This reflective process appeared to strengthen cognitive engagement by connecting abstract theoretical concepts with concrete experiences. Students voluntarily participated in the film watching process and contributed to the creation of meaningful learning environments by carrying the insights they gained from this process to in-class discussions. This type of

active participation reveals how multimedia materials are associated with higher levels of attention and mental effort by acting as a bridge between theory and practice. As highlighted by Greenspan et al. (2025), digital platforms in higher education encourage critical thinking and social interaction while minimizing geographical barriers to access, supporting the broader goals of quality education (SDG 4).

Additionally, this course structure not only appeared to improve cognitive processing but also was positively associated with students' emotional engagement with learning. The use of multisensory materials such as films and videos can increase students' emotional attachment to the course and encourage behavioral participation (Champoux, 1999; Clayton, 2012). Multimedia tools can enhance student engagement and essential skills, providing the motivation critical for deep generative processing (Mayer, 2014; Staneviciene and Žekienė, 2025). It can be said that the emotional responses of the students to the characters and scenarios presented in the films show that they do not only learn cognitively but also experience identity-related and emotional reflections. Moreover, the inclusion of students who have difficulty in exams in the process with the extra points they receive from film evaluation assignments is a good example of individualization of education (Tomlinson, 2001), which supports both emotional security and motivation.

This study also found strong positive correlations between variables directly related to course content (positive attitudes toward film use, the perception that using multimedia as a teaching tool positively affected learning, and relating theory to daily life), indicating that such media-supported practices are associated with higher cognitive engagement. Additionally, students with positive attitudes toward multimedia completed more optional assignments, suggesting a positive link between meaningful media and behavioral engagement. Furthermore, significant correlations between course attendance and some personality dimensions suggest that behavioral engagement is also facilitated by the interaction of personality traits and course design. Providing a hybrid model that blends traditional lectures with active learning strategies (Brame, 2017) accommodates these individual differences. Students enter the classroom with unique personality profiles that shape how they approach academic tasks and interact with content (Lee et al., 2022). These findings reveal the necessity of flexible and multi-layered teaching designs that take individual differences into account in education. This multifaceted approach, combining digital tools with student-centered teaching, appears to contribute to the psychological sustainability of learning. This perspective is also supported by Sanchez-Pastor et al. (2025), who stress that achieving quality education (SDG 4) and the core objectives of ESD necessitates prioritizing student needs and meaningful engagement over solely academic outcomes.

Collectively, when the findings of the second and third research questions are considered together, it becomes clear that individual personality traits and multimedia-supported applications play complementary roles in supporting student participation. Ultimately, designing learning environments that are sensitive to individual characteristics and sustained by multimedia tools has the potential to play a decisive role in revealing the full potential of students.

5.4 Qualitative themes and course process

The findings related to the fourth research question focus on interpreting and integrating the study's quantitative results with the qualitative data obtained from students' reflections. The qualitative findings of this study provide important insights into how the use of films and animations in the educational psychology course informs students' learning experiences, motivations, and participation in the course. Student reflections are grouped around four main themes: enjoyable learning, positive evaluation, perspective change, and learning effectiveness. Qualitative themes revealed how multimedia-based learning experiences contribute positively to the course process.

The theme of enjoyable learning serves as a critical emotional state that facilitates deep cognitive processing and helps students overcome the barriers of rigid, traditional instruction (Hernik and Jaworska, 2018). Through the integration of reflective writing and interactive discussions, this instructional design seems to shift the focus from simple information transfer into emotionalized learning experiences that foster lasting affective connections (Green and Batool, 2017). By embracing personality diversity, the design provides flexible entry points that allow each student to engage with the material according to their unique psychological profile (Liu et al., 2024). Ultimately, these strategic design components may serve as elements that potentially bridge theory and practice, significantly linked to perceptions of overall learning effectiveness.

The positive evaluation theme shows that students appreciate the emotional bond they establish with the instructor and the meaningful structure of the course. According to the educational interface model, this type of emotional engagement includes not only cognitive but also emotional involvement, and this allows students to feel valued and interested in the learning environment (Kahu and Nelson, 2018). In the current study, the emergence of the positive evaluation theme indicates that the learning environment is perceived as a dynamically co-created space grounded in the emotional bond established with the instructor (Rusticus et al., 2023). While the literature posits that environmental demands, such as rigorous assignments and curriculum requirements, can act as hindering factors that suppress student engagement (Li and Xue, 2023), the findings of this research present a notable contrast to this assumption. It is observed that by tailoring digital tools and assessment processes to personality diversity, these potentially burdensome academic requirements are effectively perceived as engaging psychological touchpoints (Deng and Benckendorff, 2021). Ultimately, it is concluded that by moving beyond mere information delivery to holistically supporting student development, the instructor's approach may help bridge the gap between theoretical complexity and emotional security, thereby cultivating a robust sense of belonging and intrinsic commitment (Moulds and Perry, 2024).

The perspective change theme highlights a shift in cognitive structures, indicating that educational concepts are approached by observing their practical manifestations rather than relying solely on theoretical abstraction. It is observed that integrating diverse film narratives appeared to enable learners to visualize complex theories in various real-life scenarios, which may have contributed to a deeper and more grounded comprehension (Aravopoulou et al., 2017). This cognitive shift

aligns directly with recent research that frames film education as a process of transformative learning. The flexible pedagogical space established in this course naturally functioned as what contemporary literature describes as a shared "third space" (Li, 2021). Within this space, films act as a reflective mirror, allowing students to safely evaluate and transform their pre-existing assumptions. While the necessity of bridging abstract concepts with tangible, real-world applications is heavily emphasized in hard sciences and engineering education through physical or technical modeling (Khandoker et al., 2023), the current findings suggest that multimedia narratives serve an equally powerful function in educational psychology. Consequently, it is concluded that presenting theoretical knowledge through diverse and concrete visual representations appears to effectively transform learners' perspectives, turning abstract ideas into easily understandable, practical realities.

Finally, the learning effectiveness theme highlights positive perceptions of learning outcomes, specifically emphasizing how abstract theories are comfortably comprehended, deeply internalized, and retained. While a recent study raises concerns that multimedia tools might carry the risk of oversimplifying complex theoretical concepts in higher education (Loki, 2025), the current findings offer a compelling contrast to this assumption. Rather than rendering the academic content superficial, it is suggested that structurally supported media environments may assist students in more easily grasping and making sense of (meaning-making) complex topics, thereby facilitating long-term knowledge retention. This aligns with foundational studies demonstrating that multisensory tools and narrative structures may make complex information accessible and facilitate deep, lasting comprehension (Rajpopat, 2023).

This holistic perspective aligns with current research focused on SDG 4, which emphasizes that achieving quality education requires prioritizing student dispositions as the inherent psychological readiness and curiosity of unique individuals alongside meaningful engagement beyond purely academic outcomes (Sanchez-Pastor et al., 2025). Accordingly, it is suggested that embracing personality diversity through multimedia tools provides varied entry points that sustain focus and transform traditional instruction into enjoyable and lasting experiences. While a global deceleration in learning outcomes is warned of by the United Nations (2025), utilizing such personality-sensitive digital strategies is proposed as a vital pathway to advance sustainable learning. This approach helps recapture student attention while meeting the cognitive, socio-emotional, and behavioral learning objectives of ESD outlined by UNESCO (2017). Ultimately, although instructor support and a supportive emotional atmosphere are synthesized as essential pillars for sustaining online engagement (Hu and Xiao, 2025), it is concluded that these elements are equally vital in face-to-face environments where digital narratives bridge the gap between theoretical complexity and human connection.

6 Conclusions

The findings of this study suggest that moving beyond standard film screening to a personality-sensitive, multimedia-supported instructional design shows a positive association with students' cognitive, emotional, and behavioral engagement. By integrating diverse multimedia options into the instructional process alongside flexible grading, the course accommodated different personality profiles (measured via HEXACO) and learning preferences, creating an environment that appears to support their multidimensional engagement. The quantitative pre-post results from the BPNSFS further lend support to this instructional approach, reflecting an overall trend of increased basic psychological need satisfaction and a parallel reduction in need frustration.

Complementing numerical trends, the qualitative findings offer valuable insights into how students experienced and made sense of this learning process. Instead of oversimplifying academic content, providing theoretical engagement through real-life cinematic examples appears to help abstract concepts to be understood and retained more effectively. When students are given the autonomy to choose tasks that align with their traits, their intrinsic curiosity and course attendance tend to naturally increase.

By integrating these quantitative and qualitative insights into meta-inferences, the results suggest that accessible digital tools, when integrated into a personality-sensitive pedagogy, can act as sustainable sources of motivation rather than mere distribution systems. Ultimately, the current findings suggest that discarding standardized and uniform educational templates in favor of human diversity has the potential to constructively support the advancement of the goals of Quality Education (SDG 4). A face-to-face environment enriched with personality-sensitive digital narratives appears to successfully bridge the gap between theoretical complexity and human connection. To maximize the contribution of higher education to global sustainability, future reforms should consider prioritizing this approach. Creating innovative and integrative learning environments holds significant potential for advancing sustainable learning through long-term psychologically sustainable engagement and developing the active citizenship capacity central to ESD and SDG 4.

7 Limitations and future research

This study offers valuable insights; however, there are some methodological and contextual limitations. First, the research was conducted with a relatively homogeneous sample of students from the Faculty of Education at a single university in Istanbul. This limited sample may restrict the generalizability of the findings to other universities, academic departments, or varying cultural and socioeconomic contexts. Second, data collection was confined to a single semester of an "Educational Psychology" course. The specific instructional design, course content, and the instructor's unique implementation of multimedia limit the transferability of the results to other academic disciplines or course structures that do not similarly integrate multimedia and interactive activities. Third, the reliance on self-reported data for several key quantitative measures presents a limitation. Self-reported data is often influenced by social desirability bias, which can lead students to respond in ways they believe are more acceptable,

potentially shaping their positive evaluations of the instructional design. Since the participants were education students actively learning about these exact psychological concepts during the course, their theoretical familiarity with the subject matter may have naturally influenced their responses. Consequently, these self-reported changes should be interpreted with caution. Fourth, there are concerns regarding measurement robustness. Using researcher-designed single items to assess complex psychological constructs, like professional identity awareness, limits the depth of the metrics. Another measurement limitation is that the 24-item Brief HEXACO Inventory showed low internal consistency. While this is common for short scales, it introduces measurement error. Because of this, the correlations between personality traits and engagement variables should be evaluated carefully. Future research should prioritize the use of fully validated, multi-item scales to enhance the reliability and generalizability of findings while providing a more comprehensive measurement of these established variables. Finally, although this study found significant correlations between personality traits and engagement variables, the cross-sectional design and correlational analyses preclude establishing definitive causal relationships between personality and learning outcomes.

Given these limitations, it is recommended that future research on the long-term lifespan of widely-used, personality-sensitive, multimedia-supported learning environments should utilize longitudinal and independent replication studies across various disciplines and cultural contexts. To enhance the findings, self-reported metrics should be paired with engagement measures that include system log data and direct observations.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the Ethics Committee of İstanbul Arel University under approval number [Reference Number=BSA4YC8PBP]. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

FA: Conceptualization, Resources, Investigation, Writing – review & editing, Writing – original draft, Supervision, Project administration, Validation, Data curation, Formal analysis, Methodology, Software, Visualization.

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The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declared that generative AI was used in the creation of this manuscript. During the preparation of this manuscript, the author used Google's GEMINI Pro and the standard version of Grammarly for limited text rephrasing to enhance clarity and fluency. Following this, the author thoroughly reviewed and edited the content and takes full responsibility for the final manuscript.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2026.1765742/full#supplementary-material

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