Formation of Professionally-Oriented Media Education for Future Teachers-Psychologists in the Era of Artificial Intelligence

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***Abstract*—The quick development of artificial intelligence and digital technology is changing psychology and education, placing new demands on educational psychologists' professional training. In order to improve media literacy, ethical reasoning, and preparedness for using Artificial Intelligence (AI) in psychological work, this project set out to develop and evaluate an AI-supported, professionally focused media education model. 120 undergraduate pedagogy and psychology majors participated in a controlled pedagogical study that compared an experimental group that finished a 16-week AI-integrated training program with a control group that followed the standard curriculum. Assessments conducted before and after the intervention included performance-based tasks and self-report measures that focused on media competency, critical thinking in environments rich in media and AI, and openness to adopting AI in professional settings. The experimental group outperformed the control group in information processing, manipulation detection, and the use of AI tools in case-based psychological scenarios. They also demonstrated statistically significant advances across all three competences, which were backed by substantial effect sizes. These findings suggest that methodically planned, morally sound AI-mediated training can significantly improve future educational psychologists' professional readiness for jobs in media-rich situations. In situations where universities aim to match psychological training with quickly developing AI and digital-media ecosystems, the suggested approach provides a transferable framework for curriculum development and ongoing professional education.**

***Keywords*—teaching, psychological diagnostics, digital ethics, artificial intelligence, Artificial Intelligence (AI)-supported training, educational innovation, educational psychologists**

I. Introduction

The integration of digital media, machine learning, and Artificial Intelligence (AI) is radically changing educational systems around the world because of the rapid growth of technology [1]. As educational psychologists must not only handle complex human behaviours but also critically interact with and ethically integrate digital tools into their professional practice, this shift is especially significant for their training [2]. As a result, creating professionally focused media education that is especially suited to the requirements of aspiring teacher-psychologists has emerged as a top priority.

AI technologies, such adaptive learning platforms and intelligent tutoring systems, are changing education by improving access and engagement, according to recent international research. However, the effectiveness of these technologies depends more on instructors' pedagogical abilities to use them than on their accessibility [3, 4]. Traditional power relations in education are further complicated by the expanding influence of generative AI, which includes tools like ChatGPT and gives students more agency. To remain pedagogically relevant in the face of this change, educators must cultivate critical data literacy, quick design proficiency, and sophisticated media negotiating abilities [5].

AI's contribution to educational psychology goes beyond simply delivering material; it also encompasses individualized feedback, mental health diagnostics, and emotional well-being support [6]. It was underlined the need for professional development centred on AI's ethical deployment in mental health and educational contexts, whereas showed that teachers' acceptance of AI depends on perceived utility and simplicity of use [7].

According to research on media use in higher education, faculty members' own values and views have a big impact on how they utilize and manage media technologies in their classes [8, 9]. This suggests that educational psychologists must critically examine their own presumptions about technology, danger, and normalcy when counseling students and colleagues; simply being "media literate" is insufficient [10]. Even well-meaning applications of AI and digital media may unintentionally reinforce latent biases or ignore vulnerable learners in the absence of such reflexive competency.

Therefore, interdisciplinary learning models that connect media education, psychology, and AI ethics are considered crucial for modern professional training [11, 12]. Instead of actively influencing responsible, psychologically informed media use in educational institutions, prospective teacher-psychologists run the risk of becoming passive consumers of digital media and platform logics in the absence of integrated frameworks [13]. For those required to oversee preventive and corrective work in schools and universities, this conflict between scattered preparation in various programs and sophisticated AI-mediated environments is especially challenging.

Statistics from around the world confirm how urgent this problem is. According to reports 88% of university students in the UK have used generative AI for assessments, and 92% of them interact with AI tools [14]. With usage rates ranging from 13% to 57%, similar patterns have been reported in the US and other regions [15]. Few training programs explicitly prepare educational psychologists to navigate AI-mediated environments, despite these pervasive practices.

The problem is especially severe in Kazakhstan. Despite the rapid digitization of the country's educational system, professional training in media ethics and AI literacy is still dispersed. The socio-emotional and ethical ramifications of AI use in learning environments are not adequately covered in the structured curricula of many educational psychology programs [16]. As a result, there is a big disconnect between the professional skills of aspiring psychologists and technological developments. Because Kazakhstan has a distinct sociocultural and educational context, it is essential to create models that match local requirements with international best practices to guarantee training that is both culturally sensitive and practically applicable [17].

For seeking teacher-psychologists, this study presents an empirically supported model of professionally focused media education. To give educators, the critical, adaptive, and reflective abilities required for successful practice in digital environments, the model combines AI tools, media literacy, and ethical reasoning. By fixing the structural flaws in current curricula, this study offers a scalable framework that can be tailored to the educational environment in Kazakhstan and supports global pedagogical reform.

This study thus offers an empirically validated paradigm of professionally focused media education for aspiring teacher-psychologists. The paradigm gives educators the critical, flexible, and reflective skills necessary for successful practice in digital contexts by fusing AI technologies, media literacy, and ethical reasoning. This study provides a scalable framework that can be adapted to the educational environment in Kazakhstan and, under suitable contextual conditions, inform broader pedagogical reforms in educational systems rich in AI and media. It does this by directly addressing the gaps that have been identified: inadequate integration of AI and media literacy into psychological training, lack of systematic ethical preparation, and limited context-sensitive frameworks.

II. Literature Review

Although there has been a lot of academic interest in the intersection of educational psychology, Artificial Intelligence (AI), and digital media, previous contributions are inconsistent in how they view the professional role of educational psychologists. Media education has steadily penetrated teacher-education frameworks, but its links to psychological counseling and socioemotional support are poorly understood and sometimes handled as a generic adjunct rather than a core professional competency [18, 19]. Media literacy is usually limited to fundamental digital skills or critical reading tactics, rather than being portrayed as a multidimensional ability that includes ethical judgment, psychological insight, and adaptive decision-making in AI-intensive situations [20]. As a result, existing models do not adequately address the special roles of educational psychologists, such as counseling, behavior assessment, and socio-emotional development, which need sophisticated interpretation of media experiences and AI-mediated interactions [21].

International research shows that AI technologies are rapidly spreading in education, with both teachers and students increasingly embracing chatbots and generative systems like ChatGPT. Survey-based research in countries such as Sweden and the United States show significant disparities in perceived risks and advantages across fields and demographic groups, with social science students frequently reporting more ethical concerns than technical students [22]. Simultaneously, most AI use happens in situations with inadequate institutional guidance: students report limited training in AI literacy and ethical decision-making, as well as little formal support for mediated ethical reasoning, data literacy, and social skills in psychology-related programs [23].

The psychological repercussions of AI-powered personalization are increasingly becoming obvious. While adaptive systems can boost motivation and personalize learning paths, they may also promote apathy, overreliance on opaque algorithms, and a loss of learner autonomy [24]. Emotional alienation, increased anxiety, and a less critical posture toward algorithmic feedback have been reported in studies, particularly among susceptible learners [25–27]. As a result, educational psychologists must view AI not only as a pedagogic tool, but also as a socio-technical environment that changes identity, emotion, and social interactions, with immediate implications for assessment, prevention, and intervention.

Ethical issues complicate the situation. The fast implementation of algorithmic systems for monitoring, assessment, and behavioral nudging presents unanswered problems concerning autonomy, prejudice, and data privacy [28]. Despite an ongoing academic discussion, pre-service programs for educational psychologists rarely involve systematic development of AI ethics competences, critical reflection on the effects of media on mental health or help on creating and maintaining virtual identities [29]. Empirical research has linked algorithmic content feeds to anxiety, body-image distortion, and cyberbullying among young people, but these findings are rarely transferred into training for future psychologists to address such problems in educational contexts [30].

The national literature in Kazakhstan reflects similar worldwide issues and exposes institutional barriers to increasing advanced media and AI training, such as technology limits and curriculum reluctance. Recent research highlights a lack of interdisciplinary models that integrate psychology, ethics, and AI training, as well as the fact that local courses frequently import generic Western frameworks without enough contextual adaption [31]. As a result, despite being on the front lines of prevention and intervention, educational psychologists are typically left with insufficient resources to think critically and ethically about virtual settings, let alone support students within them.

Throughout this collection of study, AI is portrayed as either a value-neutral efficiency tool or a transformative force reshaping cognition and social relationships. Some research focus on AI as a technique of optimizing learning

processes [32], while others highlight its potential to reshape human development and educational values [33, 34]. These opposing viewpoints highlight the importance of conceptual integration and truly multidisciplinary approaches connected with psychological practice.

Despite theoretical and technological advances, the literature reveals significant gaps, including insufficient attention to future psychologists' socio-psychological and ethical preparation, underdeveloped models for incorporating AI and media literacy into professional training, and a lack of regionally grounded, culturally adaptive frameworks. The current study fills these gaps by creating and empirically testing a professionally oriented media-education paradigm for educational psychologists in Kazakhstan. The model (a) views media literacy as a psychologically informed, ethically saturated competence rather than a narrow technical skill set; (b) incorporates AI tools into profession-specific scenarios of diagnosis, counseling, and prevention; and (c) is explicitly designed to align with Kazakhstani higher education while remaining adaptable to other contexts.

A. Problem Statement

Globally, psychological support and education are changing due to the quick development of digital media and Artificial Intelligence (AI). However, professional training for aspiring educational psychologists in Kazakhstan is still disjointed and devoid of organized approaches to incorporating media literacy and artificial intelligence into practice. Programs currently in place concentrate on general digital competencies while ignoring important ethical and psychological issues like algorithmic bias, digital trauma, and media-driven behavioral problems in schools. Future experts are deprived of crucial resources to successfully navigate AI-mediated learning environments because of this gap. It is critical to match professional training with these changing needs considering Kazakhstan's aggressive digitization initiatives.

The aim of the present study is to describe and empirically verify a model of profession-oriented media education for prospective educational psychologists to respond to the demands of the AI era.

To this, the research establishes the following tasks:

1) assess the training practice and identify areas of deficit in media and AI training in psychology training courses;
2) suggest a convergent model that integrates AI tools, ethical standards, and media literacy with specific focus in psychological contexts
3) pilot and empirically try out the model's efficacy for developing media literacy, critical thinking, and ethical readiness in educational psychology students.

Based on the theoretical framework and the aims of the intervention, the study developed the following hypotheses:

H1. Students in the experimental group will have significantly higher media literacy at post-test than students in the control group.

H2. Students in the experimental group will perform much better in critical thinking than in the control group.

H3. Students in the experimental group will be much more AI-ready than those in the control group.

H4. Students in the experimental group will do much better on profession-specific scenario-based activities (digital risk assessments, counseling judgments, and prevention tactics).

H5. Across all measured domains, the experimental group will improve more than the control group.

III. Materials and Methods

A. Methodological Basis of the Study

The methodology is embedded in a pedagogical-practice strategy for professional media education of prospective educational psychologists. Theoretical foundation of media literacy has its roots in the European Commission's DigCompEdu, and operationalization for developing critical thinking development is based on adaptation of the Watson-Glaser Critical Thinking Appraisal, adapted for AI and media effect circumstances [35, 36]. The research draws upon the theory of problem-based learning, instructional individualization, and the blending of theory with practical digital tools.

B. Study Design

To evaluate the impact of a specially designed focused AI-integrated training course tailored specifically to media education, a pedagogically controlled experiment was conducted over one academic semester (16 weeks) from September 2024 to December 2024 (Fig. 1).

Students were assigned into two groups: an experimental group (n = 60) that learned using the new AI model, and a control group (n = 60) that learned using the regular curriculum. The intervention was for a single term of study (16 weeks), covering theory lectures and practice lab sessions. Using lectures and practical exercises with AI tools, the experimental group finished four AI-supported modules: media analysis, AI-assisted psychological diagnostics, AI-driven content creation, and ethical reflection. The control group relied on conventional lectures and assignments while studying related subjects without the use of AI tools.

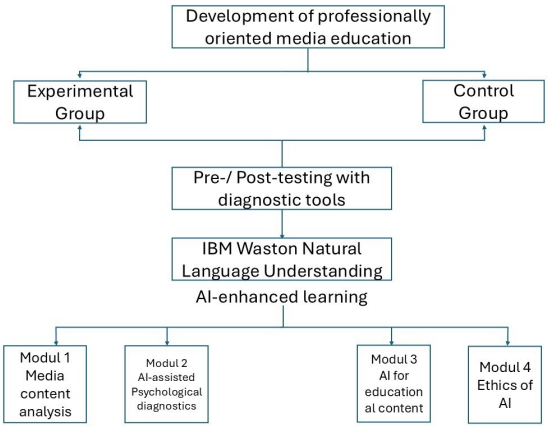

Fig. 1. Flowchart of the AI-enhanced experimental media education program for future educational psychologists.

Step 1: Participant Selection and Group Assignment

A total of 120 undergraduate students specializing in Pedagogy and Educational Psychology were selected to participate in the study. The sampling was done based on:

- Grade Point Average (GPA) ≥ 2.5 (on a 4-scale)
- Basic digital literacy minimum (tested with a primary IT proficiency test)
- Informed and voluntary consent to join the study

Among the exclusion criteria were:

- Beyond exposure to the general curriculum, prior formal training in media literacy courses or AI tools
- Involvement in ongoing studies or experimental learning initiatives
- Inadequate capacity for attendance (expected absences surpassing 20% of sessions)

The students were divided into two equal groups:

- Experimental Group (n = 60): were instructed utilizing the new AI-rich media training program
- Control Group (n = 60): received the normal curriculum minus AI elements

Participant demographics for experimental and control groups are shown in Table 1.

Table 1. Participant demographic characteristics

Group	Gender	Age (years)	Grade Point Average (GPA)	IT Proficiency Score (out of 10)	Urban vs. Rural	Language of Instruction
Control	Female: 39, Male: 21	21.23	3.15	8.27	Urban: 39, Rural: 21	Kazakh: 26, Russian: 25, English: 9
Experimental	Female: 44, Male: 16	20.92	3.08	8.07	Urban: 35, Rural: 25	Kazakh: 29, Russian: 17, English: 14

Step 2: Initial Diagnostic Assessment

All students completed a battery of diagnostic measures before applying the training program to record baseline levels of the target competencies. Media literacy was assessed by a revised self-report measure based on the European DigCompEdu framework that covered digital content assessment, ethical use of media, and well-being in the digital environment (Cronbach's alpha = 0.87). Critical thinking was evaluated through Watson–Glaser Critical Thinking Appraisal adapted for AI and media-oversaturated environments ($\alpha = 0.81$). AI readiness was measured using an inventory tool familiarity that was tailored, ethical consciousness, and readiness to implement AI in practice ($\alpha = 0.84$)

Furthermore, a case-based evaluation was utilized to mimic real-world professional issues. The participants answered directed scenarios of online conflict resolution and social network information verification. Their answers were scored on an ethical judgment rubric, media literacy rubric, and communication competence rubric. Scores were independently scored by two coders with an interrater reliability percentage above 85%.

These tools gave an overall template for assessing the effect of training intervention on media literacy, critical thinking, and readiness for AI.

Step 3: Program Implementation—Experimental Group

The experimental group completed a four-module AI-integrated media-education program designed for aspiring educational psychologists. The AI tools were chosen based on their alignment with required competences and practical practicality (institutional/educational licenses, no real patient data, typical of systems likely to be utilized in educational and counseling settings).

Module 1 (AI for Media Analysis) taught students how to detect deception, analyze emotional tone, and determine source dependability using IBM Watson and NewsGuard. Module 2 (AI for Psychological Diagnostics) employed Dialogflow for chatbot simulations and sentiment analysis, allowing students to investigate how conversational agents reflect psychological states and critically evaluate their outputs.

Module 3 (AI for Content Creation in Education) used Quillionz, Canva AI, and Google Gemini to create quizzes and multimodal materials, honing abilities in building psychologically informed, adaptable learning content.

Module 4 (Ethical Aspects of AI in Education and Psychology) focused on case studies and reflective exercises about privacy, algorithmic bias, and digital well-being, with the same technologies serving as concrete anchors for ethical analysis.

Across modules, theoretical information was regularly linked with hands-on work, with the goal of developing effective and ethically responsible AI use in educational-psychological practice.

Step 4: Final Assessment

The control and experimental groups administered the same diagnostic test battery employed at baseline at the end of the training program. The post-test provided scores on changes in readiness to apply AI in professional practice, media literacy, and critical thinking. These scores were employed to assess the intervention effect.

Step 5: Data Analysis

Besides descriptive statistics and paired-sample tests, independent-samples t-tests were utilized to compare experimental and control groups for continuous outcome variables. One-way ANOVA (Analysis of Variance) was utilized to compare post-intervention group differences. $p < 0.05$ was utilized as the significance level.

For categorical variables, including the frequency of indicators of ethical thinking in open-ended responses, Chi-square tests of independence were used to measure group differences in frequency distributions. These analyses provided quantitative and qualitative verification of intervention effects.

To examine the interrelationship between the three fundamental competencies—media literacy, critical thinking, and AI readiness—the Pearson correlation analysis was performed on experimental group post-intervention test scores. This enabled the examination of whether there existed possible co-developmental patterns or whether these domains were independent. The correlations were calculated using R (v4.2) with a significance level of $p < 0.05$.

C. Ethical Considerations

All procedures involving human subjects followed the 1964 Helsinki Declaration and its revisions and were authorized by the Astana International University (Approval No. 6788). All students provided informed consent after being told of the study's objectives, the voluntary nature of participation, their right to withdraw at any time, and the anonymization and secure treatment of their data.

The psychological simulation tasks utilized in the experimental modules were based on hypothetical training

instances (e.g., academic stress, classroom dispute, non-graphic cyberbullying), and the ethics committee determined that they posed no more than a minor risk. During the debriefing, participants were provided with information about university counselling services and could skip any scenarios that made them uncomfortable. The intervention also included explicit instruction on ethical and responsible AI use, privacy, and data protection to help participants improve their professional ethical awareness.

D. Methodological Limitations

There were several drawbacks that should be mentioned, even though the study was well-designed to assess the efficacy of an AI model of media education. For example, generalizability to larger populations or different cultural contexts may be limited because the sample was drawn from a single pedagogical university. External validity would be enhanced by future replications of the study in different institutional settings.

Second, self-reported and performance-based skills were only evaluated in the short term by pre- and post-tests; longer-term retention of these gains was not monitored. It might be feasible to assess the sustainability and transfer of learning outcomes by adding a post-test that is postponed several months after the course is finished, preferably during practicum or early professional engagement. Additionally, there was considerable subjectivity involved in the interpretation of open-ended responses during scenario tests, albeit this was lessened by the use of several coders.

Lastly, the sample was predominately female, which is typical for pedagogy and psychology departments, despite efforts to balance academic accomplishment between genders. Additionally, the results could have been impacted by unmeasured factors like individual learning styles, prior exposure to AI tools, and access to digital resources. To properly isolate the effects of the intervention, larger, more varied samples and multivariate controls will be needed in subsequent studies.

IV. Results

To identify the baseline preparedness of students and quantify gaps in current training programs, a pre-intervention diagnostic questionnaire was administered. The findings reported an indication of a low level of understanding of important media and AI capabilities by both experimental and control groups. As presented by Table 2, less than one-third of the respondents indicated proper understanding of required media literacy principles or self-efficacy to estimate the credibility of internet content. Just 22% of the experimental group and 20% of the control group reported that they knew something about using AI tools in learning, and sensitivity to ethical concerns of AI use was still very low (15% and 13%, respectively).

Table 2. Type sizes for final papers Awareness and perceived preparedness of students regarding media and AI topics (pre-intervention)

Media/AI Competency Area	Experimental Group (%)	Control Group (%)
Understanding of media literacy concepts	28	30
Familiarity with AI tools in education	22	20
Ability to detect fake news and manipulation	18	20
Experience using AI in psychological tasks	12	10
Awareness of ethical issues in AI use	15	13
Confidence in evaluating digital content reliability	25	23
Comfort using AI-driven chatbots or simulations	10	8

Above all, the skill to detect media disinformation and manipulation was noted by less than 20% in each group, and fewer than 12% had ever used AI for psychological or counseling applications. Familiarity with AI chatbots or computer simulations related to psychological practice was also low.

These results point to broad conceptual and practical gaps, especially in areas that call for integration of ethical thought, psychological awareness, and application of computer software. The results corroborate the demands for increasingly systematically formulated and specialized models of media education appropriately tailored to professional needs as an educational psychologist.

A. Presentation of the AI-Integrated Media Education Model

To counterbalance the gaps uncovered in the diagnostic phase, a complete training model was drafted merging artificial intelligence technologies, media literacy methods, and ethical sensitivity into the professional education of the next generation of educational psychologists. The model under development is constructed by four interconnected modules, each tackling a center bank of competences aligned with the psychological and pedagogical requirements of working in digitalized and AI-augmented environments.

The AI-integrated media education model's conceptual framework is summed up in Fig. 2. The primary sources of instructional input are profession-oriented learning tasks and AI technologies. They are anticipated to improve two mediating domains: ethical reasoning (privacy and prejudice, psychological harm, professional norms) and media literacy (critical analysis, manipulation detection, responsible content generation). When taken as a whole, these areas help educational psychologists become more proficient in their field. These areas include media and AI contact with students, parents, and teachers, preventative and intervention design, and diagnostic judgment in digital instances. Within the institutional and sociocultural environment of Kazakhstani higher education, bidirectional linkages between the components show that changes in one domain both influence and are influenced by the others.

As seen from Fig. 3, three main areas are covered in the model: (1) digital-media proficiency, (2) psychological and ethical preparedness, and (3) AI application skills. All of the areas are dealt with through experiential modules consisting of tool training and value reflection. For instance, media literacy is achieved via AI tools used such as IBM Watson for the identification of misinformation, while psychological diagnostics are built upon through chatbot creation and sentiment analysis using Dialogflow. Likewise, ethical considerations are infused through directed discussion, scenario analysis, and fairness checks using algorithms.

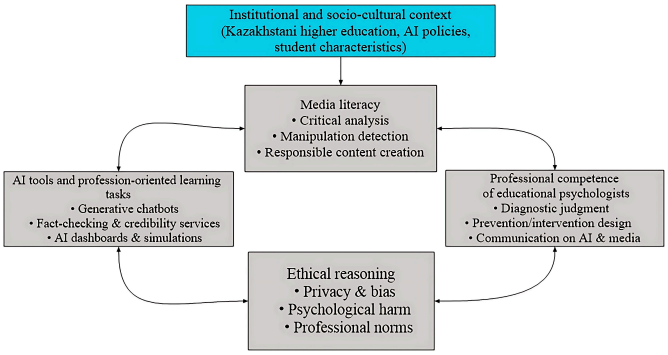

Fig. 2. Conceptual framework of the AI-integrated media education model for future educational psychologists.

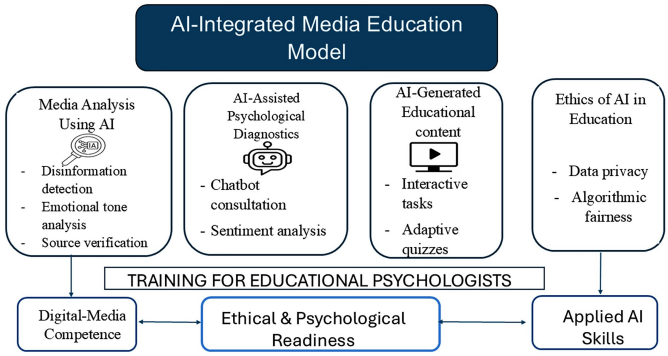

Fig. 3. AI-integrated media education model for future educational psychologists.

The model is forward-thinking in its design, starting with awareness-gaining, going through application in real-life simulations, and ending with reflective analysis of results. All modules are founded on problem-based learning philosophy with an emphasis on real-case psychological scenario and group work. Design accommodates theory and practice integration as well as autonomy, flexibility, and ethical responsibility.

This framework enables adaptable inclusion in diverse educational environments and can be replicated across institutions with disparate technological infrastructure. The model exists not merely to enhance functional digital competencies but also to equip students to function as thoughtful, ethically situated brokers between AI technologies and human-centered psychological practice.

B. Comparative Analysis of Pre- and Post-Test Results

To assess the success of the AI-integrated media education program, pre-and-post-intervention scores were contrasted on three main areas of media literacy, critical thinking, and preparedness for AI. As evident from Fig. 4, the experimental group showed statistically significant improvement in the three areas following completion of training modules.

Specifically, the average score for media literacy increased from 2.74 during the pre-test to 4.00 post-intervention, showing significant improvement in students' ability to analyse media content, detect manipulations, and utilize verification methods through AI tools. This was the utilitarian effect of Module 1, wherein media analysis with AI was emphasized.

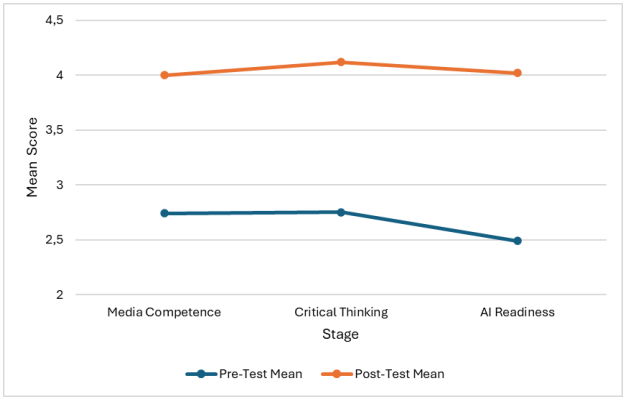

Fig. 4. Score progression in the experimental group across domains.

For critical thinking, the mean score rose from 2.75 to 4.12, demonstrating better analytical reasoning, argument analysis, and assumption detection, particularly in AI and media-rich contexts (Fig. 4). It develops after Modules 2 and 4, which examined students through complex ethical and psychological case-based thinking using AI-assisted diagnostics and simulations.

The preparedness component of AI increased from 2.49 to 4.02, indicating increased confidence and proficiency in the use of AI resources within educational psychology. These encompass competencies in chatbot-based communication, software application of sentiment analysis, and the development of AI-assisted teaching materials. These competencies were particularly acquired through Modules 2 and 3 of the courses.

Table 3. Score progression in groups across domains

Domain	Group	Pre-test mean	Post-test mean	Paired *t*-test (*t*, *df*, *p*)	ANOVA post-test (*F*(1,118), *p*)	Cohen's *d* (within-group, dz)
media literacy	Experimental	2.74	4	$t(59) = 29.98$, $p < 0.001$	$F(1,118) = 25.47$, $p < 0.001$	3.87
	Control	2.88	3.12	$t(59) = 1.86$, $p = 0.068$	—	0.24
Critical thinking	Experimental	2.75	4.12	$t(59) = 23.24$, $p < 0.001$	$F(1,118) = 39.72$, $p < 0.001$	3
	Control	2.81	3.03	$t(59) = 1.92$, $p = 0.060$	—	0.25
AI readiness	Experimental	2.49	4.02	$t(59) = 22.85$, $p < 0.001$	$F(1,118) = 44.32$, $p < 0.001$	2.95
	Control	2.61	2.83	$t(59) = 1.80$, $p = 0.077$	—	0.23

In total, findings confirm that the combined model greatly improved not just the functional media and AI abilities but also the psychological and ethical readiness of the participants. The striking difference between the pre-test and post-test scores further supports the effectiveness of the model as an official intervention in bridging key competency gaps in the education of future educational psychologists.

In practical terms, Table 3 shows that the intervention significantly altered the competence profile of the experimental group, whereas the control group stayed close to baseline. The experimental group showed significant pre-post improvements in media literacy, critical thinking, and AI readiness ($p < 0.001$ in all three domains), with Cohen's d values ranging from 2.95 to 3.87, indicating a transformative rather than incremental effect of the program. The control group's changes were minor and statistically

non-significant ($p \approx 0.06$–0.08), suggesting that exposure to the standard curriculum resulted in minimal increases.

The ANOVA results for post-test scores support this pattern by demonstrating a clear split between groups following the intervention. Substantively, this means that the AI-integrated media-education model did more than just accelerate existing development; it also caused a qualitative shift in students' ability to analyze media, reason critically in AI-mediated situations, and responsibly deploy AI tools in educational-psychological work—effects that cannot be explained solely by general academic progression.

C. Detailed Skill-Based Outcome Comparison

Supplemented by quantitative increases in self-rated skill, the study assessed applied skills and ethical judgment using scenario-based and open-ended performance tasks. These were conducted immediately after the intervention to gauge how well participants could operate conceptual knowledge in professional practice.

Beyond self-reported gains, scenario-based and open-ended performance measures demonstrated that the training resulted in significantly improved applied skills and ethical judgment. Immediately following the training, students in the experimental group detected a significantly larger number of fake news items than controls (88% vs 62%), with a very strong and statistically robust between-group difference ($t(118) = 22.52$, Cohen's $d = 4.11$. A similar pattern occurred for interpreting emotional tone in text messages, demonstrating that AI-integrated training significantly improved abilities critical to psychological diagnosis.

In profession-specific simulations, experimental-group students created higher-quality reactions to psychological dilemmas (4.3 vs 3.2 on a 5-point scale; $t(118) = 11.82$, $p < 0.001$, $d = 2.16$) and used AI tools more effectively while making case choices. Taken together, these very large effect sizes demonstrate that the intervention not only increased declarative knowledge but also significantly improved students' capacity to utilize AI and media-analytic competences in genuine educational-psychological tasks (Table 4).

Table 4. Scenario-based skill assessment results (post-test)

Skill area	Experimental group ($n = 60$) mean (SD)	Control group ($n = 60$) mean (SD)	$t(118)$	p-value	Cohen's d
Fake news identification accuracy (%)	88.0 (4.0)	62.0 (8.0)	22.52	< 0.001	4.11
Interpretation of emotional tone in text (%)	85.0 (5.0)	59.0 (7.0)	23.41	< 0.001	4.27
Psychological scenario response quality (1–5)	4.3 (0.4)	3.2 (0.6)	11.82	< 0.001	2.16
AI tool application in case simulation (1–5)	4.1 (0.45)	2.8 (0.65)	12.74	< 0.001	2.33

Improved ethical understanding was also evident in the qualitative and scenario-based indicators coded from open-ended responses. As indicated in Table 5, experimental-group students were significantly more likely than controls to express key ethical concerns in written responses. 81.7% of experimental responses identified privacy problems, compared to 48.3% in the control group, $\chi^2(1, N = 120) = 13.22$, $p < 0.001$. References to algorithmic bias were also much higher among experimental participants (75.0% vs 43.3%). Mentions of digital responsibility (90.0% vs 55.0%; $\chi^2(1, N = 120) = 16.72$, $p < 0.001$) and explicit usage of ethical-framework terminology (68.3% vs 28.3%; $\chi^2(1, N = 120) = 17.65$, $p < 0.001$) also exhibited significant group differences. These patterns show that the intervention not only improved students' technical and analytical skills with AI and media, but it also fostered a qualitatively richer ethical vocabulary and increased sensitivity to privacy, bias, and responsibility in AI-mediated contexts—capabilities that are critical to the professional role of future educational psychologists.

Table 5. Frequency of ethical reasoning indicators in open-ended responses

Ethical reasoning indicator	Experimental group ($n = 60$) % (n)	Control group ($n = 60$) % (n)	$\chi^2(1, N = 120)$	p-value
Recognition of privacy concerns	81.7% (49)	48.3% (29)	13.22	< 0.001
Identification of algorithmic bias	75.0% (45)	43.3% (26)	11.18	< 0.001
Mention of digital responsibility	90.0% (54)	55.0% (33)	16.72	< 0.001
Use of ethical framework language	68.3% (41)	28.3% (17)	17.65	< 0.001

These findings confirm that the AI-integrated model fosters not only cognitive development, but also practical skill acquisition and ethical preparedness—key components of media and AI literacy for educational psychologists.

D. Correlation Between Competency Domains

To validate intercorrelations among the three skills that were being highlighted—media literacy, critical thinking capacity, and AI readiness—a Pearson correlation test was administered between experimental group post-test scores. Results of the same are presented in Table 6.

As clear from the table, the three pairs were low in value and statistically not significant ($p > 0.05$ for all the pairs). For example, between media literacy and critical thinking, the correlation was $r = 0.09$, denoting a very weak association. Also, the negative association between media literacy and AI readiness ($r = -0.11$) was also insignificant, denoting no significant negative association. The highest correlation, with readiness for AI and critical thinking ($r = 0.13$), was also statistically not significant.

These results indicate that while students improved on all topics following intervention, the development of each competency may be controlled by different instructional mechanisms. Failure to find large correlations further supports the argument that the training program was developed in a way that renders it legitimate as a multi-modular intervention, where all domains (media analysis, reasoning psychological, and ethical use of AI) are developed via domain-specific targeted techniques. This realization points toward the multidimensionality of preparing next-generation educational psychologists for AI-mediated settings and justifies the need for exploring each competency as a standalone, albeit complementary, domain of professional preparation.

Table 6. Correlation between post-test competencies in the experimental group

Pair of Competencies	Correlation (r)	p-value	Interpretation
media literacy – Critical Thinking	0.09	0.492	Weak, not significant
media literacy – AI Readiness	–0.11	0.411	Weak negative, not significant
Critical Thinking – AI Readiness	0.13	0.327	Weak, not significant

V. Discussion

The results of this study confirm that pedagogical interventions focused on media with AI support do hold promise in significantly developing the professional skills of prospective teacher-psychologists. In fact, there was a statistically significant improvement in digital literacy, critical thinking about media, and pedagogical deployment following the training, which confirms the effectiveness of systematic AI-mediated learning environments.

These results are similar to those of Pallant *et al*. [37], who demonstrate that students who use generative AI in a mastery-oriented manner—constructing and supplementing knowledge—achieve higher-level learning outcomes, whereas merely procedural use is linked to lower-level outcomes. The observed improvements in reflective thinking and professional competence are consistent with this mastery pattern. In our intervention, students were also required to incorporate AI outputs into media analysis, psychiatric diagnosis, and ethical reasoning rather than just replicating them. By incorporating mastery-oriented use of generative AI into a programmatic four-module model for educational psychologists, our study expands on Pallant *et al*.'s [37] course-level focus while demonstrating how institutional AI policies and curriculum design can work together to support critically engaged, professionally relevant AI use in training.

Using rich behavioral traces instead of just coarse outcome measurements, Spikol *et al*. [38] show how supervised machine learning applied to multimodal learning analytics can accurately predict success in project-based learning. This argument is conceptually consistent with our approach, which treats distinct competency scores (media literacy, critical thinking, and AI readiness) as a structured evidence base for comprehending how students go through an AI-supported curriculum, even though we do not develop predictive models. Universities in various regions could move toward shared dashboards and indicators to track these competencies over time and modify curricula and support mechanisms based on comparable, data-informed benchmarks rather than isolated local impressions if, in accordance with Spikol *et al*. [38], similar analytical routines were integrated into institutional quality-assurance and program-review systems.

The results of the current study demonstrate the significant potential of AI-augmented hybrid training for enhancing future educational psychologists' media literacy and pedagogical preparedness. Testing conducted after the intervention showed a significant improvement in the experimental group's capacity to assess online content, identify the ethical ramifications of AI use, and analyze media effects. This tendency is consistent with Chiu's finding that generative AI can only positively alter educational practices and policies when its use is purposefully planned and pedagogically guided, as opposed to being left to haphazard experimentation. According to our findings, universities can implement similar, outcome-oriented modules that set clear goals for ethical AI use and critical evaluation while flexibly modifying particular tools (like ChatGPT and Midjourney) and delivery formats to fit local infrastructure and regulatory requirements [39].

Concurrently, a different study created an all-encompassing educational AI model covering four areas: teacher professional development, data-driven decision-making, tailored learning, and cognitive support. In accordance with Zhou *et al*.'s [24] view of ethical literacy as a fundamental tenet of AI-aided teacher education [40], the education program explicitly prioritized ethical reasoning and online accountability while utilizing AI technology in content development, psychological diagnostic tools, and media analysis to strengthen the cognitive and reflective capacities of future teachers.

After receiving AI-augmented media-related training, educational psychology students showed statistically significant improvements in media literacy and professional readiness. The experimental participants also showed improvements in content curation, critical media engagement, and reflective practice. These results are consistent with those of Koshanova *et al*. [41], who demonstrate that media education fosters creativity and non-linear, adaptable thinking in addition to technical skills. Our multimodal, dialogic intervention led students assisted by AI tools to feel more confident applying media literacy principles in counseling scenarios and to more consistently articulate explicit ethical concerns when critiquing online content, which is consistent with their findings on heuristic dialogues and media-supported environments [41]. This is consistent with current calls for media accountability in psychological education.

Our AI-supported technology served as a formative "study buddy" in addition to a delivery platform, in keeping with the practical teaching paradigm proposed in a prior study. Ongoing metacognitive self-reflection was facilitated by adaptively matching students with media-based exercises and intelligent feedback loops, akin to Chongqing Three Gorges University's automated correction and performance-monitoring centers. Long-term competence increases and maintaining student attention seem to depend on this kind of customized scaffolding [42].

Significantly, the diagnostic and predictive focus of this research is mirrored in the methods of other research where deep learning models were employed to predict dropout risks from scholarly and behavioural information. Institutional data sources and machine learning techniques (multilayer perception and logistic regression) were employed by researchers to identify key predictors of scholar failure at a rate of as much as 90%. In contrast, although our research is not attempting to forecast dropout, it also uses AI for diagnostic ends—measuring skill proficiency and ethical understanding as opposed to persistence of enrolment [43].

Methodologically, both articles apply quantitative modelling, and our article also utilizes t-tests, ANOVA, and correlation matrices to evaluate program effect. Statistical power is equivalent to logistic regression models and performance verification models that were uncovered.

This study's cultural and institutional context in Kazakhstani higher education has significant implications. The lessons were applied in Russian- and Kazakh-language programs with a long history of content-heavy, exam-oriented instruction and little prior exposure to formal media or AI ethics. To ensure contextual relevance, case scenarios, linguistic resources, and disinformation instances were tailored to local platforms, regional media sources, and key social issues. At the same time, inconsistencies in digital infrastructure and conservative institutional views toward generative AI limited what could be accomplished in one semester. As a result, the proposed approach should be seen as a culturally grounded template for Kazakhstan and other post-Soviet contexts rather than a universally applicable answer, and it will require additional adaption when applied to other national settings.

VI. Conclusions

This study created and evaluated an integrated model of professionally oriented media education for future educational psychologists that meets the needs of the artificial intelligence era. The AI-integrated training program dramatically improved students' media competency, critical thinking skills, and AI readiness, with the experimental group exceeding the control group in all domains. The model had a substantial educational impact, as evidenced by significant improvements (paired *t*-test *p*-values < 0.001 and Cohen's d effect sizes > 2.9).

Students trained with AI-supported modules had an 88% accuracy rate in detecting fake news, compared to 62% in the control group. Their average performance in AI-assisted psychological diagnoses was 4.3 out of 5, while the control group was 3.2. Ethical reasoning also increased significantly, with 90% of the experimental group showing awareness of digital responsibility in open-ended reflections, compared to 55% in the control group.

Using validated assessment techniques, such as the DigCompEdu framework and an adapted Watson-Glaser Critical Thinking Appraisal, resulted in reliable and generalizable findings (Cronbach's α = 0.87). Correlation research indicated poor correlations between media literacy, critical thinking, and AI readiness, showing that these skills develop along different learning paths. This emphasizes the importance of modular, competency-based instructional design in teacher development programs. Overall, the study indicates that AI-enhanced, ethically based media education models can significantly improve future educational psychologists' professional preparation by addressing both technical and ethical aspects of practice.

A. Practical Implications and Further Research

This study is important from a scientific and practical standpoint. The suggested model can be used as a foundation for curriculum remapping in psychology and education schools, particularly in programs that aim to combine media literacy, AI ethics, and diagnostic training into a single, cohesive framework. Pre-service courses, continuing education, teacher retraining, and interdisciplinary workshops in educational technology and counseling can all make use of the training modules, resources, and scenario-based activities. Instead of depending on discrete, tool-focused initiatives, institutions should systematically incorporate AI-supported, ethically based media abilities into the professional development of educational psychologists.

A number of restrictions must be taken into consideration when interpreting the work's practical implications. The model's applicability to more varied institutional and demographic contexts is limited because it was tested in a single pedagogical university with a sample that was primarily female. Furthermore, the sustainability of learning benefits and their transfer to real-world professional contexts have not yet been determined; only short-term pre- and post-intervention effects were examined. When applying the approach to different colleges or areas, these limitations should be considered.

B. Directions for Future Research

At least three avenues should be explored in future research. To evaluate the durability and transfer of media literacy, ethical reasoning, and AI preparedness, longitudinal studies with delayed follow-up assessments in practicum or early professional activities are first required. Second, the model needs to be expanded to handle new issues like deepfakes, AI-driven content manipulation related to mental health, and new types of algorithmic harm. Third, cross-institutional research in a variety of cultural and technological contexts would make it clearer which aspects of the model are context-specific, and which can be applied more widely. This would help shape policy interventions and cooperative efforts in the ethical training of psychologists working in the digital age.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

AA: Conceptualization, Data curation, Funding acquisition, Writing—review and editing; SA: Formal analysis, Methodology, Supervision Writing—original draft; PS: Visualization, Resources, Writing—review and editing; AZ: Investigation, Software, Writing—review and editing; AT: Project administration, Validation, Writing—review and editing. All authors had approved the final version.

References

[1] A. Haleem, M. Javaid, M. A. Qadri, and R. Suman, "Understanding the role of digital technologies in education: A review," *Sustain. Operation. Comput.,* vol. 3, pp. 275–285, 2022. doi: 10.1016/j.susoc.2022.05.004

[2] L. Guan, J. C. K. Lee, Y. Zhang, and M. M. Gu, "Investigating the tripartite interaction among teachers, students, and generative AI in EFL education: A mixed-methods study," *Comput. Educ.: Artif. Intell*., vol. 8, 100384, 2025. doi: 10.1016/j.caeai.2025.100384

[3] S. F. Ahmad, M. K. Rahmat, M. S. Mubarik, M. M. Alam, and S. I. Hyder, "Artificial intelligence and its role in education," *Sustainability*, vol. 13, no. 22, 12902, 2021. doi: 10.3390/su132212902

[4] S. Wang, F. Wang, Z. Zhu, J. Wang, T. Tran, and Z. Du, "Artificial intelligence in education: A systematic literature review," *Expert Syst. Appl*., vol. 252, 124167, 2024. doi: 10.1016/j.eswa.2024.124167

[5] Y. Dai, A. Liu, and C. P. Lim, "Reconceptualizing ChatGPT and generative AI as a student-driven innovation in higher education," *Procedia CIRP*, vol. 119, pp. 84–90, 2023. doi: 10.1016/j.procir.2023.05.002

[6] H. Mulyani, M. A. Istiaq, E. R. Shauki, F. Kurniati, and H. Arlinda, "Transforming education: Exploring the influence of generative AI on teaching performance," *Cogent Educ*., vol. 12, no. 1, 2448066, 2025. doi: 10.1080/2331186X.2024.2448066

[7] L. Babashahi, C. E. Barbosa, Y. Lima, A. Lyra, H. Salazar, M. Argôlo, M. A. De Almeida, and J. M. De Souza, "AI in the workplace: A systematic review of skill transformation in the industry," *Admin. Sci*., vol. 14, no. 6, p. 127, 2024. doi: 10.3390/admsci14060127

[8] J. Gómez-Galán, "Media education in the ICT Era: Theoretical structure for innovative teaching styles," *Information*, vol. 11, no. 5, p. 276, 2020. doi: 10.3390/INFO11050276

[9] K. Zhang and S. H. Ting, "Mediating and moderating effects of WeChat use on cross-cultural adaptation among international students in China," *Int. J. Intercult. Relat*., vol. 106, 102160, 2025. doi: 10.1016/j.ijintrel.2025.102160

[10] S. Xue and D. Churchill, "Teachers' private theories and their adoption of affordances of mobile social media: A qualitative multi-case study of teachers' integration of WeChat in higher education in China," *Educ. Media Int*., vol. 57, no. 3, pp. 208–232, 2020. doi: 10.1080/09523987.2020.1824421

[11] T. K. F. Chiu, Q. Xia, X. Zhou, C. S. Chai, and M. Cheng, "Systematic literature review on opportunities, challenges, and future research recommendations of artificial intelligence in education," *Comput. Educ.: Artif. Intell.*, vol. 4, 100118, 2023. doi: 10.1016/j.caeai.2022.100118

[12] B. Pei, Y. Cheng, A. Ambrose, E. Dziadula, W. Xing, and J. Lu, "LearningViz: A dashboard for visualizing, analyzing and closing learning performance gaps—a case study approach," *Smart Learn. Environ*., vol. 11, p. 56, 2024. doi: 10.1186/s40561-024-00346-1

[13] I. Tenberga and L. Daniela, "Artificial intelligence literacy competencies for teachers through self-assessment tools," *Sustainability*, vol. 16, no. 23, 10386, 2024. doi: 10.3390/su162310386

[14] J. Freeman, "Student generative AI survey 2025," *HEPI*, 2025.

[15] C. P. Barlett, R. M. Kowalski, and A. M. Wilson, "Meta-analyses of the predictors and outcomes of cyberbullying perpetration and victimization while controlling for traditional bullying perpetration and victimization," *Aggression Violent Behav*., vol. 74, 101886, 2024. doi: 10.1016/j.avb.2023.101886

[16] A. A. Konvisar, V. V. Bezhina, and M. R. Mukanov, "Digital education in Kazakhstani teacher training system," *Bull. L.N. Gumilyov Euras. Nation. Univ. Pedagog. Psycholog. Sociol Ser*., vol. 146, no. 1, pp. 283–292, 2024. doi: 10.32523/2616-6895-2024-146-1-283-292

[17] A. Yeleussiz and G. Qanay, "Media literacy in Kazakhstan: Educators' perspectives and policy implementation," *J. Curric. Stud. Res*., vol. 7, no. 1, pp. 1–25, 2025. doi: 10.46303/jcsr.2025.1

[18] M. Spiteri and S. N. Chang Rundgren, "Literature review on the factors affecting primary teachers' use of digital technology," *Technol. Knowl. Learn*., vol. 25, no. 1, pp. 115–128, 2020. doi: 10.1007/s10758-018-9376-x

[19] M. H. H. Alzakwani, S. M. Zabri, and R. R. Ali, "Enhancing university teaching and learning through integration of artificial intelligence in information and communication technology," *Edelweiss Appl. Sci. Technol*., vol. 9, no. 1, pp. 1345–1357, 2025.

[20] M. Alwaqdani, "Investigating teachers' perceptions of artificial intelligence tools in education: potential and difficulties," *Educ. Inform. Technol*., vol. 30, no. 3, pp. 2737–2755, 2025. doi: 10.1007/s10639-024-12903-9

[21] R. Fischer, Y. Bailey, M. Shankar, N. Safaeinili, J. A. Karl, A. Daly, F. N. Johnson, T. Winter, H. Arahanga-Doyle, R. Fox, A. Abubakar, and D. M. Zulman, "Cultural challenges for adapting behavioral intervention frameworks: A critical examination from a cultural psychology perspective," *Clin. Psychol. Rev*., vol. 110, 102425, 2024. doi: 10.1016/j.cpr.2024.102425

[22] C. Stöhr, A. W. Ou, and H. Malmström, "Perceptions and usage of AI chatbots among students in higher education across genders, academic levels and fields of study," *Comput. Educ. Artif. Intell*., vol. 7, 100259, 2024. doi: 10.1016/j.caeai.2024.100259

[23] C. K. Lo, "What is the impact of ChatGPT on education? A rapid review of the literature," *Educ. Sci*., vol. 13, no. 4, p. 410, 2023. doi: 10.3390/educsci13040410

[24] Q. Zhou, K. Chen, and S. Cheng, "Bringing employee learning to AI stress research: A moderated mediation model," *Technol. Forecast. Soc. Change*, vol. 209, 123773, 2024. doi: 10.1016/j.techfore.2024.123773

[25] A. Dzhanegizova, A. M. Nurseiit, and K. S. Vyborova, "Artificial intelligence in education: Analysis of dynamics, perception, and prospects for integration," *Qainar J. Soc. Sci*., vol. 2, no. 4, pp. 34–49, 2024. doi: 10.58732/2958-7212-2023-4-34-49

[26] K. Sperling, C. J. Stenberg, C. McGrath, A. Åkerfeldt, F. Heintz, and L. Stenliden, "In search of Artificial Intelligence (AI) literacy in teacher education: A scoping review," *Comp. Educ. Open*, vol. 6, 100169, 2024. doi: 10.1016/j.caeo.2024.100169

[27] R. Chinoracky and N. Stalmasekova, "Ethical problems in the use of artificial intelligence by university educators," *Educ. Sci*., vol. 15, 1322, 2025. doi: 10.3390/educsci15101322

[28] E. Armano, M. Briziarelli, and E. Risi, Digital Platforms and *Algorithmic Subjectivities*, London: University of Westminster Press, 2022.

[29] H. K. Aladsani, "Developing postgraduate students' competencies in generative artificial intelligence for ethical integration into academic practices: A participatory action research," *Interact. Learn. Environ*., 2025. doi: 10.1080/10494820.2025.2487517

[30] A. İlhan, R. Aslaner, and C. Yaşaroğlu, "Development of digital literacy skills of 21st century mathematics teachers and prospective teachers through technology assisted education," *Educ. Inform. Technol*., vol. 30, no. 8, pp. 10837–10862, 2025. doi: 10.1007/s10639-024-13283-w

[31] N. Abueva, A. Buzelo, W. Yanqiu, A. Zhussupova, and A. Omar, "Educational trajectories of students in the digital information space: challenges and prospects on the example of Kazakhstan and China," *Econ. Annals-XXI*, vol. 178, no. 7, pp. 4–16, 2019. doi: 10.21003/ea

[32] Y. Li, Y. Wu, and T. K. F. Chiu, "How teacher presence affects student engagement with a generative artificial intelligence chatbot in learning designed with first principles of instruction," *J. Res. Technol. Educ*., 2025. doi: 10.1080/15391523.2025.2493942

[33] S.-H. Wu, M. S.-Y. Jong, and C.-C. Tsai, "The impact of teachers' TK and TPACK in their composed SVVR on students' active learning and learning engagement: A multilevel structural equation modeling analysis," *J. Res. Technol. Educ*., 2025. doi: 10.1080/15391523.2025.2529200

[34] A. Alrayes, T. F. Henari, and D. A. Ahmed, "ChatGPT in education–Understanding the Bahraini academics perspective," *Electron. J. E-Learn*., vol. 22, no. 2, pp. 112–134, 2024. doi: 10.34190/ejel.22.2.3250

[35] A. Garavaglia, L. Petti, and S. Triacca, "Integration of LifeComp and DigComp 2.2 as a theoretical framework for media education," in *Social Justice, Media and Technology in Teacher Education*, M. Ranieri, M. Pellegrini, L. Menichetti, A. Roffi, and D. Luzzi, Eds., Cham: Springer, 2022, pp. 59–70. doi: 10.1007/978-3-031-20777-8_5

[36] N. Sawicka-Gutaj, D. Gruszczyński, P. Guzik, A. Mostowska, and J. Walkowiak, "Publication ethics of human studies in the light of the Declaration of Helsinki—a mini-review," *J. Med. Sci*., vol. 91, no. 2, pp. 81–85, 2022. doi: 10.20883/medical.e700

[37] J. L. Pallant, J. Blijlevens, A. Campbell, and R. Jopp, "Mastering knowledge: The impact of generative AI on student learning outcomes," *Stud. High. Educ*., 2025. doi: 10.1080/03075079.2025.2487570

[38] D. Spikol, E. Ruffaldi, G. Dabisias, and M. Cukurova, "Supervised machine learning in multimodal learning analytics for estimating success in project-based learning," *J. Comput. Assist. Learn*., vol. 34, no. 4, pp. 366–377, 2018. doi: 10.1111/jcal.12263

[39] T. K. F. Chiu, "The impact of Generative AI (GenAI) on practices, policies and research direction in education: A case of ChatGPT and Midjourney," *Interact. Learn. Environ*., vol. 32, no. 10, pp. 6187–6203, 2024. doi: 10.1080/10494820.2023.2253861

[40] C. Guan, J. Mou, and Z. Jiang, "Artificial intelligence innovation in education: A twenty-year data-driven historical analysis," *Int. J. Innov. Stud*., vol. 4, no. 4, pp. 134–147, 2020. doi: 10.1016/j.ijis.2020.09.001

[41] M. T. Koshanova, A. K. Abdirkenova, P. B. Seiitkazy, Z. T. Koshanova, and A. A. Seitkassymov, "The use of media technologies in the formation of creativity in future psychological and pedagogical specialists," *Think. Skills Creat*., vol. 41, 100891, 2021. doi: 10.1016/j.tsc.2021.100891

[42] C. Yang, S. Huan, and Y. Yang, "A practical teaching mode for colleges supported by artificial intelligence," *Int. J. Emerg. Technol. Learn*., vol. 15, no. 17, pp. 195–206, 2020. doi: 10.3991/ijet.v15i17.16737

[43] S. C. Tsai, C. H. Chen, Y. T. Shiao, J. S. Ciou, and T. N. Wu, "Precision education with statistical learning and deep learning: A case study in Taiwan," *Int. J. Educ. Technol. High. Educ.,* vol. 17, no. 1, p. 12, 2020. doi: 10.1186/s41239-020-00186-2