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DIGITAL AND MEDIA LITERACY IN TEACHER EDUCATION: AN EMPIRICAL STUDY OF TRAINING OUTCOMES

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Abstract. The rapid expansion of digital information ecosystems and the proliferation of disinformation have significantly transformed contemporary educational environments, requiring teachers to integrate digital technologies while fostering students' critical thinking and digital media literacy. This study examines the implementation and evaluation of a training course developed within the European project *Teachers 4.0 Digital Age*, delivered in Bulgaria to in-service teachers. The programme, structured into ten modules and delivered through a blended learning format on an e-learning platform combined with synchronous sessions, involved 166 participants, of whom 126 completed the evaluation. The findings reveal high levels of satisfaction and a significant increase in teachers' self-reported confidence in recognising disinformation and applying digital media literacy in classroom practice, highlighting the effectiveness and relevance of structured professional development in addressing current educational challenges.

Keywords: digital media literacy; disinformation; teachers' professional development; in-service teacher training; digital competences in education

Introduction

In the contemporary digital information environment, characterized by the rapid dissemination of content and the widespread presence of disinformation, digital media literacy has become a key competence for learners. It encompasses not only the ability to use digital technologies, but also critical thinking, ethical awareness, and the capacity to evaluate and create information responsibly. In this context, education systems face the challenge of preparing students to navigate complex and often misleading information landscapes. Teachers play a central role in this process, as they are expected to integrate digital tools while fostering students' ability to critically assess information and engage responsibly in digital environments. The present study examines the implementation and evaluation of a training course developed within the European project *Teachers 4.0 Digital Age*,

which aims to strengthen teachers' competences in digital media literacy and the recognition of disinformation. The course included ten thematic modules focusing on key topics such as disinformation, digital learning environments, media practices of students, pedagogical strategies for integrating digital media literacy into classroom activities. The findings indicate a high level of participant satisfaction with the course content, structure, and interactivity. In addition, the comparison of pre-course and post-course self-assessment results suggests a positive shift in teachers' perceived confidence in recognising disinformation and applying digital media literacy approaches in their professional practice. The results highlight the importance of targeted professional development programmes that support teachers in responding to the challenges of the contemporary digital information environment.

Digital Media Literacy and Educational Challenges

One of the most pressing challenges is the proliferation of fake news. Fabricated or misleading information can spread rapidly through social media platforms, often designed to provoke emotional reactions rather than thoughtful analysis. Without the skills to question sources, verify claims, and recognize bias, learners may accept such content as truth. As highlighted in the literature, "disinformation is when false information is knowingly shared to cause harm" (Wardle et al., 2017). Digital media literacy equips students with strategies such as cross-checking sources, identifying credible authors, and distinguishing between opinion and fact. These skills are critical not only for academic success but also for informed citizenship.

Another major concern is the existence of filter bubbles. Algorithms used by digital platforms personalize content based on user preferences, which can limit exposure to diverse perspectives. Pariser (2011, as cited in Samuels, 2012) argues that personalized online environments can "pre-sanitize our information environments" and restrict access to alternative viewpoints. As a result, learners may unknowingly develop a narrow worldview, reinforcing existing beliefs while excluding alternative perspectives.

Addressing conflicting topics in the classroom is therefore a key component of digital media literacy. Issues such as politics, climate change, or public health often involve competing narratives and interpretations. Rather than avoiding these topics, educators can use them as opportunities to develop critical discussion skills. As critical media literacy emphasizes, students should be able to analyze power relations, representations, and diverse perspectives across social and political issues (Kellner et al., 2007), while also engaging in dialogue about complex and controversial topics as part of media literacy education (Hobbs, 1998). Teaching students about how algorithms work – and encouraging them to actively seek out different perspectives – helps break these bubbles. Digital tools such as news aggregators, fact-checking websites, and classroom discussion platforms can be

used to intentionally diversify the information students encounter.

The integration of digital tools plays a crucial role in fostering these competencies. Fact-checking websites, reverse image search tools, and AI-assisted verification platforms can help students investigate the authenticity of content, as such practices are essential for identifying false information and verifying digital content (Adjin-Tettey, 2022). Interactive media creation tools (such as video editing software or blogging platforms) allow learners to produce their own content, reinforcing their understanding of how media messages are constructed. Additionally, learning management systems and online collaboration tools support guided discussions, peer feedback, and reflective practice, which have been shown to improve individuals' ability to evaluate information and discern accuracy (Guess et al., 2020).

Ultimately, digital media literacy is not just about protecting students from disinformation – it is about empowering them to navigate a complex information landscape with confidence and responsibility. By addressing fake news, filter bubbles, controversial topics, and sensitive social issues through the thoughtful use of digital tools, educators can cultivate informed, critical, and empathetic digital citizens.

Digital Media Literacy Training Programme for Teachers

The training course, examined in this study, focuses on the above-mentioned issues. It was implemented within the framework of the European project "Teachers 4.0 Digital Age", which aims to strengthen teachers' competences in the fields of digital media literacy and the recognition of disinformation. The course forms part of the broader project activities related to the development and implementation of an e-Learning platform for in-service teachers, designed to support educators in addressing the challenges of the contemporary digital information environment. According to the project Action Plan, the training activities are integrated into the project work packages related to the development of the e-Learning platform and the delivery of training seminars for teachers. The platform hosts learning materials, activities, and assessment tools that enable teachers to develop practical skills for promoting critical thinking and media literacy in the classroom.

The course follows a blended learning approach, combining asynchronous self-paced learning on the e-Learning platform with synchronous online sessions aimed at discussion, collaborative activities, and reflection. The training programme is structured into ten thematic modules (1. Introduction to the course "Teachers 4.0 in the Digital Age", 2. Disinformation: Nature and Manifestations, 3. Disinformation: Key Terms and Definitions, 4. Preparation for Teaching and Learning in a Digital School Environment, 5. Assessment and Measurement of Digital and Media Literacy in School, 6. Exploring the Key Media Practices of Children and Students, 7. Teaching Digital and Media Literacy as a Means of Countering Disinformation,

8. Building Digital and Media Literacy Competences in the Classroom and the School, 9. Learners in All Their Diversity, 10. Practical Examples of Lesson Plans) with a total duration of 60 hours. The key topics cover such issues as the nature of disinformation, digital school environments, assessment of digital literacy, media practices of young people, and practical lesson planning. The modules include a variety of interactive elements, including multimedia materials, quizzes, knowledge checks, and collaborative learning activities designed to support active engagement and application of knowledge in class.

The training activities target in-service teachers and educational professionals, aiming to equip them with practical strategies for addressing disinformation and fostering digital media literacy among their students. Within the project framework, the programme is expected to reach many educators across participating European countries, contributing to the development of a network of teachers capable of acting as multipliers of knowledge and skills in the field of digital media literacy.

Methodology

Participants

The study involved participants who attended the national implementation of the *Teachers 4.0 Digital Age* training programme in Bulgaria between 11 October 2025 and 16 March 2026. The training was delivered across six course cohorts, each comprising up to 30 participants and lasting approximately two months. According to the collected registration data, a total of 166 participants enrolled in the programme, representing a diverse professional group in terms of teaching experience, subject area, and institutional background. Of these participants, 126 respondents completed the evaluation questionnaire, which served as the main dataset for analyzing participants' satisfaction with the course and the perceived impact of the training. The sample consisted primarily of in-service teachers, as well as other educational professionals, including resource teachers, school counsellors, psychologists, and educators working in specialized educational centres. Participants represented diverse subject areas, levels of teaching experience, and institutional backgrounds.

Data Analysis

Quantitative data were analyzed using descriptive statistical methods, including mean scores and percentage distributions. Changes in participants' self-assessment before and after the training were examined at the indicator level. In addition, qualitative responses to open-ended questions were analyzed through thematic grouping to identify key patterns related to course effectiveness, application of learning, and areas for improvement.

Ethical Considerations

Data were collected through Google Forms. Questionnaire responses were collected anonymously, while the registration form included identifiable information

used solely for administrative purposes. Participation in the study was voluntary, and all data were processed in accordance with applicable data protection regulations.

Data collection instruments

The data for the present analysis were collected using four main instruments: (1) a registration form, which gathered demographic and professional information about the participants, including institutional affiliation, teaching experience, subject area, educational qualification, and prior participation in training related to digital or media literacy; (2) a pre-course self-assessment questionnaire, designed to measure participants' perceived level of knowledge and confidence regarding digital media literacy, disinformation, and related teaching strategies; (3) a post-course self-assessment questionnaire, used to assess changes in perceived competences following the training; and (4) a course satisfaction questionnaire, which evaluated participants' perceptions of the training, including the quality of the course content, level of engagement and interactivity, usefulness of assessment activities, and overall evaluation of the programme.

Based on the collected data, the following section presents the main findings from the analysis of the training implementation and participants' feedback. The results focus on the characteristics of the participant sample, including their distribution by teaching experience, subject area, and institutional setting, as well as on the evaluation of the training programme based on the post-course questionnaire. In addition, the analysis examines changes in participants' self-assessment before and after the course, providing insight into the perceived impact of the training on teachers' competences, particularly in relation to addressing disinformation and fostering digital media literacy in the classroom.

The analysis addressed key dimensions of the training programme, including participants' professional profiles and their evaluation of the course content and overall learning experience. The results are presented through both numerical summaries and graphical visualizations, including bar charts illustrating the distribution of participants by teaching experience, subject area, and institutional setting. These visual representations facilitate a clearer understanding of the sample characteristics and support the interpretation of the findings.

Participants' Profile

Based on the registration data, the group included teachers and educational professionals working in institutions located in Sofia – the capital city, in other towns and cities across Bulgaria, and in villages and smaller settlements (Fig. 1). This distribution suggests that the programme reached participants from both metropolitan and non-metropolitan educational contexts, which increases the relevance of the findings for different types of school environments.

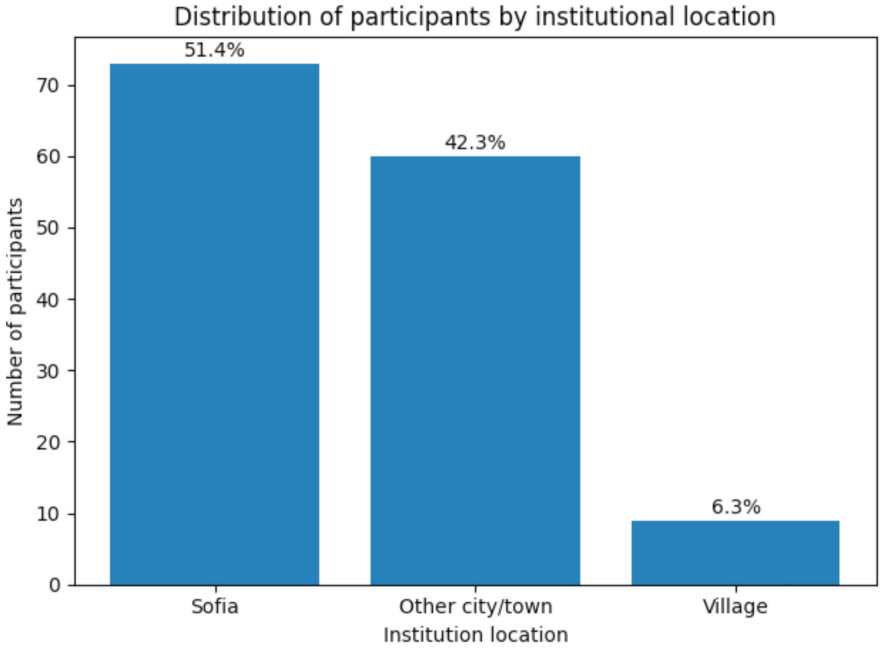


Figure 1. Distribution of participants by institutional location

In terms of professional experience, the sample included participants with up to 2 years (18.7%), 3 – 5 years (18.7%), 6 – 10 years (16.3%), and over 10 years (46.4%) of teaching experience. The group therefore combined early-career teachers with more established professionals, allowing the training to address both introductory and practice-oriented needs. The disciplinary profile of the participants was also broad. Subject areas represented in the sample included primary education, Bulgarian language and literature, foreign languages, history and geography, philosophy and civic education, mathematics, natural sciences, information technologies, arts, economics, as well as special educational support roles (Fig. 2) such as resource teachers, psychologists, counsellors, and speech therapists. This indicates that digital and media literacy is perceived as a cross-curricular competence with relevance across multiple subject domains.

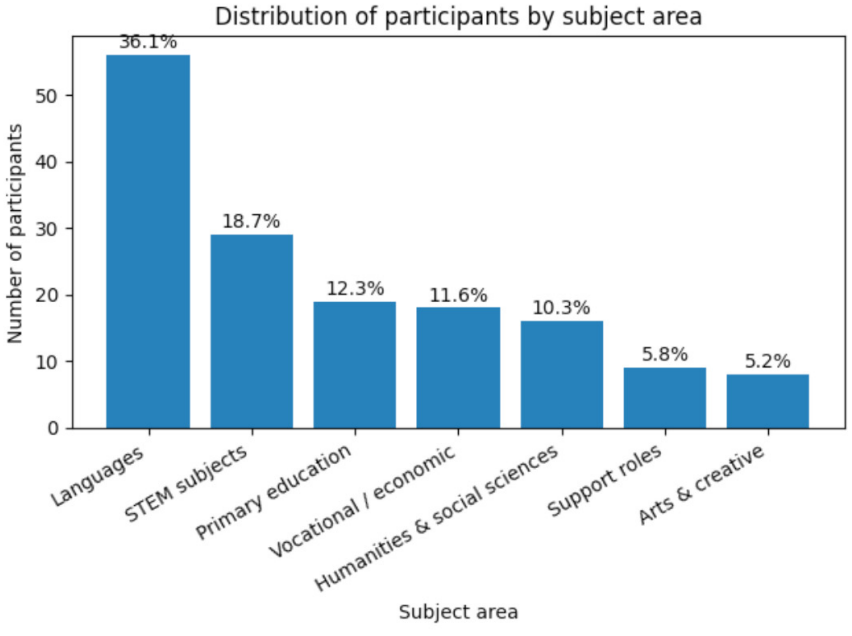


Figure 2. Subject area: Distribution of participants by subject area

Overall, the participant profile demonstrates that the training programme attracted a professionally heterogeneous audience with varied levels of experience, different disciplinary specializations, and institutional locations. Such diversity strengthens the interpretive value of the training results, as it suggests that the programme responds to needs shared by educators working in a wide range of educational and regional settings. Participants represent a wide range of subject areas, with the largest proportion coming from language disciplines (36.1%), followed by STEM subjects (18.7%) and primary education (12.3%).

Research Aim

The aim of the study is to examine the impact of a training course in digital and media literacy on teachers' self-assessment, professional confidence, and satisfaction, as well as to identify the principal strengths of the programme and the areas requiring further improvement.

Research Hypothesis

Participation in a training course focused on digital and media literacy leads to a statistically and pedagogically significant increase in teachers' self-assessment regarding identification of disinformation, using fact-checking tools, integrating

critical thinking, and applying digital and media literacy competences in the teaching process.

Sample and Instruments

The quantitative analysis includes three datasets: a satisfaction survey with 126 respondents; a pre-course self-assessment completed by participants before the beginning of the training; and a post-course self-assessment completed after the course had been concluded.

The pre- and post-course self-assessment questionnaires include seven conceptually comparable indicators (Table 1) measuring key competences related to digital and media literacy. Additionally, three open-ended questions addressed what was most liked in the course, recommendations for the improvement and other comments. The satisfaction survey comprises 11 indicators (Table 3) assessed on a five-point Likert scale (1 = very low rating; 5 = very high rating).

Pre- and Post-Training Self-Assessment Indicators

Table 1. Pre- and Post-Training Self-Assessment Indicators

Code	Measured Competence
P1	Ability to recognize disinformation
P2	Teaching digital literacy
P3	Ability to teach students how to verify information
P4	Factchecking and verification tools
P5	Critical thinking and media literacy
P6	Theoretical understanding of media literacy
P7	Digital pedagogical skills

Analysis of Self-Assessment Before and After the Course. To evaluate the effect of the training, a pre–post self-assessment design was employed. The pre- and post-course questionnaires include items (Table 1) with closely related substantive meanings, measuring the same competence domains. Although the wording of the items is not identical, they are conceptually comparable, allowing for an analysis of change at the indicator level.

Table 2. Change in Teachers' Self-Assessment of Competences before and after the course

Indicator	Before the Course (Mean)	After the Course (Mean)	Difference	Improvement (%)
P1 Recognition of disinformation	3.60	4.67	+1.07	29.7%
P2 Teaching digital literacy	2.51	4.56	+2.05	81.7%
P3 Teaching students to verify information	3.11	4.56	+1.45	46.7%

P4 Knowledge of fact-checking tools	3.05	4.65	+1.60	52.4%
P5 Integration of critical thinking	3.21	4.60	+1.39	43.5%
P6 Understanding of media literacy	3.71	4.66	+0.95	25.7%
P7 Use of digital tools in teaching	3.55	4.59	+1.04	29.3%

Figure 3 compares mean self-assessment scores before and after the training across seven key competence areas, revealing a consistent and substantial increase in all indicators. The results demonstrate that participants reported higher levels of confidence following the course, with post-training scores clustering around the upper range of the scale (approximately 4.56–4.67), compared to pre-training values ranging between 2.51 and 3.71. The most pronounced improvement is observed in teaching digital literacy, which increased from 2.51 to 4.56, representing a gain of 2.05 points. Significant improvements are also evident in fact-checking tools, which rose from 3.05 to 4.65 (an increase of 1.60 points), and teaching students to verify information, which improved from 3.11 to 4.56 (an increase of 1.45 points). These findings indicate that the training had a particularly strong impact on practical competences related to identifying and addressing disinformation. Moderate but still notable improvements are observed in critical thinking integration, which increased from 3.21 to 4.60 (an increase of 1.39 points), and recognition of disinformation, which rose from 3.60 to 4.67 (an increase of 1.07 points). The smallest increase is found in understanding of media literacy, which improved from 3.71 to 4.66 (an increase of 0.95 points), likely due to relatively higher initial self-assessment levels prior to the training. Overall, the data indicate that the training programme contributed to a meaningful improvement in both theoretical understanding and practical teaching competences, with particularly strong effects in areas directly related to classroom application.

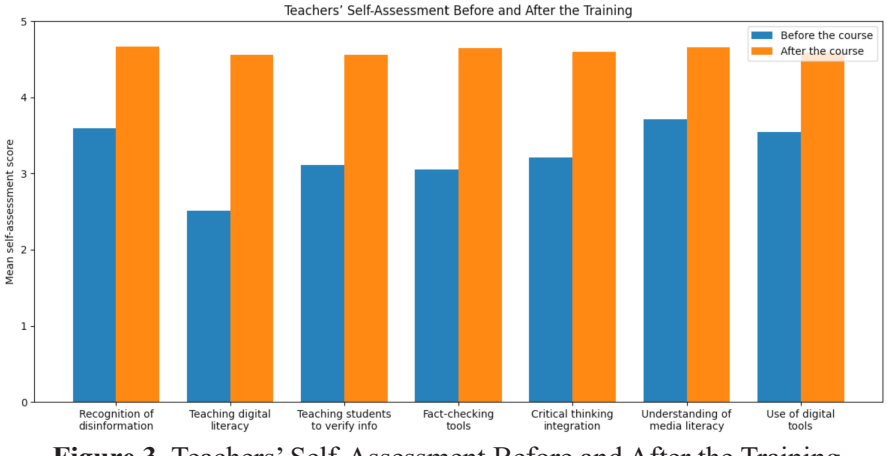


Figure 3. Teachers' Self-Assessment Before and After the Training

Open-ended responses were collected and analysed, based on participants' reflections on the most valuable aspects of the course, its practical application, and future learning needs, reveals a strong alignment between perceived usefulness and intended implementation. Participants highlighted practical exercises, ready-made lesson plans, digital tools, and training in recognizing disinformation as the most valuable components, indicating that the course was experienced as highly applicable and resource-oriented. This is further supported by their reported plans to integrate the acquired knowledge through interactive methods such as case studies, discussions, project-based learning, and interdisciplinary approaches, suggesting a high potential for sustainable transfer into classroom practice. At the same time, participants expressed a clear need for further development in areas such as disinformation analysis, AI and deepfakes, and more adaptable teaching resources, pointing to the evolving nature of digital media literacy. The preference for later, more practice-oriented modules (Modules 7–10) reinforces the importance of hands-on, applied learning in teacher training contexts. Participants indicated that they intend to apply the acquired knowledge primarily through the integration of digital media literacy into everyday classroom practice, using interactive and student-centred approaches such as discussions, case studies, role plays, project-based learning, and gamification. Many emphasized the development of students' critical thinking through activities focused on analysing media content, verifying information, and recognizing disinformation. The use of practical resources, digital tools, videos, and fact-checking platforms was also highlighted, along with interdisciplinary integration across different subjects. Additionally, participants plan to adapt the content to different age groups and learning contexts, implementing it gradually and consistently to foster responsible, informed, and critically engaged students.

Figure 4 presents the modules most frequently mentioned in participants' open-ended responses, highlighting the stronger perceived impact of the later and more practice-oriented modules. Clearly, teachers see that today's learners care mainly about the effectiveness and practical applicability of learning content and hence try to stress less on abstract concepts and purely theoretical issues. This finding is particularly relevant in the context of digital media literacy, where appropriate application of tools along with the development of critical thinking seems to matter much more rather than the mere usage digital tools.

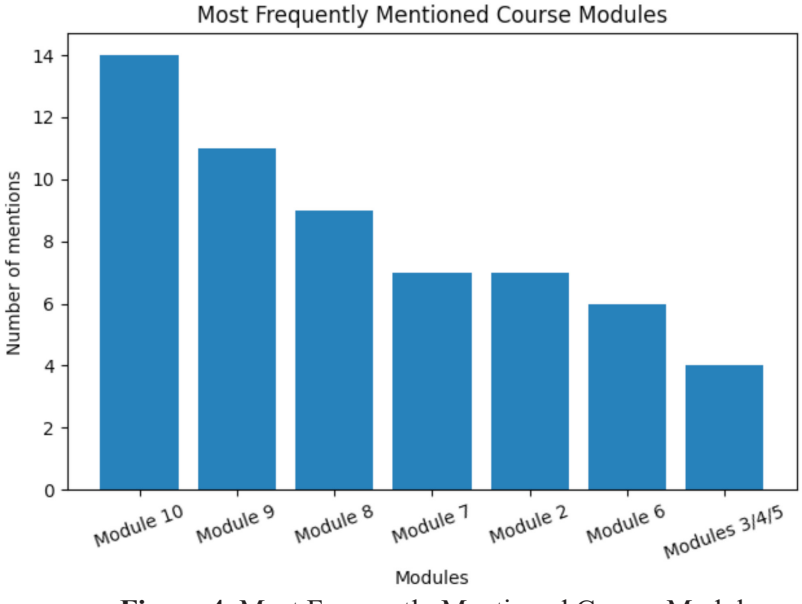


Figure 4. Most Frequently Mentioned Course Modules

Analysis of Course Satisfaction Indicators

The analysis of the satisfaction survey (Table 3) indicates a very high overall level of positive evaluation of the course. The overall mean score across all responses is 4.56 out of a maximum of 5 points, placing the training in the category of very high satisfaction.

Table 3. Course Satisfaction Indicators

Code	Indicator	Description
Q1	Overall satisfaction with the course	Assesses participants' overall impression of the training
Q2	Relevance of the topic	Measures the extent to which digital and media literacy is perceived as relevant and necessary
Q3	Clarity of content	Assesses the comprehensibility and accessibility of the information presented
Q4	Structure of the training	Assesses the logical sequence and organization of the training modules
Q5	Quality of the training materials	Measures the usefulness of the resources, examples, and supplementary materials
Q6	Practical applicability	Assesses the extent to which the acquired knowledge can be applied in pedagogical practice

Q7	Effectiveness of the teaching methods	Measures participants' evaluation of the training approaches used
Q8	Platform functionality	Assesses the usability and technical performance of the online platform
Q9	Communication and support	Assesses the interaction between participants and trainers during the course
Q10	Acquired knowledge and skills	Measures the extent of learning and competence acquisition
Q11	Readiness for application	Assesses teachers' intention to apply what they have learned in the educational process

More than 90% of all responses fall within the 4 – 5 range, and more than two thirds of the participants assigned the maximum rating. This points to a clearly positive perception of the training programme.

The highest mean values were observed for the following indicators: Q6 – Practical applicability, Q10 – Acquired knowledge and skills, Q11 – Readiness to apply what was learned. These findings indicate that the course was perceived not only as informative, but also as directly applicable to pedagogical practice.

High scores were also recorded for: the structure of the training, the quality of the training materials, the effectiveness of the methods used. Slightly lower, though still high, values were observed for indicators related to platform functionality and the clarity of some parts of the content, which points to specific areas for improvement.

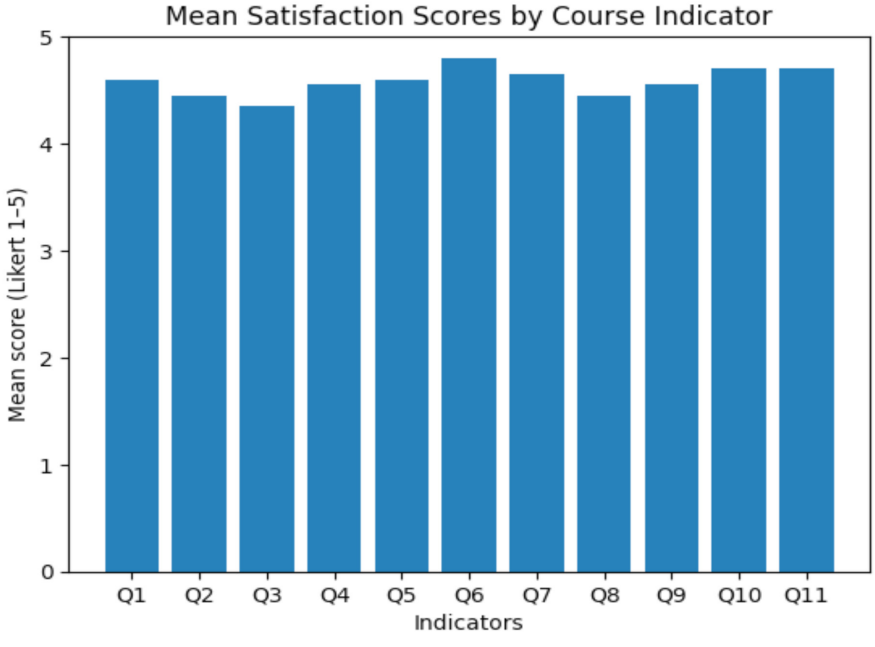


Figure 5. Mean Satisfaction Scores by Course Indicators

Figure 5 presents the mean scores for the 11 indicators (Table 3) of course satisfaction, showing particularly high values for practical applicability, acquired knowledge and skills, and readiness to apply learning outcomes in teaching practice.

Participants' responses indicate a high level of overall satisfaction with the course, with many describing the experience simply as "everything" or expressing satisfaction with the course as a whole. The most frequently highlighted strengths relate to the practical orientation and applicability of the content, including concrete examples, ready-to-use lesson ideas, and strategies for integrating digital media literacy across different subject areas. Participants also valued the wide range of resources provided, such as videos, supplementary materials, and digital tools, as well as the clear and well-structured organization of the content. Particular emphasis was placed on topics related to recognizing disinformation, developing critical thinking, and promoting safe online behavior. Additionally, the flexible learning format, the possibility to progress at one's own pace, and the interactive elements were identified as important advantages. Overall, the course was perceived as relevant, engaging, and highly beneficial for teachers' professional development. Participants' suggestions focused mainly on improving the technical functionality of the platform and assessment methods, increasing practical tasks and real-

life examples, enhancing language localization, and providing more adaptable resources, while many respondents reported no need for major improvements.

Many highlighted the usefulness of the acquired knowledge for both professional and personal contexts and expressed willingness to implement it in classroom practice. Additional suggestions included expanding access to similar trainings, integrating the course more widely in schools, increasing opportunities for experience exchange, adding more interactive and applied tasks, extending access to the platform and resources, and further developing content related to AI and inclusive education. The distribution of course satisfaction ratings further confirms this positive evaluation, with the majority of responses concentrated at the highest level (rating 5), followed by a substantial share of ratings at level 4. Lower ratings were minimal, indicating a consistently high level of participant satisfaction (Fig. 6).

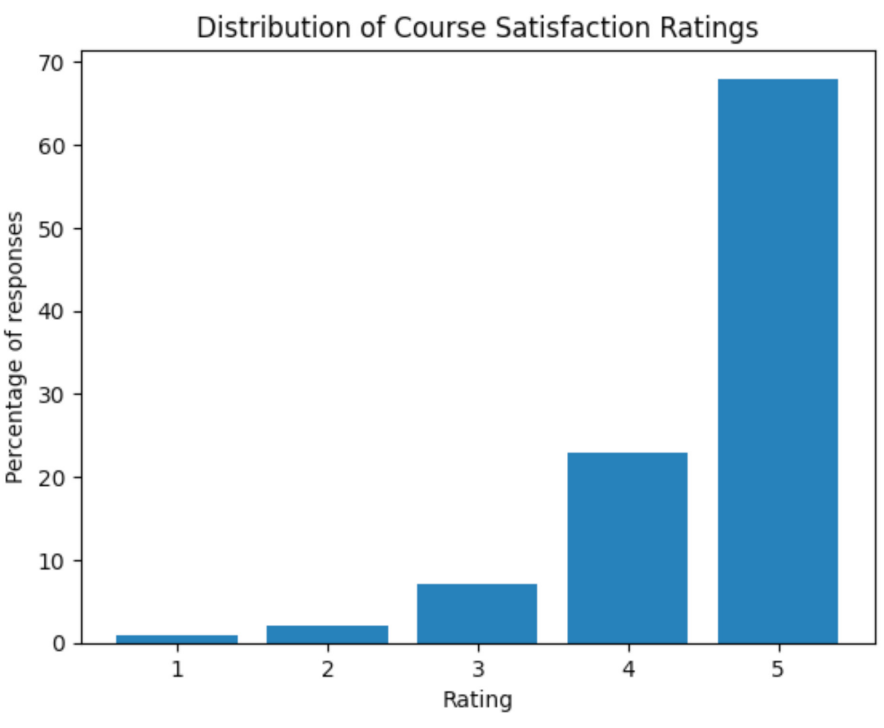


Figure 6. Distribution of Course Satisfaction Ratings

Discussion

The findings confirm the research hypothesis that participation in a digital and media literacy training course enhances teachers' professional confidence and leads to a positive evaluation of the training process. Notably, the most significant improvements were observed in areas directly related to teaching practice, including information verification and classroom application. The high level of participant satisfaction, combined with increased self-assessment scores and insights from qualitative responses, suggests that the course was perceived not only as theoretically relevant but also as practically applicable in contemporary educational settings. Teachers expressed strong appreciation for the applied modules, resources, and concrete classroom examples, and demonstrated a clear readiness to integrate the acquired knowledge across subjects and learning contexts. At the same time, the findings highlight several areas for improvement, including technical optimization of the platform, more flexible assessment approaches, improved language localization, and the need for more age- and subject-specific materials. Furthermore, participants identified key directions for future development, particularly in relation

to AI, deepfakes, inclusive education, and methods for assessing learning progress, reflecting the dynamic and evolving nature of digital media literacy.

Conclusions and Summary

To conclude, digital media literacy is no longer optional but constitutes a foundational competence for navigating contemporary information environments. As disinformation, fake news, and algorithm-driven filter bubbles increasingly shape how individuals access and interpret information, learners must be equipped with the ability to critically evaluate content, question sources, and recognize bias. In this context, the integration of digital media literacy into compulsory education emerges as a key priority, ensuring that all students systematically develop these essential competences from an early stage of their educational trajectory.

The findings of the present study demonstrate that targeted professional development programmes can play a significant role in strengthening teachers' competences in this area. The observed increase in self-assessment scores, combined with high levels of participant satisfaction and a clear intention to apply the acquired knowledge in practice, indicates that the training was both effective and relevant to teachers' professional needs.

At the same time, the consistently high evaluation of the course may also be explained by the fact that it addresses a clearly defined and currently underdeveloped area in teacher education. The strong positive response suggests the existence of a significant gap in the provision of structured training in digital media literacy and disinformation, which this programme begins to fill. In this sense, the high satisfaction levels reflect not only the quality of the training itself but also the urgency and relevance of the topic in contemporary educational contexts.

Future efforts should therefore focus not only on expanding access to teacher training programmes, but also on embedding digital media literacy as a core component of school curricula, supported by appropriate pedagogical frameworks, resources, and institutional policies.

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