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Training interventions for teachers' self-efficacy enhancement in the use of Artificial Intelligence: A systematic literature review in the five-year period 2020-2025

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Training interventions for teachers' self-efficacy enhancement in the use of Artificial Intelligence: A systematic literature review in the five-year period 2020-2025

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Περίληψη
Η είσοδος των τεχνολογιών παραγωγικής Τεχνητής Νοημοσύνης στις ζωές όλων και συνεπώς και στην εκπαίδευση, αναδεικνύει νέες ανάγκες για την επαγγελματική ανάπτυξη και την επιμόρφωση των εκπαιδευτικών, με έμφαση στην ενίσχυση της αυτοαποτελεσματικότητάς τους. Άλλωστε, η υψηλή αυτοαποτελεσματικότητα των εκπαιδευτικών αποτελεί ένα σημαντικό προαπαιτούμενο για την παιδαγωγική αξιοποίηση της Τεχνητής Νοημοσύνης. Η παρούσα συστηματική ανασκόπηση εξετάζει τη συμβολή επιμορφωτικών προγραμμάτων στη βελτίωση της αυτοαποτελεσματικότητας των εκπαιδευτικών στη χρήση εφαρμογών Τεχνητής Νοημοσύνης, εστιάζοντας σε δημοσιεύσεις από τον Ιανουάριο του 2020 έως και τον Απρίλιο του 2025 στη βάση δεδομένων Scopus και σε σχετικά επιστημονικά άρθρα σε περιοδικά, πρακτικά συνεδρίων και κεφάλαια βιβλίων. Τα ευρήματα της ανασκόπησης δείχνουν ότι στοχευμένα, ζώσης ή και εξ αποστάσεως προγράμματα επαγγελματικής ανάπτυξης με εργαστηριακό και πρακτικό χαρακτήρα και διάρκεια έως δύο μηνών, μπορούν να ενισχύσουν την αυτοαποτελεσματικότητα ή συναφείς παραμέτρους, όπως η ετοιμότητα των εκπαιδευτικών. Τα αποτελέσματα της ανασκόπησης συμβάλουν στη διαμόρφωση ενός σύγχρονου πλαισίου για τον σχεδιασμό επιμορφωτικών προγραμμάτων που λαμβάνουν τόσο τις παραπάνω ενθαρρυντικές πρακτικές όσο και τις ανάγκες των ίδιων των εκπαιδευτικών.

Abstract
The entry of generative Artificial Intelligence technologies into everyone's lives – and therefore into education – reveals new needs for teachers' professional development and training, with an emphasis on enhancing their self-efficacy. After all, high teacher self-efficacy is an important requirement for the pedagogical use of AI. This systematic review investigates the contribution of training programs to improving teachers' self-efficacy in using AI applications, focusing on publications from January 2020 to April 2025 in the Scopus database, as well as relevant scientific articles in journals, conference proceedings, and book chapters. The findings of this literature review reveal that targeted, face-to-face and/or distance professional development programs with a workshop and practical character, and a duration of up to two months, can enhance self-efficacy or related parameters such as teacher readiness. The findings contribute to the development of a modern framework for designing training programs that take into account both these encouraging practices and the needs of teachers themselves.

Key words: Artificial Intelligence, Training, Training programs, Teachers, Self-efficacy

1. Introduction

In recent years, the rapid development of generative Artificial Intelligence (AI) technologies, especially after the release of the ChatGPT application in 2022, has led to their increasing integration into every area of life, including education, offering new tools and possibilities (Dimeli & Kostas, 2025; Fokides & Peristeraki, 2025; Stan et al., 2025). However, their proper utilization – especially in

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educational contexts – often runs up against a lack of knowledge, as well as fear of the unknown and the possible under-conceptualization of human thinking and productivity (Elbanna & Armstrong, 2023). Therefore, the proper utilization of such applications requires exploring and enhancing factors that can contribute in this direction, and one such factor is self-efficacy, which is a key element for performing a behavior. "General self-efficacy" is part of a sociocognitive perspective and relates to an individual's beliefs about their ability to manage complex situations (Bandura, 1986). In contrast, "specific self-efficacy" refers to one's beliefs about managing more specific tasks, such as utilizing emerging technologies (Ajzen, 2002; Bandura, 1986; Wang & Chuang, 2024). It is clear that general and specific self-efficacy have a two-way relationship, as enhancing one can positively influence the other (Kladaki & Mastrothanasis, 2021; Mastrothanasis et al., 2021; Hasan, 2003). Therefore, the use of productive AI technologies and the promotion of innovation in education require high levels of teacher self-efficacy (Bandura, 1997; Gkontelos et al., 2023; Mastrothanasis, 2018; Mastrothanasis & Kladaki, 2025; Mastrothanasis et al., 2021). Of course, in order to predict the performance of a behavior, it is not enough to reinforce self-efficacy beliefs; other parameters, such as cognitive background and technological readiness, also need to be taken into account (Scherer et al., 2023).

In order to enhance teachers' self-efficacy beliefs in the use of AI applications – and therefore to increase the likelihood of their pedagogical use – training programs with a targeted nature, duration, and purpose play a key role (Chou et al., 2025). Furthermore, the above-mentioned need for teacher training is becoming more urgent in the Greek context (Kladaki et al., 2025). For instance, in a study by Alexopoulos et al. (2025) involving 24 literature teachers, it was found that although teachers acknowledge the potential benefits of using such technologies in courses such as Modern Greek Literature, their intention to use them is hindered by several factors, the main one being lack of knowledge. In other words, although they recognize the potential positive pedagogical impact of AI, they do not feel that they have sufficient knowledge to use it. To this end, teachers highlighted training as a key facilitating factor for the use of AI.

Indeed, Greek teachers who teach arts subjects, such as theatre and literature, overwhelmingly state that they have not used AI in their lessons, as revealed in a survey of 118 primary and secondary school teachers (Alexopoulos & Kladaki, 2025). Therefore, they suggested flexible, accessible, and distance training based on self-directed learning but also incorporating a practical, workshop-based approach. Regarding the training focus, teachers expressed a desire to learn multimedia content production applications and receive support in areas such as activity development, lesson planning, formulating questions, assessment, and the creation of theatre literary texts (Alexopoulos & Kladaki, 2025).

2. Aim, Research Questions and Contribution

Considering the above, this research investigates teacher training programs aimed at enhancing teachers' self-efficacy in the use of AI, as reflected in the current literature. Therefore, the research questions of this systematic review are stated as follows: 1) What is the emerging trend in teacher training to enhance self-efficacy in AI use? To answer this question, the countries in which the studies were conducted, the years of publication, and the educational level of the subjects who participated in the studies are examined. 2) What is the dominant type of training and its duration for enhancing teachers' self-efficacy in using AI? 3) What is the effect of these training programs on teachers' self-efficacy in using AI? The results obtained can serve as a useful guide for the design and implementation of relevant training programs in Greece – an area that is emerging as important, according to Greek teachers themselves, as mentioned above.

3. Methodology

The literature review (Andreadakis & Vamvoukas, 2011) followed the guidelines for systematic reviews and meta-analysis ("Preferred Reporting Items for Systematic Reviews and MetaAnalysis

extension for Scoping Reviews") by Tricco et al. (2018) and was conducted in four consecutive stages, identification, screening, eligibility and inclusion. The required scientific context of the work was defined according to the PRISMA 2020 criteria.

3.1. Identification and pre-screening

The domain of the review covered studies published in English from January 2020 to April 2025. The choice of this five-year period was determined by the fact that during this period tectonic developments have taken place in the field of generative AI. A possible broadening of the time horizon under consideration would likely lead to divergences with current training preferences and trends, given the developments after 2022 and the advent of the ChatGPT application. In addition, the search was restricted to the Scopus database, using a compound command combining the terms "teachers", 'training', "training program", "training course", "professional development", "Artificial Intelligence", "Generative AI" and "self-efficacy", utilizing the logical operators "AND" and "OR". This search returned 800 results.

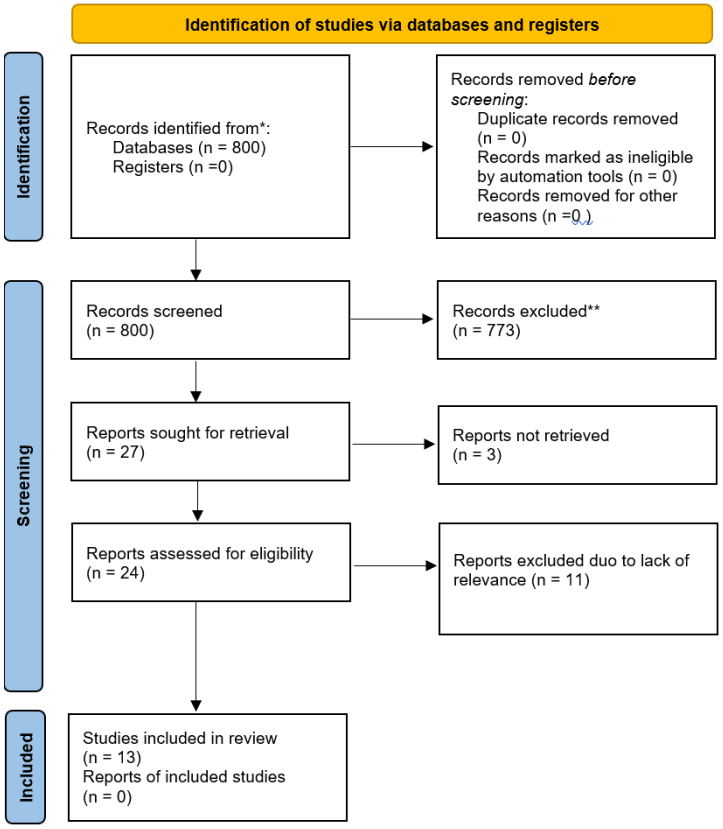
3.2. Inclusion and exclusion criteria

The selection of studies was determined by inclusion and exclusion criteria related to a) the type of publication, b) the language of the text, c) the type of research, and d) its quality. More specifically, a criterion was set (type of publication) that the selected publications should be from journals, conference proceedings, or book chapters and should be written in English. Furthermore, regarding the type of research, qualitative, quantitative, or mixed-methodology studies were preferred. The identified studies were evaluated by two independent reviewers, who approved those that met the criteria, based on the publication quality framework of Kmet et al. (2004), with an acceptable agreement value of ≥ 0.55, and in line with the methodological principles of educational research (Mastrothanasis & Alexopoulos, 2025).

4. Results

Through the inclusion process and after a careful evaluation of 24 records, 13 studies about training programs that affected teachers' self-efficacy in using AI were finally selected. It is worth noting that of the 13 studies, 4 (Ayanwale et al., 2024; Brünner et al., 2025; Ding et al., 2024; Kitcharoen et al., 2024) did not focus directly on self-efficacy, but focused on a related concept-factor, such as "readiness" or "self-assessment of understanding" in AI use. Their inclusion was determined by the fact that self-efficacy is the result of multifactorial influences, including readiness, reason for which was discussed above. Therefore, because of the direct link between self-efficacy, readiness and confidence, it was deemed appropriate to include these 4 studies. The process followed for the final inclusion of the 13 studies is illustrated roughly with numerical data in the PRISMA 2020 flow diagram (Figure 1).

Figure 1: *PRISMA 2020 systematic review flow diagram*



4.1. What are the main demographic and methodological characteristics of studies examining teacher training programs aiming to enhance teachers' self-efficacy in the use of AI technologies? (RQ1)
Regarding the type of publication, of the 13 studies, 11 (84.6%) were published in peer-reviewed journals, while only 2 (15.4%) were published in conference proceedings. It should be noted that none of the included studies were book chapters (see Table 1).

Table 1: *Type of publication*

Type of publication	**N**	**%**
Journal article	11	84,6
Conference proceedings article	2	15,4
Σύνολο	**13**	**100**

Focusing on the publication date of the selected studies (Table 2), it is observed that the majority of them (N=7) were published in 2024 (53.9%) and up to April 2025 (N=5, N%=38.5%). On the other hand, only 1 study was published in 2023 (N=7.7%). Furthermore, it is worth noting that none of the selected studies had 2022, 2021 or 2020 as the publication year. That is, although studies from January 2020 to April 2025 were examined, no study published in the years 2020-2022 was selected.

Table 2: *The publication year of the studies*

Publication Year	**N**	**%**
2024	7	53,9
2025	5	38,5
2023	1	7,7
Σύνολο	**13**	**100**

Furthermore, the majority of the studies regarding teacher training programs to enhance their self-efficacy in using AI came from China (N=3, N%=23.1%) and Taiwan (N=3, N%=23.1%), as well as Kazakhstan (N=2, N%=15.4%). Also, 1 study each (7.7%) was identified in Austria, Greece, the U.S, Indonesia and Thailand (Diagram 1).

Diagram 1: *The countries in which the studies were conducted*

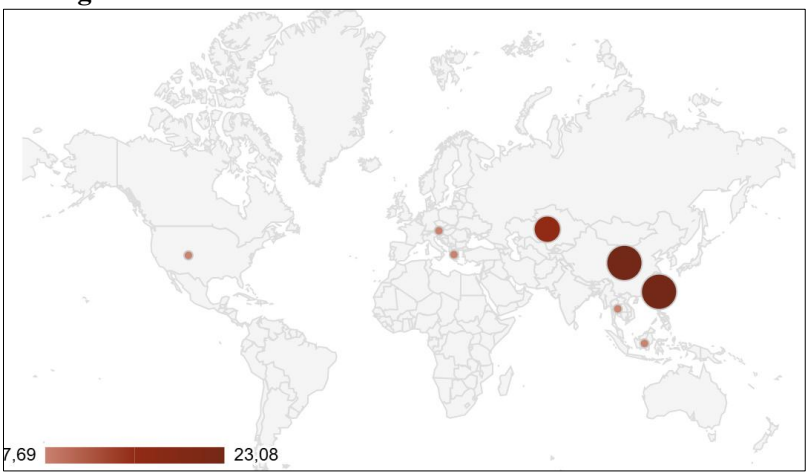


Table 3: *Participants' identity* In terms of subject identity (Table 3), 6 of the 13 studies (N%=46.2%) designed and conducted a training program for practicing in-service teachers, while an equal number of studies (N=6, N%=46.2%) focused on candidate teachers. Finally, 1 study involved both in-service and candidate teachers (N%=7.7%). Furthermore, of the 13 studies, 7 (53.9%) were purely quantitative, while 6 (46.2%) were mixed (qualitative and quantitative) studies.

Table 3: *Participants' identity*

Participants' identity	**N**	**%**
In-service teachers	6	46,2
Candidate teachers	6	46,2
In-service and candidate teachers	1	7,7
Total	**13**	**100**

4.2. What training type was chosen? (RQ2)

Among the selected studies, the vast majority (N = 10, N% = 76.9%) included a face-to-face training program for the teachers. On the other hand, only 3 studies (23.1%) focused on a hybrid training program, combining face-to-face and distance learning. Considering the type of training selected in the studies, it was observed that the majority of them (N = 6, N% = 46.2%) were purely laboratory-based, while 4 studies (30.8%) included micro-teaching or experimental teaching on the use of AI applications (Table 4).

Table 4: *The way and type of training*

	Conduct of training		**Training type**		
Research	**Face-to-face**	**Mixed (face-to-face and distance)**	**Fully workshop type (with practical training)**	**Blended Programs - Blended Learning (combination of online and face-to-face courses or workshops and practical training)**	**Micro-teaching / experimental teaching**
Alpysbayeva et al. (2025)	✓				✓
Ayanwale et al. (2024)	✓		✓		

Brünner et al. (2025)		✓		✓	
Chou et al. (2024)	✓				✓
Ding et al. (2024)	✓		✓		
Zulianti et al. (2025)		✓		✓	
Hsu et al. (2024)	✓		✓		
Kitcharoen et al. (2024)	✓		✓		
Konakbayeva et al. (2025)	✓				✓
Lu et al. (2024)	✓				✓
Pellas (2025)	✓		✓		
Sun et al. (2023)		✓		✓	
Yang et al. (2024)	✓		✓		

Regarding the duration of the training programs to enhance teachers' self-efficacy beliefs in the use of AI technologies, it was found that the majority of the surveys (N=9, N%=62.2%) had a very short to short duration (from 2 days to 1 month), while the vast majority (N=9, N%=84.6%) had a very short to medium duration (from 2 days to 2 months). Only 2 studies had a longer duration (6-8 months), of which one extended over a period covering the students' internship period, during which the use of AI tools was emphasized (Chou et al., 2024), while the other (Yang et al., 2024) had a laboratory and practical orientation. In more detail, as presented in Table 4, the majority of the selected studies (N=5, N%=38.5%) had a short duration (from 2 days to 1 month) and a maximum duration of 80 hours, which were distributed in either distance or face-to-face learning conditions. An equal number (N=4, N%=30.8%) of surveys were of very short duration (from 3 hours to 2 days) with a minimum duration of 135 minutes. Of the 13 surveys, 2 (15.4%) were of medium duration (1 to 2 months) and 2 surveys, as mentioned above, were of longer duration (Table 5).

Table 5: *Training duration*

Research	Months / Days	Hours	Description	N	%
Ayanwale et al. (2024)	1 month	10	Short (from 2 days to 1 month)	5	38,5
Pellas (2025)	7 days	2,15			
Lu et al. (2024)	1 month	10			
Sun et al. (2023)	25 days	75			
Zulianti et al. (2025)	Not mentioned	80			
Ding et al. (2024)	1 day	4	Very Short (up to 2 days)	4	30,8
Hsu et al. (2024)	1 day	3,10			
Kitcharoen et al. (2024)	2 days	12			
Brünner et al. (2025)	1 day	1			
Alpysbayeva et al. (2025)	2,5 months	20	Medium (from 2 to 2.5 months)	2	15,4
Konakbayeva et al. (2025)	2 months	Not mentioned			
Chou et al. (2024)	Not mentioned (in 6-month	Not mentioned	Long (from 6 to 8 months)	2	15,4

	practice)				
Yang et al. (2024)	8 months	13			
Total				**13**	**100**

4.3. What is the impact of training on teachers' self-efficacy? (RQ3)

In order to answer the third research question regarding the impact of training programs on teachers' self-efficacy beliefs in the use of AI, it is noted that the majority of the studies showed a significant increase in self-efficacy levels. If we add to these studies the 4 that focused on a factor related to self-efficacy – such as self-confidence and readiness to use AI – then an even more promising picture for improving these beliefs emerges (Table 6). On the other hand, in Hsu et al.'s (2024) study, no significant change in self-efficacy was observed before and after training, as it was explained that its levels were already high before the start of the program. A different finding was reported in the study by Konakbayeva et al. (2025), in which there was a decrease in the levels of teaching self-efficacy of the participants after the end of the training program. This development was attributed to the fact that the undergraduate visual arts students who participated in the study became aware for the first time, in practice, of the complexity of actual teaching – something they had not attempted until recently. However, in the other studies mentioned above, there were positive results.

Specifically, in the study by Alpysbayeva et al. (2025), there was a significant improvement in the ability to design interactive lessons with the integration of Alisa (a digital AI assistant) among the 37 teacher candidates who participated in the 10-week in-person training program with micro-teaching. Furthermore, there was a 7.3% increase in their self-efficacy in teaching with technology. The 34 teacher candidates who participated in the experimental group of Chou et al. (2024) and took part in a face-to-face program through experimental teaching and hands-on activities showed significant improvement in technology acceptance, innovation expectations, and perceptions of AI usefulness. The program, overall, appeared to enhance the self-efficacy of the prospective teachers in using AI. A similar enhancement in teacher self-efficacy was noted in the 20 participants of the experimental group of Zulianti et al. (2025), who took part in a blended professional development program based on the TPACK model, with online courses and face-to-face workshops. The results showed a significant improvement in knowledge, teaching skills, and self-efficacy in the use of AI. In this study, 215 teacher candidates (108 in the experimental group) participated, and the training was conducted through micro-teaching, i.e., short practical exercises in small classroom settings. The experiment included face-to-face lessons, and for the experimental group, ChatGPT was used during the lesson preparation stage. As shown, students in the experimental group had significantly higher self-efficacy after the training compared to the control group. The use of ChatGPT helped them better prepare their lessons and practice classroom management skills through simulated dialogues with "students" using ChatGPT.

Table 6: *The main results of the studies, with a focus on self-efficacy (✓= clear enhancement, (✓) = stability or mild positive change, ↓ = decrease, Blank = the study did not focus on this area)*

Research	Self-efficacy in the use of AI	Self-efficacy in creating lesson plans	Related factors (e.g. readiness)	Description
Alpysbayeva et al. (2025)	✓	✓		Improvement in lesson planning, increase in self-efficacy in teaching with AI (7.3% increase).
Ayanwale et al. (2024)			✓	Confidence and readiness contributed to commitment to AI use.
Brünner et al. (2025)			✓	Participants gained an improved sense of self-assessment of their

				understanding of AI.
Chou et al. (2024)	✓			Enhanced acceptance and self-efficacy in using AI.
Ding et al. (2024)			✓	Improved digital literacy and confidence in AI.
Zulianti et al. (2025)	✓	✓		Improved knowledge and teaching skills in using AI.
Hsu et al. (2024)	(✓)		(✓)	No significant changes in self-efficacy (already high) - anxiety - confidence correlation.
Kitcharoen et al. (2024)			✓	Improved readiness and confidence to use AI and ICT.
Konakbayeva et al. (2025)	↓	✓		Decrease in perceived teaching self-efficacy.
Lu et al. (2024)	✓	✓		Enhancement of professional self-efficacy with ChatGPT.
Pellas (2025)	✓			Self-efficacy in science learning through AI video.
Sun et al. (2023)	✓			Improving teaching self-efficacy.
Yang et al. (2024)	✓	✓		Improving teaching self-efficacy.

In the study by Pellas (2025), 55 candidate teachers from three Greek universities (chemistry, biology, geology, and physics), with experience in AI use, participated in practical, face-to-face training on video AI and its application in Problem-Based Learning (PBL) for teaching scientific concepts. The results showed that AI-generated videos significantly improved participants' self-efficacy, task performance, and knowledge retention. Similarly, the 40-candidate primary and secondary IT teachers who participated in face-to-face and online training by Sun et al. (2023), based on the TPACK model to enhance teaching competence, knowledge, skills, and self-efficacy in using AI, showed significant improvement in these areas. Encouraging results were also obtained from the study by Yang et al. (2024), in which 50 practicing primary school teachers participated in a face-to-face professional development program with workshops and classroom practice. The findings showed enhanced self-efficacy in integrating AI into English teaching, as well as improvement in classroom management and student engagement. The program helped teachers gain positive experiences of success and feel more confident in using AI technologies. Finally, equally positive results appeared in all four studies (Ayanwale et al., 2024; Brünner et al., 2025; Ding et al., 2024; Kitcharoen et al., 2024), which, although not focusing purely on self-efficacy, reinforced, through training, related factors identified in the literature, such as teachers' readiness and confidence in using AI technologies (Table 6).

5. Discussion

The purpose of this systematic review was to investigate the impact that targeted professional development programs for teachers can have in enhancing their self-efficacy in using AI, to provide a reliable framework for such programs. Specifically, the first research question focused on highlighting the emerging trend, as determined by the type, time, country of publication, and the status of the subjects. All selected studies were published between 2023 and 2025, while no relevant studies were found in 2020–2022. This confirms the limitation of the review to these years, directly linked to the development of productive AI technologies after 2022 and the advent of ChatGPT. Before 2022, there was no strong need for teacher training programs to enhance self-efficacy in AI use, a situation reversed thereafter. The growing interest in such programs is evident, as the first quarter of 2025 already included almost as many inquiries as the entire year of 2024. This reflects teachers' expressed requests for targeted training for the safe pedagogical use of AI (Alexopoulos et al., 2025). The selected studies mainly come from the East and countries not directly connected to major technological developments. Including Greece, this pattern may relate to limited technological access

and digital literacy, intensifying the need for teacher training. The knowledge gap and training need were also reflected by Greek teachers of art subjects in a related survey (Alexopoulos & Kladaki, 2025). The equal focus on candidate and practicing teachers can be attributed to the ease of access for research on students (as most studies originate from higher education) and the need to equip both current and future teachers with essential digital skills and familiarity with emerging technologies that could transform pedagogical tools in the near future.

According to the second and third research questions, predominantly face-to-face (often combined with online), workshop-based, and practical training approaches were adopted, showing encouraging results for enhancing teachers' self-efficacy, or related factors such as readiness, in using AI. Medium-length, flexible programs (from a 2-day workshop to 2-month courses) were more common than extensive ones, aligning with teachers' preference for flexibility (Alexopoulos & Kladaki, 2025). Finally, the integration of emerging AI technologies and the enhancement of teachers' self-efficacy should also be viewed within the framework of inclusive education, where reflective and technology-assisted practices foster equity and pedagogical innovation (Drossinou-Korea & Alexopoulos, 2023; Mastrothanasis et al., 2025).

6. Conclusion

The present systematic review highlighted the vital importance of targeted training interventions in enhancing teachers' self-efficacy in using AI technologies in education. The findings suggest that most relevant studies report a positive impact on teachers' self-perceived competence, either directly or through related parameters such as readiness or professional confidence.

Based on the data, there is a need to design professional development programs with specific characteristics: short to medium duration (up to two months), a laboratory-based and practical nature, flexible attendance, and clear pedagogical targeting. Particularly for the Greek educational population, and especially for those teaching arts-related subjects, it is proposed to develop distance, self-regulated programs that incorporate applications for producing educational material using AI and offer practical examples of integrating AI into teaching practice.

The study documents the need for policy support and educational planning to create a modern training framework that responds to evolving technological capabilities and teachers' real needs. It is therefore proposed to pilot and evaluate such programs to enhance digital readiness and pedagogical innovation in Greek education. Finally, it should be noted that the study was limited to the Scopus database, in an effort to identify a reliable core of relevant studies.

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