



EMPOWERING EDUCATORS FOR GIFTED LEARNERS: A SYSTEMATIC REVIEW OF PRE-SERVICE AND IN-SERVICE TEACHER TRAINING IMPACTS ON SKILLS, BELIEFS AND COMPETENCE

(Review study)

Elif Uysal ^a

^a University of Reading, Reading, Berkshire RG6 6AH, United Kingdom

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Abstract

This systematic review examines the impact of teacher training programs on the education of gifted students. The importance of effective teacher training in fostering positive classroom environments and enhancing student outcomes is widely acknowledged. The review aims to synthesize findings from various studies conducted globally, shedding light on the effectiveness of diverse teacher training interventions. A comprehensive search was conducted across databases to identify relevant studies. Articles were screened based on predefined criteria, resulting in the inclusion of 10 studies. The selected studies encompassed a range of designs, including quantitative, qualitative, and mixed methods approaches. The participants in these studies included teachers from various educational levels who underwent different training interventions. The synthesized findings reveal diverse outcomes stemming from teacher training programs. Quantitative studies highlighted the potential benefits of training, with evidence indicating improved teaching skills, enhanced class climates, and increased awareness of gifted students with learning disabilities. However, the effects were not universally consistent, with some studies showing minimal impact on teacher practices. This systematic review illuminates the multifaceted landscape of teacher training programs for gifted education. While there is clear evidence of positive impacts on teaching practices, the varying outcomes call for a more holistic understanding of the factors contributing to effective training. The review underscores the significance of continued research and the development of comprehensive training strategies that consider diverse teacher needs and the evolving educational landscape.

Keywords: Teaching programmes, gifted education, giftedness, in-service training, pre-service training

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¹Corresponding author (Elif Uysal).

ORCID ID.: [0000-0002-4845-2566](https://orcid.org/0000-0002-4845-2566)

E-mail: elifuysal@hotmail.com

1. Introduction

Gifted education is a vital and evolving field within pedagogy that focuses on optimizing the potential of exceptionally talented students. These students often exhibit unique cognitive, emotional, and social needs that demand specialized instructional approaches to support their holistic development. The importance of addressing these needs cannot be overstated, as failure to provide appropriate educational opportunities may result in underachievement and untapped potential. Teachers play a central role in this process, yet many educators lack the necessary knowledge, skills, and strategies to effectively cater to the demands of gifted education. This gap underscores the need for targeted professional development, which is fundamental to equipping teachers with the competencies required to nurture gifted learners and create environments that foster their growth.

Existing literature has highlighted the transformative potential of teacher training programs in gifted education. For instance, Goodnough (2001) demonstrated the significant impact of structured university courses on teachers' attitudes and beliefs toward giftedness, emphasizing the importance of reflective opportunities for professional growth. Similarly, Gagne (2009) and Reis and Renzulli (2015) have underscored the critical role of differentiated instructional strategies in meeting the diverse needs of gifted students. Despite these advancements, research has also revealed inconsistencies in the design, duration, and implementation of professional development programs, leading to varied outcomes. This study builds upon prior findings by synthesizing existing evidence and offering a comprehensive evaluation of the impact of teacher training programs on educators' competencies, perceptions, and instructional practices in gifted education.

This research aims to explore the extent to which teacher training programs both pre-service and in-service enhance educators' attitudes, knowledge, and skills for working with gifted learners. By investigating how these programs influence teachers' self-efficacy, instructional methods, and ability to adopt differentiated approaches, the study seeks to connect these outcomes to established theoretical frameworks in gifted education. Central to these frameworks is the recognition of diverse forms of giftedness, the promotion of creativity, and the prioritization of socio-emotional development in instructional design (Gagne, 2009; Tomlinson, 2014).

The theoretical implications of this study lie in its contribution to the discourse on effective teacher preparation in gifted education. It highlights the alignment of professional development initiatives with pedagogical theories that advocate for tailored approaches to gifted learners' needs. From a practical perspective, the findings offer guidance for designing and implementing training programs that empower educators to better support gifted students. Additionally, the study emphasizes the importance of sustained, job-embedded professional development as a means of ensuring long-term efficacy and adaptability in instructional practices, as noted by Rogers (2007).

By synthesizing the existing body of literature, this research seeks to bridge the gap between theory and practice in teacher preparation for gifted education. The findings aim to provide a deeper understanding of how professional development programs influence teachers' attitudes, knowledge, beliefs, and competencies. Ultimately, the study aspires to enhance educational strategies and contribute to ongoing efforts to support gifted learners effectively, ensuring their talents are nurtured and their potential fully realized.

2. Method

The method section outlines the systematic approach taken to examine the impact of pre-service and in-service teacher training programs on various aspects of teacher engagement with gifted education. A detailed description of the study's design, participants, and procedures ensures that readers can evaluate the appropriateness and replicability of the methods. This section is divided into subsections to comprehensively describe participant characteristics, sampling procedures, measurement approaches, and the research design.

PICO	Inclusion Criteria	Exclusion Criteria
Participants (P):	Regular school teachers in gifted education settings at various levels.	Studies where the population are not specified as including “gifted education”
Intervention	As pre-service and in-service teaching training programmes as the intervention focusing on promoting teachers' attitudes, perceptions, practice skills, competency, self-efficacy, knowledge, and qualifications towards gifted education.	Reasons for exclusion for the majority of studies are conducted alternative designs (not including training.)
Comparison	No specific comparison group requirement.	
Outcomes	Changes in teachers' attitudes, perceptions, knowledge, beliefs, behaviors, practice skills, qualifications, competency, self-efficacy, knowledge, perceptions and qualifications in gifted education programmes, about giftedness after completing the intervention.	There was not any exclusion in terms of context. *non-trained studies such used assessment tools just for evaluation of teacher degrees and did not include any training in research.
Study Design and Publication	Empirical studies with quantitative, qualitative, or mixed-methods designs, published in English for both title and abstract and full-text screening. Studies published in journals relevant to teacher training programmes or professional development programmes, or teacher courses in gifted education as the intervention.	Outcomes non-English language studies. Non-journals' articles.
Years Considered	Studies published out of 1975-2023/August	

The participants in the included studies were educators, primarily teachers, who underwent various forms of professional development in the domain of gifted education. The studies encompassed a diverse range of participant demographics, including gender, educational level, experience, and cultural background. The sample sizes varied across studies, accommodating between 24 to 2031 participants. Participant characteristics are essential to contextualise the findings and assess the generalizability of the results. The systematic review protocol was developed prior to conducting the review. The research question was developed by taking into account the Population (P), Intervention (I), comparison groups (C), and primary outcomes (O), as outlined by Higgins and Green in 2006.

Sampling procedures

A detailed electronic search strategy was designed for each database, using a combination of keywords related to teacher training, gifted education, and outcome measures. The process for selecting studies involved initial screening of titles and abstracts to identify potentially relevant articles, followed by a review of full-text articles to determine final inclusion. Various electronic bibliographies were utilized to identify potential research sources. The search encompassed electronic databases such as ERIC via Ebscohost, PsycINFO, Web of Science, Science Direct, Taylor & Francis Online, SAGE Journals Online, Scopus, JSTOR, Springer Link, and Google Scholar. The search was confined to studies published from 1975 to August 2023. No restrictions were placed on the publication date. In addition to electronic databases, this study also attempted to identify additional studies by contacting relevant study authors. Pertinent 'grey' literature was accessed by consulting specialised online journals, including High Ability Studies, Gifted Education International, and Journal of Secondary Gifted Education. The review included research reports and articles from various sources such as Young Gifted and Talented, National Association for Gifted Children, National Academy of Gifted and Talented Youth, Scottish Network for Able Pupils, Campaign for British Teachers Education Trust, and National Association for Able Children in Education.

This systematic review study was searched for the following keywords:

"gifted" OR "giftedness" OR "talented" OR "superior intelligence" OR "high abilities" OR "high intelligence" OR "high-IQ" AND "gifted children" OR "teacher training" OR "gifted education" "differentiation" "teachers' beliefs" OR "initial teacher education" OR "teacher attitudes towards giftedness" AND "pre-service teaching programmes" OR "in-service teaching programmes". All gathered studies were systematically assembled within a matrix situated on a spreadsheet platform. This systematic arrangement served the purpose of facilitating the identification of duplicate articles, their subsequent classification based on predefined inclusion criteria, and the comprehensive documentation of studies that were excluded from the final analysis.

The chosen studies were imported into the Zotero reference management software. A total of 221 articles were brought into the software, out of which 165 were identified as duplicates. The screening procedure occurred in a two-fold manner. Initially, the inclusion and exclusion criteria were applied to the titles and abstracts of the 34 studies, resulting in a selection of articles meeting the criteria. Subsequently, the second stage involved a comprehensive analysis of the full reports for these 10 studies. The inclusion and exclusion criteria were reasserted across these reports, leading to removing studies whose abstracts did not meet these prerequisites. This winnowing process excluded abstracts that failed to adhere to these stipulated criteria. Scrutinising titles, keywords, abstracts, and, when necessary, the entire content ensured the thorough incorporation of all pertinent research, thus ensuring the appropriateness of the included studies.

Data Extraction

The extraction process adhered to a predetermined protocol, encompassing general study information (including bibliography, study aim, and research questions), design details (such as sample size, sampling method, intervention process, data collection, and data analysis), as well as outcomes (about teachers' attitudes, behaviours, knowledge, perceptions, and qualification levels about gifted education) within the data extraction scope. An independent researcher will review the database search outcomes, applying the inclusion and exclusion criteria to screen articles based on their titles and abstracts. Cases with unclear eligibility will proceed to the full-text review stage. The full text of the remaining articles will be sourced and evaluated to ascertain adherence to the inclusion and exclusion criteria. After this process, the researcher convened to deliberate upon each paper, determining their eligibility for inclusion in the systematic review. Instances of disagreement were referred to another author, who independently evaluated the articles and made the final inclusion decision. In order to systematically evaluate the quality of the included studies and ensure a rigorous assessment of the evidence, this systematic review employed the CASP (Critical Appraisal Skills Programme) checklist. CASP checklists are widely recognised tools for critically appraising research studies. They are designed to assist researchers in assessing various study types, including qualitative research, cohort studies, and randomised controlled trials (Critical Appraisal Skills Programme, 2018). Using CASP checklists adds a structured and evidence-based approach to the review process, enhancing the credibility of this study's findings. The synthesis procedure will align with the research questions and central findings of the eligible studies.

Only studies meeting all inclusion criteria will be incorporated into the data synthesis. The design of the data extraction form should consistently reflect the research protocol and intended outcomes. The form's structure should generally follow the PICOCS framework, with necessary adjustments considered.

Outcome Measures

Outcome measures in the studies encompassed various dimensions, including changes in teachers' knowledge, attitudes, and behaviours related to gifted education. The outcome measures were assessed using pre- and post-intervention surveys, interviews, focus groups, observations, and assessments. These measures provide insight into the effectiveness of the teacher training programs and the impact on teachers' abilities to modify curriculum, adopt instructional strategies, and cater to the needs of gifted students. This Data Items Report consolidates information from various studies examining the impact of teacher training programs in gifted education. It conveys information through different studies using the teachers' opinions method (Serin and Yalman 2024; Serin and Yalman 2025). It provides an overview of participant characteristics, detailed descriptions of training programs, outcome measures, and relevant statistics for effect size estimation. The synthesis

of these elements aids in assessing the efficacy of teacher training interventions. It contributes to the systematic review's analysis of the impact of professional development on educators' abilities to effectively educate gifted and talented students.

3. Results

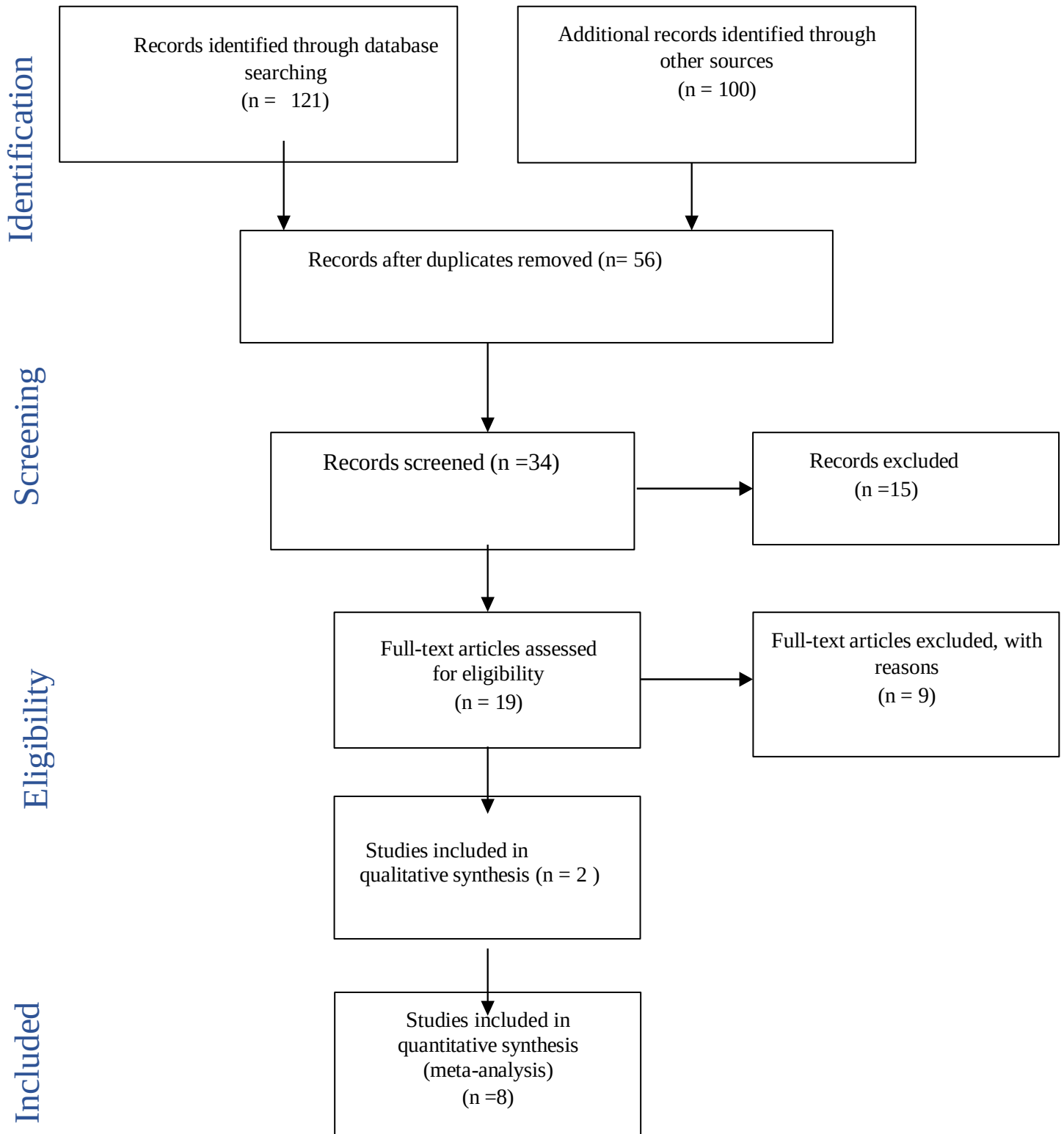


Figure. 1. An overview of the search protocol utilizing PRISMA. PRISMA flow diagram reporting the systematic literature search. PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses (Moher et al., 2009).

Summary Measures

Study Title: Effects of Training on Teachers' Accuracy in the Identification of Gifted Children (Gear, 1978).

The study assessed teachers' attitudes through the "Attitude Toward Culturally and Economically Disadvantaged Children and Youth-Revised Questionnaire." While this measure specifically addresses attitudes towards disadvantaged children, it provides insights into how training programs might impact teachers' attitudes, which is relevant to this research question. The study examined the effectiveness and efficiency of teachers' identification of gifted students as a measure of their behaviours. *Effectiveness* was defined as the ratio of confirmed gifted students nominated by the teacher to the number of gifted children in the classroom. *Efficiency* was the ratio of confirmed gifted children identified by the teacher to the total number nominated as gifted. These measures indicate how teacher training influenced their behaviours in identifying gifted students. The study evaluated teachers' competence in accurately judging giftedness using the identification effectiveness and efficiency measures. This reflects how training may enhance teachers' competence in recognising gifted students. The study did not explicitly mention self-efficacy as a dependent variable. However, the findings related to the effectiveness and efficiency of identification could indirectly provide insights into teachers' self-efficacy in identifying gifted students.

Effects of a Training Module on Omani Teachers' Awareness of Gifted Students with Learning Disabilities (Al-Mamari et al., 2020).

The study aimed to examine the effects of an online training module on Omani teachers' knowledge and awareness of Gifted Students with Learning Disabilities (GSLD). This variable is relevant to this research question as it addresses the impact of training on teachers' knowledge about a specific aspect of gifted education, i.e., students with learning disabilities who are also gifted. The main research focus was on exploring the effects of the training module on Omani teachers' awareness of GSLD. The research aimed to improve teachers' understanding of GSLD and their specific needs. This variable aligns with this research question as it measures teacher awareness changes related to a specific group of gifted students with learning disabilities. Although not explicitly mentioned, the training module likely contributed to enhancing teachers' self-efficacy in identifying and teaching GSLD, as they gained new knowledge and strategies to address the needs of these students. Self-efficacy is a crucial component of this research question, indicating the impact of training on teachers' confidence in dealing with gifted students with specific needs. The training module aimed to improve teachers' competency in dealing with GSLD. This includes understanding GSLD characteristics, applying appropriate teaching strategies, and recognising the unique needs of this student population. Competency in GSLD education is directly relevant to this research question regarding teachers' competence in gifted education. While not explicitly stated, the research context implies that the training module may have impacted teachers' beliefs and attitudes towards GSLD. Teachers' attitudes might have become more positive and empathetic towards these students due to increased awareness and understanding. Although not directly measured, this relates to teachers' attitudes and beliefs in gifted education. The research highlighted the lack of specialised programs and training for teachers dealing with GSLD in Oman. The training module aimed to address this gap by providing teachers with targeted knowledge and skills to improve their qualifications in

GSLD education. This variable aligns with this research question about teachers' qualifications in gifted education. It is not explicitly mentioned, but the study might have included an assessment of teachers' perceptions of the effectiveness and relevance of the training module in improving their awareness and understanding of GSLD. This is relevant to this research question regarding teachers' perceptions of training programs in gifted education.

Examining the Effectiveness of the In-service Training Program for the Education of the Academically Gifted Students in Turkey: A Case Study (Tortop, 2014).

The study examined teachers' attitudes and beliefs towards gifted education, as indicated by their perceptions of the effectiveness of the in-service training program. The qualitative data from interviews and experts' opinions indicated that the in-service training positively influenced teachers' attitudes, beliefs, and proficiency levels in gifted education. The study evaluated teachers' knowledge and proficiency levels in various areas related to gifted education through the in-service training program. Teachers reported gaining knowledge about different approaches in the education of gifted students, self-regulated learning, scientific research methods, and thematic unit design. The study investigated changes in teachers' behaviours and practice skills in teaching gifted students after the in-service training. Teachers were engaged in designing units for gifted students based on the EPGBU curriculum components, focusing on scientific creativity, thinking skills, research skills, and self-regulation skills. The study included teachers' qualifications in selecting participants for the in-service training. The teachers selected for the study were Science, Math, Classroom, and Preschool teachers with specified qualifications and educational backgrounds. The study assessed teachers' self-efficacy beliefs in mentoring science fair projects and providing education for gifted students. Results indicated increased teachers' self-efficacy for scientific research mentorship and gifted education after the in-service training program. The study analysed the quality of unit designs prepared by teachers based on EPGBU curriculum components. Experts evaluated the unit designs regarding dimensions such as history and philosophy of science, content complexity, multidisciplinary, and abstractness. The in-service training aimed to improve teachers' proficiency levels in gifted education. The training included theoretical and practical sessions designed and delivered by academicians with expertise in gifted education. The study used scales (SFMSST and GESST), interviews, and experts' evaluations to collect data on teachers' attitudes, self-efficacy and prepared unit designs. Results showed that the in-service training significantly increased teachers' self-efficacy in scientific research mentorship and gifted education. Teachers' unit designs were evaluated by experts, and while they were deemed applicable, some areas of improvement were identified, such as incorporating history and philosophy of science and fostering creativity. Overall, the study demonstrated the positive impact of the in-service training program on teachers' attitudes, beliefs, knowledge, practice skills, and self-efficacy in gifted education. Teachers' perceptions and the quality of unit designs also reflected the effectiveness of the training in enhancing their competencies in teaching gifted students.

Pre-service Teachers' Perceptions and Experiences in a Gifted Education Training Model, Nancy J. Bangel (Bangel, Moon, & Capobianco, 2010).

The study assessed whether the "Introduction to Gifted Education" training program increased the participants' understanding of gifted students' characteristics and needs. This addresses the aspect of teachers' knowledge in gifted education. The research investigated whether the training program enhanced participants' confidence in their teaching abilities related to gifted students. This reflects self-efficacy, specifically their confidence in teaching gifted students. The study explored participants' attitudes towards gifted education and whether they held positive views on the combined intervention strategies (Saturday enrichment program, online course, and practicum). This

touches on teachers' attitudes and beliefs about gifted education. The research examined whether participants successfully transferred the knowledge gained from the training program into their teaching practice. This assesses the practical application of knowledge and skills related to teachers' practice skills. The study emphasised the importance of practicum opportunities for successfully applying knowledge. This variable indicates the significance of practical experience and how it contributes to teachers' competence in gifted education. The research measured whether the training model advanced participants' pedagogical and professional knowledge, encompassing their overall qualifications and competence in gifted education.

Professional Development of Pre-service Teachers: Teaching in the Super Saturday Program (Bangel, Enersen, Capobianco, & Moon, 2006).

The study assessed whether pre-service teachers perceived an increased understanding of gifted students' characteristics and needs through the online course. This variable pertains to teachers' knowledge of gifted education. Similarly, the research investigated whether pre-service teachers perceived an increased understanding of gifted students' characteristics and needs through the practicum. This is another aspect of teachers' knowledge in gifted education. The study explored whether pre-service teachers' perceptions of the online course and the practicum influenced their attitudes towards gifted students. It assessed whether they developed more positive attitudes and beliefs about gifted education. While not explicitly stated, the study implied that the online course and the practicum may have contributed to enhancing pre-service teachers' self-efficacy in teaching gifted students. This is reflected in their perceived increased understanding and ability to manage classrooms and interact with parents. The research highlighted the value of specialised training in gifted education for pre-service teachers. While not explicitly a dependent variable, this underscores the importance of teachers' qualifications in gifted education and how training programs can impact them. The study emphasised the value of the practicum as an "authentic" teaching experience. This suggests that the practicum contributed to developing pre-service teachers' competence in teaching gifted students. Teachers' Perceptions of Training Impact (Implicitly Addressed): The research indirectly explored how pre-service teachers perceived the impact of the online course and the practicum on their understanding of gifted students. This relates to teachers' perceptions about the effectiveness of training programs in gifted education.

Views about the Teacher Training Program for Gifted Education

The study assessed the participants' perceptions of the Teacher Training Program for Gifted Education (TTPGE), which is relevant to this research question regarding teachers' perceptions of gifted education. This variable captures how teachers view the training program itself.

Teachers' Perceptions of Instructors' Qualifications:

The research examined participants' opinions about the qualifications of the instructors conducting the training program. This addresses teachers' perception about the qualifications of educators in the field of gifted education. The study explored how participants perceived the progress and structure of the training program. This variable relates to teachers' perceptions about the effectiveness and organisation of teacher training. The research assessed participants' views on testing and assessment methods used in the training program. This pertains to teachers' perceptions about assessment techniques in gifted education. The open-ended questions in the questionnaire collected suggestions from participants regarding program improvement. These suggestions indirectly reflect teachers' beliefs about what aspects of the program need enhancement. While not explicitly mentioned as a dependent variable, the study emphasised the need for practical application and more practice in the training program. This underscores the importance of teachers' practice skills in working effectively with gifted children.

Program Duration and Individual Support:

The research highlighted the participants' opinions about the program's duration and the need for individual support. This relates to teachers' perceptions of the ideal duration and support required for practical teacher training in gifted education.

The influence of professional development in gifted education on the frequency of instructional practices Peters and Jolly (2018).

The study indirectly explores the impact of professional development on teachers' attitudes by examining changes in instructional practices. An increased frequency of effective practices could indicate a positive attitude shift towards gifted education. While not directly measured, an increase in instructional practices suggests improved knowledge about gifted education and beliefs in the effectiveness of these practices. The study directly measures changes in instructional behaviours. Increasing the frequency of desired practices implies improved behaviours in gifted education. An increase in the frequency of instructional practices indicates improved practice skills, especially in differentiating instruction for gifted learners. The level of professional development is a direct indicator of teachers' qualifications in gifted education. Higher levels of training signify higher qualifications. Enhanced instructional practices and qualifications indicate improved competence in teaching gifted students. The study did not explicitly measure self-efficacy, but the increased frequency of effective practices could indirectly suggest improved self-efficacy. While not directly measured, participants' views on professional development could provide insights into their perceptions about the training program and its impact on their teaching.

Evaluation Results of a Teacher Professional Development Program in Greece on Gifted and Talented Children Education (GATCE) (Gourgiotou, Katsavria, & Basagianni, 2019).

The study evaluates the participants' satisfaction with the training program, indicating their attitude towards its content, structure, and overall effectiveness. Attitudes towards the training's goals and objectives can be inferred from participants' responses to the program's content and its alignment with their needs. The study assesses the knowledge acquired by participants through the training program, including understanding gifted students' needs, identification processes, socio-emotional needs, and instructional strategies. This aligns with the variable of knowledge acquisition, reflecting the impact of the training on participants' understanding of gifted education concepts. The study explores participants' perceptions of the causes and consequences of poor development in gifted students, which can be related to their beliefs about factors affecting gifted students' academic performance. The emphasis on career orientation and curriculum design can influence participants' beliefs about the importance of individualised educational approaches. The study mentions that participants were involved in relevant tasks related to lesson plan development and classroom activities. This can reflect changes in teaching behaviors, as participants incorporate newly learned strategies and practices into their classroom instruction. The training content focuses on developing participants' skills in various areas, such as instructional strategies, differentiated instruction, and curriculum design. Participants' practice skills are expected to improve as they gain proficiency in implementing these strategies in their teaching practices. The study reports on participants' qualifications, including their educational background and specialisation in special education. The training program contributes to enhancing participants' competence in addressing the needs of gifted students through specialised education.

The study indicates increased participants' self-efficacy, suggesting that the training program enhanced their confidence in teaching gifted students effectively. This aligns with the self-efficacy variable, showing that the training positively influenced participants' confidence in their ability to

teach gifted students. The study discusses participants' perceptions of the training program's design, effectiveness, efficiency, and impact. Participants' perceptions align with the broader category of teacher perception, reflecting their subjective viewpoints on various aspects of the training program. Overall, the dependent variables in the study encompass a range of systematic review variables related to teacher attitudes, knowledge, beliefs, behaviours, practice skills, teacher qualifications, teacher competence, self-efficacy, and teacher perception. The study's findings contribute to understanding how a professional development program can impact these variables and subsequently influence teachers' abilities to teach and support gifted students effectively.

Training effects on Belgian preschool and primary school teachers' attitudes towards the best practices for gifted children (Vreys et al., 2018).

The study assesses changes in teachers' attitudes towards the best practices for gifted children by analysing responses to specific items related to beliefs and opinions about gifted education. For example, concerns about gifted children becoming vain due to interventions and concerns about parental pressure were measured. The study examines the increase in teachers' perceived knowledge of gifted education before and after the training. This is measured through responses to items related to understanding the characteristics and needs of gifted pupils, effective educational interventions, enrichment material, and differentiation techniques. The study investigates changes in teachers' beliefs about educational interventions for gifted children. This is assessed through items that gauge teachers' agreement or disagreement with statements related to the feasibility of differentiation, concerns about gifted children's reactions to interventions, and colleague support. The study explores changes in teachers' behaviours and practice skills related to differentiation for gifted learners. Teachers reported implementing compacted curricula, modifying assignments, and applying differentiation techniques in the classroom. The study examines teachers' self-assessed confidence in providing adequate education to gifted students and transferring acquired knowledge to colleagues. This is measured through responses to items indicating their confidence levels. The study reports teachers' perceptions of the effects of in-class differentiation on gifted children. This is gathered through qualitative feedback on how the children responded to the interventions, including increased self-confidence, better behaviour, and well-being. The study does not explicitly measure teacher qualifications, but it indirectly addresses teacher competence by focusing on their knowledge, skills, and confidence in teaching gifted students.

Study Selection

A systematic review was conducted to assess the effects of teacher training programs on attitudes, skills, and practices related to gifted education. The study selection process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A total of 19 relevant articles were identified through comprehensive searches across various databases. After removing duplicates, the remaining articles were subjected to title and abstract screening. Following this initial screening, ten articles were selected for full-text assessment. In the full-text assessment stage, articles were evaluated based on their relevance to the research question, study design, and availability of outcome data. After careful assessment, ten articles were included in the systematic review. The reasons for exclusions at each stage are summarised in Figure 1 in the appendix of this systematic review study.

Study Characteristics

A comprehensive summary of the characteristics of the included studies is presented in Table 1 in the appendix. These studies encompass a range of attributes, including publication year, geographical origin, research design, participant demographics, intervention specifics, methods employed, and outcome measures. The subsequent synopsis offers an overview of the studies under consideration:

Effects of a Teacher Training Workshop on Creativity, Cognition, and School Achievement in Gifted and Non-gifted Second-grade Students in Lima, Peru

Sheyla Blumen-Pardo conducted a study in Lima, Peru, working with 45 second-grade elementary female teachers from 21 public schools in the city. The teachers were between 27 and 49 years old, with an average age of 35. They participated in an In-Service Teacher Training Workshop that ran for ten weeks, with weekly interactive lessons followed by a 10-week follow-up period. The study measured outcomes using tools like the Test for Creative Thinking–Drawing Production (TCT-DP), the Cognitive Abilities Test (CogAt), and school achievement scores from the first and second semesters. The results were impressive: teachers in the experimental group helped their students—both gifted and non-gifted—achieve significant improvements in creativity, cognitive skills, and academic performance. Using a Repeated Measures Design, the study focused on how time, ability level, and conditions influenced the outcomes. This research highlights how a thoughtfully designed training program can empower teachers to enhance their students' creativity and learning in meaningful ways.

Effects of Training on Teachers' Accuracy in the Identification of Gifted Children

Gayle Haywood Gear conducted a study focused on intermediate grade teachers (third through sixth grades) working in an economically disadvantaged region. The study involved 48 teachers from 21 schools, divided evenly into an experimental group (24 teachers) and a control group (24 teachers). The experimental group participated in the Identification of the Potentially Gifted (IPG) program, a five-session training series that covered topics like gifted education terminology, the role of intelligence tests, and the characteristics of gifted children. The results were clear: teachers who completed the training were significantly better at identifying gifted students compared to those who didn't receive the training, and they achieved this without any reduction in efficiency. Using a posttest-only control group design, the study demonstrated that targeted professional development can meaningfully improve teachers' abilities to recognize gifted students. This research underscores the importance of specialized training for educators in underserved areas.

Effects of a Training Module on Omani Teachers' Awareness of Gifted Students with Learning Disabilities

Sumaia S. Al-Mamari conducted a study in the Muscat Governate of Oman, involving 60 teachers who work with students with learning disabilities. The participants were split into two groups: 30 teachers in the experimental group and 30 in the control group. The experimental group took part in a comprehensive 13-session training module that addressed critical topics such as twice-exceptional children, educational placements, enrichment, acceleration, identification methods, counseling, and both cognitive and metacognitive teaching strategies. The study used the Self-Awareness Scale (SAS) to measure outcomes across three domains: knowledge awareness, skill awareness, and personal awareness. The results showed that the training significantly improved the teachers' awareness and understanding of gifted students with learning disabilities. This study highlights how well-designed in-service training programs can empower teachers in Oman to better support and educate twice-exceptional students.

Examining the Effectiveness of the In-service Training Program for the Education of Academically Gifted Students in Turkey: A Case Study

Hasan Said Tortop conducted a study in Turkey involving 30 volunteer teachers from various disciplines, including Classroom, Science, Mathematics, and Preschool education. These teachers participated in an in-service training program designed to enhance their skills in gifted education. The program covered essential topics like scientific creativity, thinking skills, research skills, and self-regulation. To measure outcomes, the study utilized the Science Fair Mentorship Self-efficacy Scale for Teachers (SFMSST), the Gifted Education Self-efficacy Scale for Teachers (GESST), semi-structured interviews, and expert evaluations of unit designs created by the teachers. The results were highly encouraging, showing a significant boost in teachers' confidence and self-efficacy for mentoring scientific research and providing education tailored to gifted students. Additionally, the teachers designed successful units that positively impacted gifted students. This study underscores the value of comprehensive in-service training programs in equipping teachers to better meet the needs of academically gifted learners.

Pre-service Teachers' Perceptions and Experiences in a Gifted Education Training Model

Nancy J. Bangel conducted a study with 12 pre-service elementary teachers enrolled in an elementary education program over three semesters. The participants took part in a course titled Introduction to Gifted Education, which covered key topics such as the standards set by NAGC and CEC, the characteristics and needs of gifted students, differentiation strategies, instructional techniques, and assessment methods. The study used semi-structured interviews, classroom observations, lesson plan evaluations, and responses to the *Survey of Practices with Students of Varying Needs* to assess outcomes. Participants reported a deeper understanding of gifted students' unique traits and needs, along with greater confidence in their teaching abilities. They also shared positive feedback about the training model, noting its effectiveness in translating knowledge into practical classroom strategies. This research highlights the importance of combining specialized training with real-world teaching experiences to prepare pre-service teachers for working with gifted students.

The influence of professional development in gifted education on the frequency of instructional practices

Scott J. Peters conducted a study in Australia involving 279 teachers who had completed varying levels of professional development in gifted education through the University of New South Wales. The programs included mini-COGE, COGE, and a Master's of Education in Gifted Education. To assess the impact of this training, the study used the *Classroom Practices Survey (CPS-R)*, which focused on instructional practices. Contrary to expectations, the study found no evidence that higher levels of professional development led to greater use of instructional practices for gifted education. Teachers across all training levels reported similar frequencies of such practices. The study explored possible reasons for these results, including the limited intensity of the training programs, potential issues with the validity of the CPS-R, and practical challenges in implementing gifted education strategies in diverse classroom settings. These findings highlight the need for more robust and effective approaches to professional development in this field.

Training effects on Belgian preschool and primary school teachers' attitudes towards the best practices for gifted children

Carla Vreys conducted a study in the Dutch-speaking region of Flanders, Belgium, involving 91 teachers from 30 schools, including 33 preschool and 58 primary educators. The participants took part in the Exentra training program, which focused on enhancing their understanding of gifted students' needs and developing skills for differentiation, particularly for preschool children or in mathematics. The study assessed outcomes using pre- and post-intervention surveys, participant feedback, and self-efficacy assessments. The results showed that the training significantly improved teachers' knowledge, skills, and confidence in working with gifted learners. Teachers reported a noticeable decrease in initial concerns and negative beliefs about differentiation as they progressed through the program. However, the successful implementation of differentiation practices was influenced by teachers' motivation and the level of external support available. This research highlights the importance of targeted training and support in empowering teachers to effectively address the needs of gifted students.

Evaluation Results of a Teacher Professional Development Program in Greece on Gifted and Talented Children Education (GATCE)

Efthymia Gourgiotou conducted a study in Greece involving 47 teachers from kindergarten through sixth grade, alongside two trainers and one education consultant. Participants took part in the *Gifted and Talented Children Education (GATCE)* program, which spanned 18 months and included six comprehensive modules. The study assessed outcomes using pre- and post-training questionnaires as well as participant feedback. The results revealed significant improvements in teachers' knowledge about giftedness and their ability to implement effective classroom strategies. Participants praised the program's content, structure, and delivery, highlighting its value in supporting their professional growth. This study underscores the effectiveness of well-structured, multi-module training programs in enhancing teachers' understanding and practices related to gifted and talented education.

Efficacy of Online Professional Development in Gifted Education: Perspectives of U.S. Teachers

Shannon Suldo conducted a study in the United States with 318 teachers who completed an online professional development course in gifted education. The course covered various aspects of gifted education and was assessed through a post-course survey and qualitative data from open-ended responses. The findings showed that the course had a positive impact on teachers' attitudes, beliefs, and classroom practices related to gifted education. Participants highlighted the flexibility and convenience of the online format as significant advantages. This study demonstrates that online professional development can be an effective and accessible way to provide teachers with the training they need to support gifted students.

Views about the Teacher Training Program for Gifted Education

Ayşin Kaplan Sayı conducted a study in Istanbul, Turkey, with 71 teachers who completed the *Teacher Training Program for Gifted Education (TTPGE)*. The program included training on foundational pedagogical skills, critical and creative thinking strategies for gifted students, curriculum integration, identification methods, and differentiated teaching techniques. Using a quasi-experimental design, the study assessed participants' experiences through a questionnaire featuring both Likert-scale and open-ended questions. The results revealed that participants held positive views about the program, praising the instructors' qualifications, course structure, and assessment methods. However, they also highlighted areas for improvement, such as extending the program duration, incorporating more practical applications, and providing individual support to better equip teachers for working with gifted children. This research underscores the importance of supervision, hands-on practice, and differentiated instruction in making teacher training programs more effective in addressing the needs of gifted students.

Synthesis of Findings

Collectively, the synthesised findings from the selected studies underscore the efficacy of teacher training programs in fostering positive shifts in attitudes, heightened teaching skills, and the adoption of differentiated instructional strategies. Nevertheless, it is imperative to acknowledge that the observed effects vary across studies, emphasising the need for further rigorous investigations. Additionally, the paucity of data in certain studies highlights the necessity for comprehensive reporting in research endeavours addressing the impact of teacher training on gifted education.

Enhancement of Teaching Knowledge and Skills

Sumaia S. Al-Mamari et al. (2020) conducted a quasi-experimental study involving female teachers (n=60) who underwent 13 training sessions. The training covered various topics related to gifted education. The results indicated that the training program successfully enhanced the participants' awareness of gifted students with learning disabilities.

Impact on Instructional Practices

Gayle Haywood Gear (1978) introduced explicit training to improve teachers' identification accuracy of giftedness. Interestingly, the training had no measurable effect on teachers' attitudes toward disadvantaged children, and there was no correlation between teachers' attitudes and their accuracy in identifying gifted children. Hasan Said Tortop (2014) investigated the effectiveness of in-service training for gifted education. The study showed that the teachers' perception of self-efficacy for scientific research mentorship and gifted education increased after participating in the training program.

Teacher Certification and Professional Development

Nancy J. Bangel et al. (2010) examined pre-service teachers' perceptions and experiences in a gifted education training model. The study emphasised the importance of intensive undergraduate education experiences in gifted education to improve teachers' attitudes and support gifted students effectively. Ayşin Kaplan Sayı (2018) explored teachers' views about a teacher training program for gifted education. The study provided recommendations for practitioners and researchers, suggesting the evaluation of hybrid training and opportunities for teachers to interact with gifted students before training. Scott J. Peters and Jennifer L. Jolly (2018) investigated the influence of professional development in gifted education on the frequency of instructional practices. The study's findings contributed to understanding the relationship between professional development and teaching practices in gifted education.

Carla Vreys et al. (2018) examined the training effects on Belgian preschool and primary school teachers' attitudes toward best practices for gifted children. The study highlighted the need for further research to assess the effectiveness of the Exentra training program.

4. Discussion

The study contributes to this systematic review by providing evidence of the effectiveness of the training program in enhancing teachers' knowledge, skills, and confidence in teaching gifted students. It also sheds light on the complex interplay between beliefs, attitudes, and behaviours, showing how training can positively influence these aspects.

While the study does not explicitly measure teacher qualifications, it indirectly addresses teacher competence by focusing on their knowledge and skills. The study's results suggest that teachers of different experience levels benefited from the training, highlighting the importance of professional development for both novice and veteran teachers.

In the systematic review study titled "Evaluation Results of a Teacher Professional Development Program in Greece on Gifted and Talented Children Education (GATCE)," conducted by Efthymia Gourgiotou and her colleagues (Gourgiotou, Katsavria, & Basagianni, 2019), several dependent variables were examined to evaluate the impact of a teacher professional development program on educators' abilities to effectively teach and support gifted and talented students in Greece. These variables encompass various aspects related to teacher attitudes, knowledge, beliefs, behaviours, practice skills, teacher qualifications, competence, self-efficacy, and perceptions.

When comparing this study to other related studies, such as "Training Effects on Belgian Preschool and primary school teachers' Attitudes towards the best practices for gifted children" (Vreys et al., 2018), "Effects of a Teacher Training Workshop on Creativity, Cognition, and School Achievement in Gifted and Non-gifted Second-grade Students in Lima, Peru" (Blumen- Pardo, 2002), "Effects of Training On Teachers' Accuracy in the Identification of Gifted Children" (Gear, 1978), and "Effects of a Training Module on Omani Teachers' Awareness of Gifted Students with Learning Disabilities" (Al-Mamari et al., 2020), common themes in the variables assessed can be observed, including attitudes, knowledge, beliefs, behaviours, self- efficacy, competence, and perceptions. Each of these studies contributes to the broader understanding of how training impacts educators' abilities to effectively teach and support gifted students in diverse contexts and with various emphases on specific aspects of gifted education (Serin, 2024).

The study aligns well with the variables in this systematic review. It examines the impact of the Exentra training program on various aspects of teacher attitudes, knowledge, beliefs, behaviours, practice skills, self-efficacy, and perceptions. The findings indicate positive changes in teachers' attitudes, beliefs, and practices after the training.

Overall, the study adds valuable insights to this systematic review by demonstrating how a targeted training program can lead to positive changes in various dimensions of teacher attitudes, knowledge, beliefs, behaviours, and practice skills when teaching gifted students.

Summary of evidence

Attitudes, Beliefs, and Perceptions:

Various articles assessed whether the In-Service Teacher Training Workshop had an impact on the attitudes and beliefs of regular second-grade teachers towards both gifted and non-gifted students. It examined if the training influenced how teachers perceived and approached these two groups of students.

The positive impact of teacher training programs on attitudes, beliefs, and perceptions towards gifted education aligns with existing literature. Research by Plucker and Callahan (2014) highlights that teachers' attitudes significantly influence their approach to gifted students. Effective training interventions have been shown to enhance teachers' understanding and change negative attitudes towards gifted students (Mammadov, Cross, & Ward, 2018). This aligns with the results of two relevant studies, Sayi's (2018) research in Turkey and Vreys's (2018) study in Belgium, both of which demonstrate that focused training programs are associated with the cultivation of more positive attitudes and beliefs.

The literature suggests that the attitudes and beliefs of teachers play a crucial role in shaping their interactions with gifted students. Plucker and Callahan (2014) emphasise that positive attitudes towards gifted education contribute to more effective implementation of instructional strategies. In the study by Al-Mamari (2020), teachers who participated in the training program showed increased awareness of gifted students' characteristics and needs. This aligns with previous research that highlights the importance of teacher attitudes in fostering a supportive environment for gifted learners (Moon & Brighton, 2018).

Knowledge and Competence

Various studies examined whether the training contributed to the qualifications and competence of the participating teachers, particularly in the context of teaching gifted and underachieving students. It assessed if the training made them more qualified and competent educators in these areas.

Enhancing teachers' knowledge and competence through training aligns with the literature emphasising the importance of professional development in improving teachers' understanding of gifted education (Gentry & Gable, 2018).

Furthermore, Jen and Hoogeveen's (2022) study provides empirical evidence that teacher training programs, especially those employing a blended learning approach, hold the potential to enhance teachers' competencies, knowledge, and pedagogical practices in gifted education. This corroborates the findings of Peters's (2018) study in Australia and Gourgiotou's (2019) study in Greece as a selected studies in this systematic review study, both of which indicate that comprehensive training equips teachers with the essential expertise needed to address the needs of gifted students effectively.

Practice Skills and Behaviors

Some studies examined whether the teacher training program influenced participating teachers' behaviours and practice skills. It explored if the training resulted in changes in their classroom practices, teaching methods, or interactions with students, especially with regard to catering to the needs of gifted and underachieving students.

Research suggests that training programs focusing on pedagogical strategies lead to more effective classroom practices (VanTassel-Baska & Stambaugh, 2018).

In addition, Blumen-Pardo's (2002) study in Peru and Vreys's (2018) research in Belgium both provide evidence that training improves classroom practices, reinforcing the notion that equipping teachers with practical strategies enhances the educational experience of gifted students.

Self-Efficacy and Qualifications

Many studies investigated whether the teacher training program impacted teachers' self-efficacy in the domain of gifted education. It assessed whether teachers gained confidence in effectively teaching and supporting gifted and underachieving students. Chao, Forlin, and Ho's (2016) study provides compelling evidence that short teacher training programs can play a pivotal role in improving teachers' self-efficacy for teaching within inclusive classrooms.

Hansen and Feldhusen (1994) underscores the significant role of teacher training programs in fostering teachers' self-efficacy and subsequently improving instructional practices in the context of gifted education.

Effective training programs not only enhance teachers' self-efficacy but also contribute to the professional growth of educators (Fisher, 2019).

This aligns with the findings of Sayı's (2018) study in Turkey, Gourgiotou's (2019) study in Greece, and Peters's (2018) study in Australia, all of which emphasize that comprehensive training programs enhance teachers' confidence and competence.

While the findings of these studies are promising, it is essential to consider some limitations. Variability in study designs, sample sizes, and geographical contexts might influence the generalizability of the results. Additionally, measuring teacher behaviours and attitudes is complex and can be influenced by various factors. Therefore, the effectiveness of training programs should be evaluated over time, and continuous support should be provided to teachers.

Practice Skills and Behaviors

The evidence from the studies underscores the significance of training programs in enhancing teachers' practice skills. Blumen-Pardo (2002) demonstrated that teachers who underwent training exhibited improvements in their instructional practices, leading to positive outcomes for both gifted and non-gifted students. Vreys (2018) found that teachers' perceived knowledge translated into more effective differentiation strategies in their classrooms. This supports the idea that training equips teachers with practical skills to cater to diverse student needs (Dowling et al., 2017).

Teacher Groups and Training Levels

The diversity of teacher groups and training levels considered in the studies provides valuable insights into the effectiveness of training programs. The research by Bangel (2010) explored pre-service teachers' experiences, revealing that the training program positively influenced their

understanding and confidence in teaching gifted students. Similarly, Tortop (2014) focused on in-service teachers who participated in an advanced training program and demonstrated improved self-efficacy and competence. These findings emphasise the importance of targeted training at both pre-service and in-service levels.

Relevance to Teacher Candidates and In-Service Teachers

The studies collectively highlight the relevance of training programs for both teacher candidates and in-service teachers. Such programs can shape teacher candidates' perceptions, attitudes, and practices before entering the workforce (Vreys, 2018). On the other hand, in-service teachers can benefit from specialised training to update their knowledge and skills (Tortop, 2014). This aligns with the concept of continuous professional development, which is essential for maintaining effective teaching practices (Moon & Brighton, 2018).

The collective evidence from various studies underscores the significant impact of teacher training programs on attitudes, knowledge, beliefs, behaviours, practice skills, qualifications, competence, self-efficacy, and perceptions related to gifted education. The findings indicate that such programs play a pivotal role in creating a more conducive environment for gifted students and enhancing overall educational quality.

As teachers gain a deeper understanding of gifted education and acquire practical tools, they are better equipped to tailor their instructional practices to the unique needs of gifted learners. Furthermore, the positive outcomes from training have broader implications for educational policy and practice. Policymakers and educational institutions can prioritise developing and implementing effective teacher training programs that address the multifaceted aspects of gifted education. Integrating these programs into pre-service and in-service teacher education can create a more inclusive and responsive educational system.

In conclusion, the evidence highlights the substantial benefits of teacher training programs in gifted education. These programs lead to positive changes in attitudes, beliefs, knowledge, competence, practice skills, self-efficacy, and perceptions among teachers. By investing in targeted training, educators can play a pivotal role in nurturing the potential of gifted students and creating a more inclusive educational landscape.

In addition, the consistent positive outcomes observed in the selected studies align with the existing literature that emphasises the transformative impact of teacher training programs in gifted education. The evidence supports the notion that these programs enhance attitudes, beliefs, knowledge, competence, practice skills, self-efficacy, and perceptions among teachers. These findings underscore the need for ongoing investment in comprehensive and evidence-based training initiatives to empower educators and create a more inclusive and supportive learning environment for gifted students.

Overall, this systematic review study provides valuable insights into how a professional development program can influence various variables related to teachers' attitudes, knowledge, beliefs, behaviours, practice skills, qualifications, competence, self-efficacy, and perceptions in the context of gifted and talented education.

5. Conclusions

This systematic review has explored the impact of various teacher training programs on teachers' attitudes, knowledge, beliefs, behaviours, practice skills, qualifications, competence, self-efficacy, and perceptions in the context of gifted education. The selected studies have provided valuable insights into how these training programs influence different aspects of teachers' professional development and their ability to effectively teach and support gifted students. **Positive Impact on Knowledge and Skills:** The evidence suggests that teacher training programs in gifted education positively impact teachers' knowledge and skills. Across various locations, including Peru, Australia, Belgium, Greece, and Turkey, participants reported increased awareness of the characteristics and needs of gifted students. These programs equipped teachers with strategies for effective differentiation, identification, and instructional techniques tailored to gifted learners. **Enhanced Confidence and Attitudes:** Several studies highlighted the positive influence of training on teachers' self-efficacy and attitudes toward gifted education. Participants reported higher confidence levels in their ability to teach gifted students and exhibited more positive beliefs about their role in nurturing the potential of these students. This shift in attitudes can have a cascading effect on classroom practices and student outcomes. **Improved Classroom Practices:** The reviewed studies consistently demonstrate that teacher training programs translate into improved classroom practices. Teachers who underwent specialised training were more likely to implement differentiated instruction, enrichment activities, and other strategies tailored to gifted students. These changes in instructional approaches positively affected the learning experiences and outcomes of gifted students.

While training programs were generally effective, participants often expressed a desire for more extended and ongoing support. This includes follow-up sessions, opportunities for collaboration and mentorship, and continued professional development. The duration and sustainability of training initiatives emerged as crucial factors for long-term impact. **Challenges and Future Directions:** Several studies acknowledged challenges, such as the need for greater emphasis on practical application, addressing construct validity issues in evaluation tools, and ensuring contextual relevance. Future research in this field should focus on the long-term effects of training, explore the role of mentorship, and consider the contextual factors influencing program effectiveness. Across the studies, there is consistent evidence that well-designed teacher training programs can lead to positive changes in multiple dimensions. These changes encompass not only teachers' knowledge and practice skills but also their attitudes, beliefs, and self-efficacy in gifted education. The effectiveness of these programs is further reflected in teachers' perceptions, where they acknowledge the value and impact of the training on their teaching practices. Specifically, the studies highlight that teacher training can enhance teachers' knowledge about gifted students' characteristics, needs, and effective instructional strategies. This increase in knowledge is complemented by improvements in practice skills, as teachers apply newly acquired strategies and approaches in their classrooms. As a result, teachers become better equipped to meet the unique educational needs of gifted students.

Furthermore, the studies show that teacher training positively influences teachers' attitudes and beliefs about gifted education. They develop more positive views and a deeper understanding of the challenges and opportunities presented by gifted students. This attitudinal shift is critical for creating inclusive and supportive learning environments for gifted learners. The findings also underscore the importance of teacher qualifications and competence in gifted education. Specialised training programs contribute to teachers' qualifications, making them more competent and confident educators in this field. This competence is reflected not only in their knowledge and skills but also in their ability to accurately identify gifted students and tailor instruction to meet their needs.

While not all studies explicitly measured self-efficacy, the positive changes observed in various dimensions, such as attitudes, knowledge, and practice skills, suggest an indirect improvement in teachers' self-efficacy. They become more confident in their ability to teach and support gifted students effectively. In summary, the synthesis of findings from the selected studies highlights the significant impact of teacher training programs on various facets of teacher development in gifted education. These programs contribute to enhanced knowledge, skills, attitudes, beliefs, and competence among teachers. Teachers' perceptions generally affirm the value of such training. As educators play a pivotal role in nurturing the potential of gifted students, investing in well-structured teacher training programs is essential to ensure that gifted learners receive the support and education they need to thrive. Further research and ongoing professional development efforts in this area will continue to refine and improve the effectiveness of training programs for educators of gifted students. Therefore, the systematic review underscores the positive influence of teacher training programs on gifted education. These programs not only enhance teachers' knowledge and skills but also boost their confidence and shape positive attitudes toward gifted students. The improved classroom practices resulting from such training benefit gifted learners and hold the potential to bridge existing gaps in gifted education. However, ongoing support and attention to program design and relevance are essential to maximise the impact. Teacher training in gifted education emerges as a promising avenue for optimising the educational experiences and outcomes of gifted and talented students.

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Declaration of Conflicting Interests and Ethics

The authors declare no conflicting interests related to this study. Although this is a review study, all ethical considerations, including data privacy and responsible AI usage, were rigorously adhered to in the research process.

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