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From Teacher Training for Inclusive Education to Classroom Practice: Meta-Analytic Investigations on Effectiveness and Transfer Processes

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Abstract

Inclusive education aims to provide high-quality learning opportunities for all students, regardless of their individual characteristics. Teachers face the challenge of teaching increasingly diverse classrooms and having to develop competencies to adapting their teaching practice to the existing conditions. Support is typically provided through offers of teacher training programs. Research on teacher training for inclusive education shows mixed results regarding its effectiveness, often attributed to the design of the training, such as its duration, the composition of participants, or the thematic focus, while the learning process remains overlooked. To close the implementation gap, which describes insufficient implementation despite participation in training, insights into the underlying learning and transfer processes could help make the training programs more effective. Through two meta-analyses, this dissertation aims to examine the effectiveness of teacher training for inclusive education and the involved learning and transfer processes. The first study focused on training effectiveness and was based on 342 studies with 158,713 participating teachers and students, and included 1,123 effect sizes. Positive effects of training participation were observed on all four investigated key areas: teachers' knowledge ($g = 0.93$), skills ($g = 0.49$), and beliefs ($g = 0.23$), as well as positive impacts on their students' achievement and behavior ($g = 0.37$). In the second study, which focused on the transfer processes, five theoretical models were collected from the literature, analyzed, and compared in terms of their fit with empirical data. The analyses were based on 228 studies, 117 609 participating teachers and students and 1,084 effect sizes. One model stands out, suggesting that training effects teachers' acquisition of knowledge, skills, beliefs, as well as strengthens teachers' willingness to change, which in turn positively influences the learning process, its implementation, and the improvements in students' academic achievement and learning behavior. The findings of this dissertation highlight the importance of offering teacher training to support teachers in the implementation of inclusive education. Furthermore, the importance of a theoretical foundation in the design of training programs is emphasized. A training design aimed at optimally supporting the learning and transfer processes could contribute to effectively improving the implementation of inclusive education.

Keywords: Teacher Training, Inclusive Education, Effectiveness, Learning Transfer

Zusammenfassung

Inklusive Bildung hat zum Ziel, allen Schüler:innen, unabhängig von ihren individuellen Merkmalen, hochwertige Lernmöglichkeiten zu bieten. Lehrkräfte stehen vor der Herausforderung, Klassen mit zunehmender Heterogenität zu unterrichten, und Kompetenzen zu entwickeln um ihre Unterrichtspraxis daran anzupassen. Als Unterstützung werden ihnen typischerweise Fort- und Weiterbildungen angeboten. Untersuchungen zur Lehrkräfteaus- und Fortbildung für Inklusive Bildung zeigen gemischte Ergebnisse hinsichtlich ihrer Wirksamkeit, wobei diese häufig auf das Design der Trainings zurückgeführt werden, während der Lernprozess unbeachtet bleibt. Um die Implementierungslücke zu schließen, welche die mangelhafte Implementierung trotz Trainingsteilnahme beschreibt, könnten Einblicke in zugrunde liegende Lern- und Transferprozesse dazu beitragen, die Trainingsprogramme effektiver zu gestalten. Anhand von zwei Metaanalysen zielt diese Dissertation darauf ab, die Wirksamkeit von Fortbildungen für Inklusive Bildung sowie die dabei stattfindenden Lern- und Transferprozesse zu untersuchen. Für die erste Studie, die sich mit der Wirksamkeit von Fortbildungen beschäftigt, wurden 342 Primärstudien mit 158 713 teilnehmenden Pädagog:innen und Schüler:innen sowie 1 123 Effektstärken gesammelt. Es zeigten sich positive Effekte auf alle vier untersuchten Schlüsselbereiche: das Wissen ($g = 0.93$), die Fähigkeiten ($g = 0.49$) und die Überzeugungen bezüglich Inklusiver Bildung der Lehrkräfte ($g = 0.23$) verbesserten sich durch die Fortbildungs-teilnahme sowie auch das Verhalten und die Leistungen ihrer Schüler:innen ($g = 0.37$). In der zweiten Studie, die die involvierten Lern- und Transfer-prozesse untersucht, wurden fünf theoretische Modelle aus der Literatur gesammelt, analysiert und hinsichtlich ihrer Passung zu empirischen Daten verglichen. Hierfür wurden 228 Primär-studien mit 117 609 teilnehmenden Pädagog:innen und Schüler:innen und 1 084 Effektstärken gesammelt. Ein Modell sticht hervor, das Wirkungen des Trainings auf den Erwerb von Wissen, Fähigkeiten und Überzeugungen der Lehrkräfte annimmt, sowie dass die Bereitschaft zu Veränderung durch Trainings gestärkt werden kann, was sich wiederum positiv auf den Lernprozess, die Umsetzung und die Wirkung auf der Ebene der Schüler:innen auswirkt. Die Ergebnisse dieser Dissertation unterstreichen die Bedeutung Fortbildungsprogramme für Lehrkräfte anzubieten, um sie bei der Umsetzung Inklusiver Bildung zu unterstützen. Darüber hinaus wird die Bedeutung einer theoretischen Fundierung bei der Gestaltung von Fortbildungsprogrammen hervorgehoben. Optimale Unterstützung der Lern- und Transferprozesse in Fortbildungen könnte dazu beitragen die Umsetzung inklusiver Bildung effektiv zu verbessern.

Schlagworte: Lehrkräftetraining, Inklusive Bildung, Wirksamkeit, Transferprozesse

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Scientific Publications for the Cumulative Thesis

Journal Articles

- Donath, J. L., Lüke, T., Graf, E., Tran, U. S., & Götz, T. (2023). Does professional development effectively support the implementation of inclusive education? A meta-analysis. *Educational Psychology Review*, 35(1), 1-30. <https://doi.org/10.1007/s10648-023-09752-2>
- Donath, J. L., Lüke, T., Tran, U. S., Botes, E. & Götz, T. (2025). *The transfer of teacher training to inclusive classroom practice: A meta-analytic SEM approach*. [Manuscript submitted for publication]. Department of Developmental and Educational Psychology, University of Vienna.

Conference Presentations

- Donath, J. L., Graf, E., & Götz, T. (2022, July 18 - 22). *The impact of professional development addressing inclusive education - A systematic meta-analysis* [Paper presentation]. JURE Conference, Porto, Portugal.
- Donath, J. L., Graf, E., Götz, T., & Lüke, T. (2022, November, 24 – 26). *Sind Fortbildungen zu Inklusiver Bildung effektiv? – Eine Meta-Analyse* [Paper presentation]. Herbsttagung der Arbeitsgruppe Empirische Sonderpädagogische Forschung (AESF), Bamberg, Germany.
- Donath, J. L., Graf, E., Lüke, T., & Götz, T. (2023, May 4 – 5). *Effects of professional development addressing inclusive education - A systematic meta-analysis* [Paper presentation]. Annual Meeting of the American Educational Research Association (AERA), online.
- Donath, J. L., Graf, E., Lüke, T., & Götz, T. (2023, August 22 – 25). *Does teacher training support implementing inclusive education? - A systematic meta-analysis* [Paper presentation]. European Association for Research on Learning and Instruction (EARLI), Thessaloniki, Greece.

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1. Introduction

When I think back to my time in elementary school, I clearly remember one specific routine: every Monday, we received a weekly plan outlining the tasks we were expected to complete. Each day, there was dedicated time to work on these assignments, allowing us to complete them at our own pace and in a self-chosen order. Years later I discovered that we had been working on different tasks based on our abilities – it just wasn't relevant to think about tasks others were working on. This method is one way to implement differentiated instruction and enables students of different abilities to work on their own level while learning together in the same classroom (Subban, 2006). The underlying idea is closely connected to the broader goal of inclusive education, and often seen as an indicator for successful implementation.

Inclusive education aims to provide all students with access to quality education, meaning that no child should face discrimination—neither in access nor in the quality of education they receive—based on their personal characteristics (United Nations, 2015). While discussions on inclusive education often focus on students with special educational needs, other factors such as socioeconomic background, second language acquisition, and religion also play a role (Moore, 2005). The goal is to create learning conditions that allow each student to progress at their own level—without resorting to separate school types for different ability groups (Suprayogi et al., 2017). Many countries have adjusted their legal frameworks to guarantee at least a right to inclusive education (Waisath et al., 2022). The USA was among the first to introduce such changes in the 1950s, followed by Italy in the 1970s. Since the UN Convention on the Rights of Persons with Disabilities (UN CRPD), many more countries have implemented similar reforms (Somma, 2020). However, for inclusive education to be successful, legal mandates alone are insufficient—schools and educational institutions must adapt, teachers must develop the necessary competencies, and, ultimately, these changes must be effectively implemented in classrooms. Although inclusive education is perceived as appropriate strategy to educate all students (Bacakova et al., 2022), it has to be acknowledged that the change processes require efforts by all involved professionals as well as time to unfold (Gregoire, 2003).

At my elementary school, we benefitted from ideal conditions: class sizes were small, there were only a few students with special educational needs per class, and almost always two educators present. As this education approach required different teaching practices compared to common way of practices at the time, teachers actively chose to work at this

school and were motivated to implement inclusive education. Today, however, inclusive teaching is expected from all teachers, regardless of their teaching preparation, prior experience, or personal attitude toward the concept (Hick et al., 2018), posing high challenges on the teachers to adapt teaching styles to address the growing diversity of their students' needs (Van Mieghem et al., 2018). Many teachers feel that they are left alone to deal with inclusive education with no proper preparation (Ćwirynka et al. 2017; Lee et al., 2015; Yada & Savolainen, 2017). And although our societies are pursuing the goal of inclusive education since a few years now, the current implementation is often still unsatisfying (Bacakova, 2022). This raises critical questions: Is the support provided for teachers to engage in the necessary change processes effective? And how do change processes actually unfold? Understanding these dynamics is crucial to ensuring that inclusive education is not only a legal requirement but also a practical and sustainable reality in classrooms. To explore these issues, I conducted two meta-analytic investigations into the effectiveness and transfer processes within teacher training for inclusive education, aiming to shed light on how professional learning can lead to meaningful and lasting change in educational practice.

1.1 Requirements for Successful Change

Adaptations to school structures play a crucial role in the transition to inclusive education (European Agency for Development in Special Needs Education, 2013). These include factors such as available space, teaching materials, and staffing, as well as removing barriers in the overall school environment (de Beco, 2016). At the same time, teachers need to acquire knowledge and develop skills that enable them to identify students' abilities and needs and followingly create learning environments appropriate for students with diverse needs (Gottfried et al., 2021). However, competence development alone is not enough—inclusive education must also be actively implemented (de Beco, 2016). Implementing inclusive education requires more than applying specific teaching methods; it involves a shift in how responsibilities for students are understood (Suprayogi et al., 2017), in how and with whom collaboration takes place (Lütje-Klose & Urban, 2014; Ufermann et al., 2024), and in what is considered effective teaching – teaching that supports both academic learning and social integration of all students, while enabling them to learn simultaneously at different levels (World Health Organization, 2011). Therefore, beyond acquiring new competencies, it is often argued that teachers need to develop positive attitudes towards inclusive education (Lindner et al., 2023) and feeling responsible for all students' learning processes (Suprayogi et al., 2017), in order to create inclusive environments and reduce discrimination (European

Agency for Development in Special Needs Education, 2013). Acquiring new competencies and especially changing the way of practice always requires effort at first, but once teachers truly understand inclusive approaches, gain positive experiences, and develop confidence through practice, these methods can become an integral part of their everyday teaching practice (Gregoire, 2003).

When pursuing the goal to improve the implementation of inclusive education, we cannot rely on the assumption that teachers will naturally acquire the necessary skills over time. Especially when acknowledging that most teachers are not proactive in changing their instruction when dealing with learner differences (Tomlinson et al., 2003). Even when being aware and knowledgeable about inclusive teaching approaches, teachers continue reproducing traditional teaching styles (George, 2005; Whipple, 2012). Furthermore, educating students with special educational needs in segregated environments is still common in many countries (Somma, 2020). The scientific literature as well as international resolutions have long argued the relevance of professional development opportunities for teachers as a key point to enhance the implementation of inclusive education (Florian & Camedda, 2020; UNESCO, 1994).

1.2 Learning Opportunities for Pre-Service and In-Service Teachers

Competency development is essential and can occur through both formal and informal learning. Informal learning is characterized not by structured offerings, but takes place through collaboration with colleagues, reading professional literature, attending conferences, or engaging with online educational resources. In contrast, formal learning is characterized by structured offerings for specific target groups and defined content to be taught to the participants. Formal learning opportunities have been created for pre-service teachers by integrating inclusive education as a mandatory component in many teacher training curricula (Gogolin et al., 2020). This typically includes an introductory overview of inclusive education with a focus on the legal framework, philosophical foundations, and different types of special educational needs. Practical strategies for differentiated instruction, classroom management, diagnostic approaches, and the actual implementation of inclusive methods receive comparatively little attention (Allday et al., 2013). It is assumed that the practical implementation of inclusive teaching methods, as well as collaboration with other educators, will be learned during early teaching experiences, such as internships, teaching practice semesters, or the induction phase (Allday et al., 2013).

For those already in the profession, professional development programs are offered, typically on a voluntary basis. These bring together educators from different schools, often

open to both general and special educators, sometimes including school administrators and teaching assistants. However, these professional development programs are often one-time events, lasting only a few hours, with no formal follow-up, no assessment of improvements, and no feedback on the implementation in the classroom (Cramer et al., 2019). This practice allows many teachers to receive input on inclusive education at comparably low costs (Darling-Hammond et al., 2017). However, it stands against research findings on effective teacher training design that suggests to provide trainings over a long period for groups of teachers working together in their schools, focus on specific topics, and offer room and time to practice methods, plan implementation and reflect on the process (Copur-Gencturk & Papakonstantinou, 2016; Desimone, 2009; Garet et al., 2016; Mehta & Cohen, 2017). Applying newly learned methods often requires adaptation to the specific classroom context (Suprayogi et al., 2017). However, comprehensive programs that allow planning step-by-step adjustments, possibly incorporating elements such as modeling, reflection, or, in rare cases, even coaching are rarely implemented (Popova et al., 2022) due to their high cost and resource requirements (Cramer et al., 2019; Darling-Hammond et al., 2017). Nevertheless, the efforts to create training opportunities for teachers to learn about inclusion have increased worldwide as it is more and more pursued to educate all students in general classrooms (De Haro et al., 2019; Malinen et al., 2013).

1.3 Research on Teacher Training for Inclusive Education

Due to recent legal changes, the number of available training programs has increased, and they are increasingly accompanied by scientific research (Tristani & Bassett-Gunter, 2020). There is consensus that this research is important to evaluating the effectiveness of the training programs conducted. However, there are significant differences in how this research is conducted and what is actually examined when assessing its effectiveness (Waitoller & Artiles, 2013). In general, the majority of studies on teacher training for inclusive education is based on qualitative measures (Tristani & Bassett-Gunter, 2020; Waitoller & Artiles, 2013), as research on inclusive education is closely connected to qualitative methodology. However, since this dissertation is investigating questions regarding the general effectiveness of teacher training and corresponding learning processes using quantitative methodology, particular attention will be given to the methods and foundations of quantitative data collections. These, however, come to mixed results regarding the effectiveness of teacher training for inclusive education.

While some programs lead to improvements in teacher attitudes, knowledge, instructional practices or student behavior (Chalmers & Gardiner, 2015; Dignath et al., 2022; Kurniawati et al., 2014), others show no measurable effects (e.g., Adhabi, 2018; Loyalka et al., 2019; Schmidt, 2019; Scott et al., 2024), or even negative impacts (e.g., Edwards et al., 2006; Jäntschi et al., 2015; Sanches-Ferreira et al., 2018). Existing reviews on this topic primarily focus on research practices (Van Mieghem et al., 2018; Waitoller & Artiles, 2016) or other aspects of inclusive education, considering teacher training only as a potential influencing factor (Avramidis & Norwich, 2002; Dignath et al., 2022). As a result, they often include very few studies, as they tend to cover only specific dependent variables (Brock & Carter, 2017), English-speaking countries (Knight & Wiseman, 2005) or peer-reviewed articles (Tristani & Bassett-Gunter, 2020; Van Mieghem et al., 2018). Additionally, these reviews report a high variance in effect sizes (Avramidis & Norwich, 2002; Brock & Carter, 2017; Dignath et al., 2022), highlighting the need for a more comprehensive analysis of the impact of teacher training on inclusive education.

Interestingly, previous reviews did not distinguish between pre- and in-service teachers, although differences between these two groups are reported in primary studies (e.g., Edwards et al., 2006; Kimanen et al., 2019; Rumlatur & Kurniawati, 2019) and research with pre-service teachers shows a more thorough picture with generally positive effects of training participation (Florian & Camedda, 2020). In this dissertation, particular attention is also given to whether a distinction should be made between pre-service and in-service teachers when examining professional learning processes. Accordingly, the term *professional development* is used when referring specifically to in-service teachers, *pre-service training* when referring to teacher education prior to entering the profession, and *teacher training* when both groups are addressed collectively.

1.4 Indicators for Effective Teacher Training

Whether studies on teacher training effectiveness focus on in pre- or in-service teacher, they have in common to predominantly focus on dispositional variables such as attitudes and self-efficacy regarding inclusive education, rather than on actual classroom implementation (Dreer et al., 2017, König et al., 2025). This is partly because pre-service teachers may not have the opportunity to apply what they have learned until years later when they enter the profession. Still, the focus on teacher level outcomes also accounts for studies with in-service teachers. Although teacher training is aimed to improve students' behavior and achievement, evaluations of teacher trainings rarely assess the impact on students directly (Dreer et al.,

2017, Van Mieghem et al., 2019). The review of Waitoller & Artiles (2013) even showed that 98% of the studies investigating training effects with quantitative measures did not gather data on the student level. At the teacher level, the most common variables assessed are teachers' knowledge, attitude and self-efficacy (Tristani & Bassett-Gunter, 2020; Van Mieghem et al., 2018; Waitoller & Artiles, 2013). However, studies that go beyond self-reported measures to examine actual implementation—such as classroom observations or student outcome data—are relatively rare.

As a result of the mixed findings regarding its impact, a significant body of research focuses on how the design of teacher training influences its effectiveness (e.g., Desimone, 2009; Dunst et al., 2015; Sims & Fletcher-Wood, 2021). Interestingly, these discussions predominantly revolve around structural aspects—such as duration, group size, or mode of delivery—rather than the underlying learning and transfer processes (Nimante et al., 2025) that determine whether teachers can successfully apply new strategies in their classrooms. These processes remain a black box, leaving open fundamental questions about how teachers acquire, internalize, and transfer knowledge into practice. In general, research on teacher training for inclusive education is under-theorized (Boylan et al., 2018; Waitoller & Artiles, 2013). Although plenty of theoretical frameworks describe learning and transfer processes of teacher training (Desimone, 2023), these are rarely used to plan evaluations (Ahadi et al., 2024; Basma & Savage, 2023, König et al., 2025) and one over-arching theory is still lacking (Nimante et al., 2025).

As well among the theoretical framework models, many focus on the external conditions of teacher training programs (Desimone, 2023) while only briefly addressing the actual learning process in their descriptions. Understanding these processes could be crucial for designing effective training programs, as it would allow for a targeted alignment with essential learning processes, thereby enhancing their support and impact. Perhaps the key factor is not the duration or presentation style of the training itself, but rather which learning processes are triggered. This could explain why certain design features have been identified as characteristics of effective training in overview studies, but do not show the aimed results in primary studies: Even programs designed based on these criteria often fail to achieve the desired outcomes, as only a small proportion of participants actually understand the concept of inclusive education (e.g., Carew et al., 2019; Forlin et al., 2014), and measurable effects on student learning remain limited (Garet et al., 2016). Despite the abundance of training opportunities, the actual implementation of inclusive practices in classrooms and equitable participation in schools of all students remains unsatisfactory (Brown et al., 2021; Lindsay et

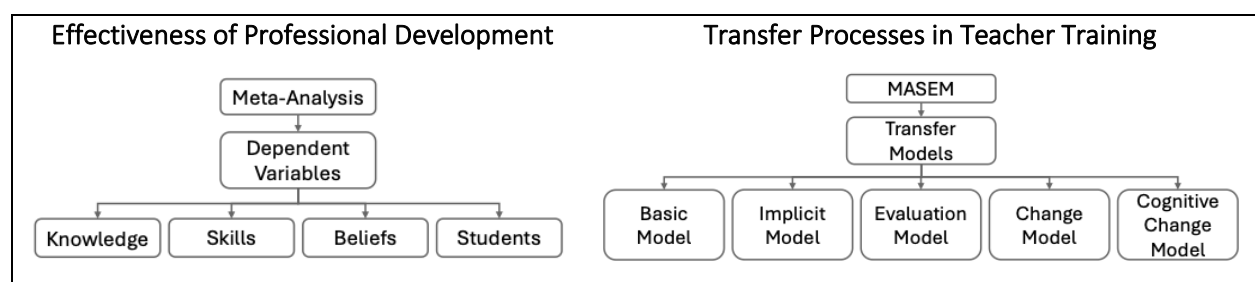
al., 2018; Sheldon et al., 2021), raising concerns if teacher training is effective to close the implementation gap (Gouëdard et al., 2020).

1.5 Aims of the Dissertation

The aim of this dissertation was twofold (figure 1): to examine the effectiveness of teacher training for inclusive education and to investigate the course of learning and transfer processes initiated by these training programs. While numerous studies have investigated the effectiveness of teacher training for inclusive education, their findings remain inconsistent, making it difficult to draw clear conclusions. As research shows generally positive influences of learning about inclusive education during the pre-service teacher training, the first study specifically aimed to investigate the effectiveness of professional development participation of in-service teachers. To address this issue, a meta-analysis was conducted, incorporating four different dependent variables to capture the multifaceted impact of professional development programs, as these interventions are designed to produce effects on multiple levels. Meta-analysis aims at summarizing and evaluating the results of various primary studies, and allows for drawing more reliable and comprehensive conclusions by combining data from multiple sources. The key areas investigated in this study to estimate effects of professional development participation were changes in teachers' knowledge, skills, and beliefs regarding inclusive education, as well as impacts on their students. Additionally, aspects of study and training design were investigated regarding their influences on professional development effectiveness.

Figure 1

Overview of Study 1 and 2



During the data collection for the first study, it became evident that theory-based evaluations are rare, and little attention has been given in these primary studies to how different outcome variables influence each other. However, transfer processes from training to classroom implementation and improved student behavior have been described, although existing theories differ in the number of relevant variables involved in the process and how

they influence each other. Many primary studies focus on isolated effects, typically at the teacher level, rather than examining how multiple variables interact within a broader theoretical framework and assuming successful implementation when dispositional improvements at the teacher level are observed. Additionally, because these studies are often not explicitly designed to test specific theoretical models, they rarely include all the relevant variables needed for a comprehensive analysis of learning and transfer processes in teacher training. To date, there is no study comparing existing models on learning transfer in the context of teacher training using empirical data. To explore this gap, a study applying meta-analytic structural equation modeling (MASEM) was conducted. MASEM extends traditional meta-analysis by modeling relationships between multiple variables within a structural equation framework. A one-stage MASEM approach (Jak & Cheung, 2020) was used, which allows for a direct estimation of relationships between variables by combining correlation matrices from different studies into a pooled dataset. This method is particularly valuable when individual studies do not measure all relevant constructs, as it can handle missing data and still estimate underlying structural relationships. To capture the broad range of described theories on learning in teacher training, models were collected from the literature and summarized under five categories, as many similarities were found in between the theories. These five models were then tested against empirical data and compared regarding selected model fit indices. Extending the current research with testing theoretical models with empirical data might allow to gain insight into underlying learning and transfer processes. The following sections summarize the two studies and their key findings.

1. Synopsis of the Publications

2.1 General Effectiveness of In-Service Teacher Training to Support the Implementation of Inclusive Education

Donath, J. L., Lüke, T., Graf, E., Tran, U. S., & Götz, T. (2023). Does professional development effectively support the implementation of inclusive education? A meta-analysis. *Educational Psychology Review*, 35(1), 1-30. <https://doi.org/10.1007/s10648-023-09752-2>

- Results of this study were presented at JURE (2022), AESF (2023), AERA (2023), EARLI (2023)

Although the development of inclusive school systems has been a policy goal in many countries for some time, teachers still report feeling unprepared and insufficiently supported in implementing inclusive education (Somma, 2020). Since professional development programs remain the most common strategy for addressing these concerns among in-service teachers (Cramer et al., 2019), it is crucial to assess whether they are truly an effective means of supporting this group. To systematically evaluate whether professional development programs contribute to the advancement of inclusive education, the meta-analytic approach was chosen. The goal was to determine whether, in general, these professional development programs promote teacher development in alignment with inclusive practices. However, teacher professional development is a complex field, influenced by numerous factors, and its effectiveness can manifest in different ways. Next to investigating effects of research practices we aimed to test design features of professional development programs that are associated with higher effectiveness as proposed by Desimone (2009). To capture effects of professional development participation at multiple levels, four key indicators were chosen: teachers' knowledge, skills, beliefs, and students' behavior.

A comprehensive literature search revealed 342 primary studies that could be included in the analyses with over 158,713 participants and a total of 1,123 effect sizes. The results showed that teacher professional development had large effects on teachers' knowledge ($g = 0.93$), moderate effects on their skills ($g = 0.49$), small effect on teachers' beliefs regarding inclusive education ($g = 0.23$) and small to moderate effects on student behavior ($g = 0.37$). These findings suggest that teacher professional development has positive effects on all assessed variables, though with differing effect sizes. A closer look into the data on changes in teachers' beliefs shows that professional development participation was associated with

improved attitudes towards inclusive education as well as more positive perceptions of inclusive teaching methods, but it was not successful in reducing teachers' concerns in the trainings. Additionally, we conducted moderation analyses to investigate potential influences on the observed effect sizes, in especially to test proposed training design factors to enhance the efficacy. Support for the design factors proposed by Desimone (2009) was limited: Alternating practice and input phases, active learning opportunities during professional development sessions, the focus on specific content, and external monitoring of learning outcomes were associated with greater effectiveness in some investigated variables, while duration of the professional development and participation with colleagues did not show significant influences.

Overall, the study suggests that professional development for inclusive education can be effective, but its transfer into teaching practice remains limited. Our analyses indicate that professional development programs facilitate the transfer of acquired knowledge and skills into school practice when active learning and practical implementation in the classroom are combined with opportunities for reflection.

2.2 Testing Models of Learning Transfer using Data from Research on Inclusive Education Teacher Training

Donath, J. L., Lüke, T., Tran, U. S., Botes, E. & Götz, T. (2025). *The transfer of teacher training to inclusive classroom practice: A meta-analytic SEM approach*. [Manuscript submitted for publication]. Department of Developmental and Educational Psychology, University of Vienna.

- Submitted at Educational Psychology Review (04.04.2025)

Teacher training for inclusive education is essential to support teachers in the transformation process and to improve education for all students. However, surprisingly little is known about the learning process that occurs from training participation to classroom implementation and its actual impact on students. There is no universally accepted framework for transfer processes in teacher training, though numerous theories describe how training translates into reform implementation (Desimone, 2023; Nimante et al., 2025). Many existing models focus primarily on training design rather than the learning and transfer process itself, assuming that well-designed programs automatically lead to positive outcomes (Opfer & Pedder, 2011). However, existing transfer models vary in complexity, with a growing tendency to break down learning processes into smaller steps. There is broad agreement that a

comprehensive theory of professional learning is lacking (Nimante et al., 2025) and understanding these processes is crucial to ensuring that teacher training effectively translates into meaningful changes in teaching practice and student outcomes.

Many existing models share similarities and were categorized into five characteristic models:

- Basic Model (e.g., Koehler & Mishra, 2009; Meiers & Ingvarson, 2005): Assumes that knowledge acquisition in teacher training leads to changed teaching practices that improve students' behavior.
- Implicit Model (e.g., Desimone, 2009; Egert et al., 2018): Assumes that teacher training improves knowledge acquisition as well as teachers' skills and beliefs, which together improve teaching practices and students' behavior.
- Evaluation Model (e.g., Kirkpatrick & Kirkpatrick, 2006; Lipowsky, 2010): Assumes that the reaction to the training, whether one likes the training or not, is essential and influences how knowledge and beliefs are acquired in the training, applied later and influencing students' behavior.
- Change Model (e.g., Fogaça et al., 2024 Guskey, 2002): Assumes that knowledge and skill acquisition in the training influence how teaching practices are modified. When teachers perceive an impact on their students as a result of these changes in teaching practice, this facilitates a shift in their beliefs.
- Cognitive Change Model (e.g., Gregoire, 2003; Sims et al., 2023): Assumes teacher training to directly influence teachers' knowledge, skills and beliefs development as well as teachers' willingness to change. This enhanced willingness, in turn, affects skill acquisition, belief formation, classroom implementation, and ultimately student outcomes.

To test how well these models align with empirical data, a systematic literature review was conducted to identify studies investigating teacher training for inclusive education and reporting quantitative data for at least two variables among the following: teachers' knowledge, skills, beliefs, teaching practices, willingness to change, satisfaction with the training and students' behavior. Overall, 228 studies were identified with 244 samples, 117 609 participating teachers and students and 1,084 effect sizes. The models were fitted to the data using one-stage meta-analytic structural equation modeling (MASEM). Comparisons of the model were based on three analyses: first all available data were included in the analysis (resulting in different sets of samples model calculations were based on), second, the models were fit based on the same set of samples, and third the models were fit based on studies with

randomized and quasi-experimental allocation to the conditions (RCT and nRCT). The analyses revealed that one model fit the empirical data significantly better than the others: The Cognitive Change Model demonstrated a good or acceptable fit across all three comparisons. Although the cut-off values for a good fit were not always met, the results were only slightly below the threshold and consistently showed the best fit compared to the other models. In the RCT and nRCT comparison, the Implicit Model also exhibited a good model fit, but this was not the case in the other two analyses. However, not all predicted pathways in the Cognitive Change Model were supported by the analysis—most notably, beliefs showed no significant impact on implementation. The same pattern was observed for the Implicit Model.

Overall, the study highlights the importance of theoretical frameworks to plan and evaluate teacher training. The analyses suggest that the Cognitive Change Model describes the learning and transfer processes in the context of teacher training for inclusive education best among the collected models. It suggests that teachers' willingness to change can be fostered in training and that it plays a crucial role in the transfer process. The study also underscores the need for theory-based evaluation studies, particularly using Cognitive Change Models, as willingness to change has rarely been considered or measured as a variable in empirical research.

2. Discussion

This dissertation aimed to investigate whether teacher training can effectively support teachers in their learning and change processes related to implementing inclusive education. Based on two meta-analyses, I demonstrate that teacher training has a positive impact on key areas relevant to the transfer process towards inclusive teaching. The key areas focused on in the first study, further referred to as effectiveness study, were teacher knowledge, skills and beliefs regarding inclusive education, and student behavior, and the study found positive impact of professional development participation in all four areas. During the data collection, it became apparent that commonly little importance is given to the theoretical background when planning evaluations of teacher training, and that there is no consensus on theoretical models for the transfer process. Therefore, in the second study, referred to as transfer study, I aimed to collect relevant theories on learning transfer in the context of teacher training and compare the validity of these theories. To reduce the complexity and because theories often overlap, five stereotypical models were categorized and tested against empirical data. The analyses show that one model exhibits a significantly higher fit with the data compared to

others. This model, referred to here as Cognitive Change Model, describes that effective teacher training enables teachers to gain knowledge, skills, positive beliefs about inclusive education as well as enhances the willingness of participating teachers to engage in the change process necessary for its implementation, which in turn supports skills and beliefs development, changes in teaching practice and, of course, positive impacts on students' behavior (e. g., Azazitur et al., 2021; Gregoire, 2003; Kennedy, 2016; Sims et al., 2023). Together the studies demonstrate that training programs can initiate learning and transfer processes and that their positive effects can reach students.

3.1 Key Areas in the Learning and Transfer Process

In particular the transfer study highlights the importance of a theory-based approach in study planning and reflects according calls in the literature (Boylan et al., 2018, Nimante et al., 2025). If the findings from this study had been available as a basis for planning the effectiveness study, the selection of key areas would have looked somewhat different. Based on the Cognitive Change Model, teacher training is assumed to directly influence teachers' knowledge, skills and beliefs development as well as teachers' willingness to change. Taking these assumptions, the effectiveness study lacks 'willingness to change' as an indicator of the learning process. In the theories summarized under the term Cognitive Change Model, willingness to change refers to the teachers' motivation to actively engage in processes to change ones teaching practice (Herawati et al., 2022; Osman & Warner, 2020; Scott et al., 2024; Wu, 2021). Typically, motivation in the context of teacher training is not examined with a focus on implementation but rather as a general willingness and eagerness to learn (e.g., Lipowsky, 2010). Moreover, it is considered an individual influencing factor on the learning process (Blume et al., 2019) rather than an aspect that can be impacted and specifically strengthened through the training itself. However, as boosted willingness to change is increasingly being recognized as a key objective of training programs, even as an essential link between knowledge and skills acquisition in teacher training and implementation in the classroom (Osman & Warner, 2020; Urton et al., 2023), future research addressing the effectiveness of teacher training—whether in primary studies or secondary analyses—should consider teachers' willingness to change as one area that can be strengthened through training participation. Specifically, how training can actively foster and enhance teachers' willingness to change should be investigated, rather than treating it as a static personal trait. This could lead to more effective teacher training programs that not only

convey knowledge but also strengthen teachers' motivation to actually implement the newly acquired skills and insights.

However, the majority of the variables directly influenced by training participation according to the Cognitive Change Models were addressed in the effectiveness study. This supports the approach chosen in the first study, to not focusing on a single indicator of training effectiveness as commonly done in previous research (e.g., Brock & Carter, 2017; Dignath et al., 2022) but instead including a broad selection of indicators. Despite this retrospective critique regarding the theoretical foundation of the effectiveness study, its' design was theory-driven as well. The selected theory by Desimone (2009), which is classified under the Implicit Models in the transfer study, also receives support when compared with empirical data—though not in all analyses. The model comparison was based on three analyses that differed in the included primary studies, with one analysis focusing exclusively on studies that used randomized or quasi-experimental designs. In this RCT and nRCT analysis, both the Cognitive Change Model and the Implicit Model showed a good fit with the empirical data. Upon closer examination, the models differ only in that one includes willingness to change, while the other does not. Since the RCT and nRCT studies examined relatively intensive training programs, it is likely that the participating teachers had a particularly high initial willingness to change, which therefore can be assumed to have been less influence by the training participation. The variables examined in the effectiveness study were therefore not selected arbitrarily, and the underlying theory receives partial support from the empirical data. However, incorporating willingness to change could further enhance the power and predictive value of future studies on the effectiveness of teacher training for inclusive education.

One variable mentioned in both theories but not explicitly included in the effectiveness study is teaching practice. It is assumed to be the link between what is learned by the teachers in the training and the actual goal of teacher training, improvements at the student level. Although this was not directly labeled as such in the first study, what is implemented in the classroom was not forgotten. However, self-assessed abilities and the implementation of inclusive teaching methods in the classroom were combined under the term 'teachers' skills for inclusive education'. As analyses showed no significant differences between these variables, they were grouped and analyzed together. This close alignment between self-efficacy expectations and what is actually implemented aligns with previous research (Boeve-de Pauw et al., 2022), suggesting that self-assessed abilities play a significant role and can serve as a good indicator of teaching practice (Urton et al., 2014). However, it is important to

note that changes in teaching practice were primarily based on self-reports from teachers as well. These may be influenced by social desirability, biased self-assessment, or simply the methodological similarity to self-efficacy assessments, making them more closely aligned than data on teaching practice derived from third-party observations. Nevertheless, this possibility was examined in the first study, but no differences were found in the effect sizes between observational and self-reported data. Even though the effectiveness study combines these variables, it still demonstrates that professional development has a positive impact on both self-assessed abilities and changes in teaching practice.

Another important aspect to consider are teachers' beliefs about inclusive education. In particular, teachers' attitudes toward inclusion are frequently described as a crucial variable, with their positive development being essential for the successful implementation of inclusive education (Lindner et al., 2023; Urton, 2014). In line with previous research the effectiveness study also revealed that this is by far the most frequently measured variable when assessing the impact of training programs (Dignath et al., 2022), a pattern reflected in many theoretical models. Including the Cognitive Change Model the assumption holds that changes in beliefs towards inclusive education positively influence its implementation (Gregoire, 2003). However, the path analyses indicate that while training participation leads to more positive beliefs—partly mediated by increased willingness to change—there is no significant relationship between belief changes and changes in teaching practice. This pattern shows in both the Cognitive Change Model and the Implicit Model, and aligns with previous research questioning the influence of attitudes on teaching practices (Gülsün et al., 2023; Sharma & Mannan, 2015). This finding could be due to the more subtle ways in which attitudes influence teaching practice, for example through spontaneous reaction to students' behavior, perception and evaluation of student achievement, or because the measured constructs of teacher beliefs are not closely aligned with the observed teaching practices. Another possibility is that attitudinal changes require a longer timeframe (Guskey, 2002) than that covered in the primary studies to manifest in practice (King et al., 2023). However, it is also conceivable that other factors play a more decisive role in the implementation of inclusive education, such as diagnostic competences, knowledge of inclusive teaching methods, the confidence to apply them in the classroom (Knigge & Rotter, 2015), support by colleagues or access to necessary resources (Lambrecht et al., 2022; Voelkel & Chrispeels, 2017). The strong research focus on attitudes in this field may also be influenced by the availability of well-established standardized instruments, making this variable relatively easy

to measure. Given these possible explanations, the role of attitudes in inclusive education should be examined more closely in future research.

Unaddressed in all theoretical models remained teachers' concerns regarding inclusive education and its implementation. As this was the only variable in the effectiveness study that was not positively influenced by professional development participation, research should urgently address how teachers' concerns and doubts can be reduced because it is often mentioned as a barrier to the implementation of inclusive education (Hintz et al., 2015). The Cognitive Change Model might serve as an anchor to address this issue, as willingness to change might serve as a counterbalance to these concerns. Kennedy's review (2016) demonstrated that training programs designed to create "aha" moments, thereby increasing personal involvement and motivation to initiate change, had a greater impact on student outcomes. This aligns with findings from the effectiveness study indicating that active participation, the planning of the implementation process during the training and concrete topics enhances the effectiveness of training, all aspects that strengthen one's involvement in the learning process and relevance for one's practice in the classroom. This suggests that such approaches might help shift concerns from being a reason for inaction to being seen as aspects that can be adjusted and adapted to fit the specific context of one's own classroom.

3.2 Validity and Generalizability of the Results

Regarding the methodological approach in this dissertation, both studies are meta-analyses. This approach was chosen because the research questions focus on the general effectiveness and learning processes that apply to all teacher training programs, regardless of their specific design, duration, or participant composition. Of course, this also comes with all the advantages and disadvantages of meta-analyses, such as the garbage-in-garbage-out problem, publication bias, and the overestimation of effect sizes. Publication bias was addressed by the study design through intentionally including unpublished literature and was not found to be a significant issue in either study. However, the included studies in both meta-analyses generally show constrained statistical power, which may affect the robustness of the findings. This highlights the urgent need for empirical educational research to pay more attention to the statistical power of studies during the planning phase. In particular, more longitudinal studies are needed that track teachers and their students over extended periods (Desimone & Garet, 2015; Kowalski et al., 2020). If future meta-analyses can rely on high-quality studies, their conclusions will also become more robust.

Regarding the participants, the two studies differ in focus. Previous meta-analyses typically do not distinguish between pre-service and in-service teachers when analyzing the effectiveness of teacher training programs. In contrast, the first study in this dissertation focuses exclusively on in-service teachers, as the primary studies in this area had previously shown less consistent or weaker effects compared to those with pre-service teachers. Interestingly, the results of the first study reveal a similarly positive picture for in-service teachers as reported in earlier literature for pre-service teachers (Florian & Camedda, 2020), indicating that teacher training can be effective for both groups. Based on this finding, the second meta-analysis included both pre-service and in-service teachers to increase statistical power and capture a broader evidence base. Moderator analyses were conducted to test for differences between the two groups, but no significant differences were found. However, there are indications that the two groups differ, particularly regarding their willingness to change (e.g., Edwards et al., 2006; Kimanen et al., 2019; Rumalutur & Kurniawati, 2019). There are various explanations for this—for example, university courses tend to focus less on implementation motivation and more on knowledge transmission. Moreover, pre-service teachers often cannot implement what they learned right away, and the motivation to apply what was strengthened in the seminar may have faded by then. However, cross-sectional studies indicate that participation in university courses on inclusive education also positively influences teaching practices and students. Nevertheless, further research is needed to determine whether the same variables are relevant in the learning and transfer processes of students and in-service teachers.

2.3 Implications for Future Research

The findings of this dissertation highlight important directions for future research and practice in teacher training for inclusive education. One key implication is the need for future studies to consider teachers' willingness to change as a key variable in the transfer process and therefore a relevant indicator for the effectiveness of teacher training programs. While this dissertation shows that teacher training positively impacts teachers' knowledge, skills, beliefs, and student behavior, it also reveals that willingness to change is a critical factor often overlooked in traditional studies. Future research should explore how training can actively foster and enhance teachers' willingness to engage in change processes, rather than treating it as a fixed personal trait. This could lead to more effective training programs that ensure newly acquired knowledge and skills are successfully implemented in the classroom. Additionally, the role of teachers' concerns about inclusive education should be further investigated, as

these concerns were the only variable not positively affected by training participation. Addressing teachers' willingness to change could be one method how teachers' concerns could be reduced during the training and could help reduce barriers to the implementation of inclusive practices.

Moreover, the importance of a theory-based approach in study design is highlighted. Although in the current dissertation the Cognitive Change Model showed good fit with empirical data, there is a need to test the theoretical models with primary studies. Since nearly none of the included studies assessed the variables described as relevant in the models together, this highlights the urgent need for further evaluation studies to be planned with a theoretical foundation. This would allow for the testing and verification of the chosen theories. Future research should continue to explore how different theoretical models of learning transfer can be applied and tested to enhance the effectiveness of teacher training.

Given the methodological challenges in this dissertation, there is a need for higher-quality longitudinal studies that track the long-term effects of teacher training on both teachers and students. Short-term studies often fail to capture the sustained impact of training, so longitudinal research would provide valuable insights into whether the positive effects of training persist over time. By collecting data over an extended period, these studies would lead to more robust conclusions, improving the generalizability of findings and providing stronger evidence for the effectiveness of teacher training on inclusive education. Further, both studies demonstrate the general low power of the studies conducted in this field. To improve the quality of studies, increasing the number of participants, both among teachers and, particularly, by collecting data from students, would lead to more meaningful and robust results. Additionally, it would be beneficial not to rely solely on self-reports from teachers, even though they are easy to gather. Incorporating more objective data, such as observations and third-party assessments, would provide a clearer picture of the effectiveness of teacher training and its impact on student outcomes.

For practical purposes, it would be advisable to strengthen the willingness of participants to engage in change processes in teacher training programs. Identifying methods that are particularly effective at fostering this motivation is crucial. For example, incorporating strategies that help teachers plan the implementation of inclusive education in a structured and step-by-step manner could make the process feel more accessible and manageable. By breaking down the complex task of implementing inclusive practices into smaller, achievable steps, teachers might feel less concerned but more confident and motivated to apply what they've learned.

Moreover, it may be necessary to provide closer support throughout the transfer process to ensure the successful implementation of inclusive practices. This could involve ongoing mentoring, coaching, or follow-up sessions after the training, where teachers receive guidance and feedback on how to integrate the strategies into their classrooms effectively. By offering continued support, teachers are more likely to overcome obstacles and sustain the changes they've learned. Such an approach would not only motivate teachers to engage more deeply with the training but also enhance the likelihood of successful, long-term implementation in their teaching practices. The implications for future research are summarized in figure 2.

Figure 2

Summary of Implications for Future Research

			
Theoretical Foundations	Psychological Factors in Transfer Process	Methodological Improvements	Practical Design of Teacher Trainings
• Importance of theory-driven study designs • Systematic assessment of theoretically proposed variables • Empirical testing and validation of theoretical models	• Investigating the role of teachers' willingness to change • Conceptualizing willingness to change as dynamic factor • Identifying methods to strengthen willingness to change	• Need for longitudinal assessments • Including outcomes at the student level • Ensuring larger sample sizes to improve statistical power	• Actively promote teachers' willingness to change • Support structured implementation planning during teacher training • Establish follow-up structures to provide ongoing support

3.4 Conclusions

This dissertation examines how teachers learn within teacher training designed to enhance the implementation of inclusive education. It demonstrates that teacher training generally has positive effects but also reveals significant gaps in the theoretical foundations of existing research. A central focus of this work is identifying a theoretical framework that effectively explains the learning and transfer processes involved. Based on the findings, a specific recommendation is made for further exploration of Cognitive Change Models that captures these dynamics. Additionally, the dissertation highlights the importance of designing training programs that actively support teachers' learning rather than relying on fixed criteria or predefined methods. By fostering targeted learning processes, teacher training can better equip teachers to implement inclusive practices effectively. Ultimately, this research contributes to a deeper understanding of how inclusive education can be realized in

classrooms—just as students benefit from individualized approaches to learning, teachers also need tailored support to translate new knowledge into practice.

3. References

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5. Publications of the Dissertation

5.1 Study 1

Donath, J. L., Lüke, T., Graf, E., Tran, U. S., & Götz, T. (2023). Does professional development effectively support the implementation of inclusive education? A meta-analysis. *Educational Psychology Review*, 35(1), 1-30. <https://doi.org/10.1007/s10648-023-09752-2>

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- Results of this study were presented at JURE (2022), AESF (2023), AERA (2023), EARLI (2023)

Author contributions (Credit statement)

Conceptualization: Johanna L. Donath, Data curation: Johanna L. Donath, Formal analysis: Johanna L. Donath & Timo Lüke, Methodology: Johanna L. Donath, Ulrich S. Tran, & Elisabeth Graf, Supervision: Timo Lüke & Thomas Götz, Visualization: Johanna L. Donath, Writing – original draft: Johanna L. Donath, Timo Lüke, Thomas Götz, & Ulrich S. Tran, Writing – review & editing: Johanna L. Donath, Timo Lüke, Thomas Götz, Ulrich S. Tran, & Elisabeth Graf

Note

The study was preregistered via OSF (<https://osf.io/jyw5z/>). Data, accompanying analysis scripts, and supporting information are available via OSF (<https://osf.io/ehjc3/>). Results of this study were presented at JURE (2022), AESF (2023), AERA 2023 (online) and EARLI (2023).



Does Professional Development Effectively Support the Implementation of Inclusive Education? A Meta-Analysis

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Abstract

Inclusive education is a reform aimed at educating all students in general classrooms, independent of diversity features such as special educational needs, giftedness, or migration. Its successful implementation requires teachers with professional knowledge about inclusive education, skills to address the diverse needs in the classroom, and positive beliefs toward inclusive education. Teachers are provided with professional development opportunities, but are these effective in improving their learning process and positively impacting students' behavior? We conducted a meta-analysis to address this question. The screening of 12,050 search results revealed 342 eligible studies with more than 155,000 participants and 1123 effects from four outcome categories: teachers' knowledge, skills, and beliefs and students' behavior. We observed positive, though varying, effects on all four outcome categories: large effects on teachers' knowledge regarding inclusive education ($g=0.93$), moderate effects on teachers' skills ($g=0.49$), small effects on teachers' beliefs ($g=0.23$), and small-to-moderate effects on student behavior ($g=0.37$). We also examined factors that might explain the differences in the strength of training effects. The data suggest that long-term training with high practical relevance and active learning opportunities facilitates transfer to schools.

Keywords Inclusive education · Professional development · Meta-analysis · Teacher training · Teacher education

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Introduction

In past decades, education systems have considerably changed how students with diverse educational needs are educated (Alzahrani, 2020). As evidenced by an increasing numbers of countries introducing laws facilitating inclusive education (Allan, 2021), school systems are adapting to address the demands of their diverse communities. Approaches that involve educating students together in general classrooms as opposed to separated classrooms are becoming increasingly popular. Such an approach is thought to overcome diversity-related disadvantages independent of students' various features such as special educational needs, giftedness, or multicultural background (UNESCO, 1994; United Nations, 2005, 2006). Well-prepared and educated teachers are crucial to realize this development toward more inclusive education.

Teachers play a crucial role in implementing inclusive education, as they shape learning opportunities and experiences in school for students (Hattie, 2009) and are responsible for introducing innovations in education systems. To realize educational reforms, teachers should be equipped with professional knowledge, skills for implementation, and positive beliefs about the reform (Bransford et al., 2005; Lipowsky & Rzejak, 2015). The expectation is that students' behavior, achievement, and attitudes will improve if teachers acquire new skills in professional development and successfully apply them in the classroom (Desimone, 2009; Lipowsky & Rzejak, 2015; Pit-Ten Cate et al., 2018).

Introduction and Problem Statement

To better prepare preservice teachers for their future professional life in inclusive classrooms, inclusive education has become obligatory in teacher education programs across many countries. These programs aim to provide knowledge about inclusive education, develop inclusive teaching practices (e.g., collaborative teaching, individualized instruction), and facilitate positive attitudes (Florian & Camedda, 2020). In-service teachers' professional development opportunities often support their ongoing implementation of inclusive education. It should be noted that we distinguish between training pre- and in-service teachers because the circumstances of learning differ (Girardet, 2018; Savolainen et al., 2012), i.e., in-service teachers have the chance to apply newly acquired methods in their classrooms but may also face the challenges with implementing new methods added to their everyday teaching tasks. In turn, preservice teachers can devote more time to learning new teaching methods but have to apply them in hypothetical or exercise contexts. Numerous studies report differences in pre- and in-service teachers' willingness to teach diverse classrooms, attitudes, and concerns (e.g., Edwards et al., 2006; Kimanen et al., 2019; Rimalutur & Kurniawati, 2019), suggesting that the two groups should be looked at separately. We therefore focus specifically on the learning of in-service teachers as they are influencing current practices in schools.

Professional development opportunities are offered to in-service teachers and commonly refer to group training sessions where teachers from different institutions

come together and receive input on a topic. However, the implementation and ongoing support thereof that is supposed to naturally follow such a professional development course are not integrated into these programs (Cramer et al., 2019; Darling-Hammond et al., 2017). Although following this practice equips many teachers with professional development at comparably low costs (Darling-Hammond et al., 2017), its effectiveness in bringing about intended changes in teacher practice can be questioned (Copur-Gencturk & Papakonstantinou, 2016; Garet et al., 2016). Educational research has identified certain aspects that can enhance the efficacy of professional development (Desimone, 2009; Dunst et al., 2015; Sims & Fletcher-Wood, 2021). Content focus, coherence with other learning activities, opportunities for intensive active learning, collective participation of teachers from one institution, and longer duration of training are characteristics that have all been associated with supporting teachers' learning in professional development and modifying their teaching practices (Cordingley et al., 2015; Desimone, 2009). However, these design characteristics are difficult to implement in a one-shot event, which reflects the majority of offered professional development programs (Cramer et al., 2019).

Because providing in-service teachers with opportunities for professional development is a common way to prepare them to implement inclusive education, it is crucial to investigate its effectiveness. Studies have reported null effects for professional development participation (e.g., Adhabi, 2018; Alquraini, 2012; Schmidt, 2019), with some even reporting negative influences on in-service teachers' attitudes toward inclusive education (e.g., Edwards et al., 2006; Jäntschi et al., 2015; Sanches-Ferreira et al., 2018). Even studies that were based on interventions that satisfied many of the above-mentioned design criteria for effective professional development report that only a few participants genuinely understood the concept of interest, felt equipped to implement it (e.g., Carew et al., 2019; Forlin et al., 2014), and not necessarily led to improved student behavior (Garet et al., 2016).

Previous Reviews

The number of studies addressing teacher professional development to improve inclusive education practices has risen with an increasing number of countries introducing inclusive education. Previous reviews have investigated research practices in this field, for example, the applied study designs and assessed outcome variables (Van Mieghem et al., 2018; Waitoller & Artiles, 2016), revealing that studies investigating the influence of professional development addressing inclusive education assess different categories of outcome variables. Specifically, teachers' knowledge, skills, and beliefs, as well as students' behavior, academic achievement, and attitudes toward school, are commonly assessed. Reviews report positive influences of professional development participation but include only a few primary studies in their analyses, with considerable variations in reported effect sizes (Avramidis & Norwich, 2002; Brock & Carter, 2017; Dignath et al., 2022). However, these studies focus on specific aspects of diversity (i.e., special educational needs) or isolated outcome measures (e.g., attitude; Dignath et al., 2022, or implementation fidelity; Brock & Carter, 2017). They mainly comprise studies on English-speaking

countries (e.g., Knight & Wiseman, 2005) or exclusively peer-reviewed studies (e.g., Tristani & Bassett-Gunter, 2020; Van Mieghem et al., 2018). As far as we are aware, no existing meta-analysis differentiates between preservice and in-service teachers, although it is plausible that learning processes differ depending on previous experience and the environment (e.g., Edwards et al., 2006; Kimanen et al., 2019). Thus, we decided to conduct a comprehensive meta-analysis on the effects of professional development in supporting in-service teachers for implementing inclusive education.

Indicators for Improved Implementation of Inclusive Education

Appropriate implementation of inclusive education differs based on the specific context and the students and personnel involved (Lindner & Schwab, 2020; Srivastava et al., 2015). Therefore, professional development providers cannot offer a generic implementation guideline. In order to be able to adjust the implementation of inclusive methods to their classrooms, effective professional development should equip teachers with increased (a) knowledge and (b) skills, (c) a positive change in beliefs, and through changes in instruction lead to (d) improved student behavior (Desimone, 2009).

When investigating the effects of professional development, all four categories of outcome variables are relevant and can be expected to influence one another. For example, knowledge about students' educational needs is necessary to identify their specific learning requirements (Demchenko et al., 2021). Teachers must also be aware of diverse teaching approaches to select an appropriate approach for their students (Lindsay et al., 2014). In addition, applying new teaching approaches can improve students' learning behavior and academic achievements, enabling teachers to perceive positive influences on students (Harris et al., 2014; Lauth-Lebens et al., 2016). Observing struggling learners benefit from changes in instruction can support the development of positive beliefs toward inclusive education, which can facilitate the acquirement of relevant knowledge and its implementation through targeted programs (Ewing et al., 2018).

As the implementation of inclusive education can differ based on the context at hand, researchers can also focus on different aspects and can choose different indicators to investigate successful implementation (Van Mieghem et al., 2018; Waitoller & Artiles, 2016). We conflated the subcategories of outcome variables reflecting all the four categories described in the literature: (a) knowledge can be measured via self-reports and knowledge tests; (b) teachers' skills are measured using assessments of implementation quality of inclusive teaching methods (e.g., collaborative teaching, individualized instruction, Universal Design for Learning, Positive Behavioral Support), variations and frequency of teaching methods, and perceived self-efficacy for inclusive education (one's belief in their ability to positively implement inclusive teaching methods and influence diverse students); (c) attitudes and concerns toward inclusive education and perceptions of inclusive teaching methods are assessed to indicate teachers' beliefs toward inclusive education; and as indicators of (d) student behavior, we conflated two subcategories, namely academic achievement (e.g., in

standardized tests, achievement in research tests, school grades) and other student behavior (including, e.g., learning behavior, school attendance, and attitudes toward school). Data on student behavior were collected via teacher surveys, school data, and students' self-reports.

As shown by previous reviews, these four categories are being studied in the context of implementing inclusive education (Van Miegheem et al., 2018; Waitoller & Artiles, 2016). Primary studies investigating the effectiveness of professional development in this context often assess several indicators alongside (see supplement C), and few studies even assess indicators from the four outcome categories described above (Murthy et al., 2019; Schmidt, 2019; Seibert, 2002). However, there is no meta-analysis that examines relevant outcomes of professional development at both the teacher and student levels.

Study Aims

The current meta-analysis aims to address this research gap by investigating the effects of professional development for in-service teachers on four important outcome categories, specifically to determine whether it (a) enhances knowledge about inclusive education, (b) improves skills of in-service teachers, (c) fosters positive beliefs toward inclusive education, and (d) supports students' behavior. For this study, we conceptualize professional development as structured training for in-service teachers, provided in a group setting and offered to facilitate teachers' preparedness for inclusive education. As the implementation of inclusive education is not limited to the classroom teacher, we include studies on general and special education teachers, teaching assistants, and school administration personnel from kindergarten to high school. Furthermore, we do not limit to specific geographical areas because according to the Salamanca statement from the United Nations (United Nations, 2006), all countries should strive toward implementing and improving inclusive education practices. Contrary to previous reviews, we distinguish between pre- and in-service teachers. It is questionable how meaningful conclusions are when interventions with pre- and in-service teachers are treated as equivalent, because the conditions under which learning takes place differ between pre- and in-service teachers (e.g., Edwards et al., 2006; Kimanen et al., 2019). As in-service teachers mainly shape the current implementation of inclusive education, we focus solely on this group.

The current study aims to identify aspects that enhance the effectiveness of professional development in addressing inclusive education. In order to extend the range of information gathered, we include studies with different designs in this meta-analysis (Dignath et al., 2022; Katsarov et al., 2022). The inclusion of different study designs has been discussed in the literature (Mueller et al., 2018), and this practice has become more common practice, as it can help answer the question of underlying effects and analyze biases introduced by the different designs (Price et al., 2004). Specifically, we aim to include cross-sectional studies, which investigate the influence of previous participation in any professional development program regarding the topic of inclusive education on the constructs of interest (Setia, 2016). In addition, we also include

intervention studies, which investigate the influence of one specific professional development program on the constructs of interest (Fink, 1995). Cross-sectional studies have often been excluded from meta-analyses due to their methodological limitations (e.g., inability to determine causal interpretations and investigate behavior over time), although such studies can provide meaningful insight into teachers' professional development. For example, cross-sectional studies can indicate the effects of naturally occurring professional development participation, including participation in short-term events and multiple programs (O'Connor & Sargeant, 2014), compared to more intensive programs (than commonly provided; Cramer et al., 2019), which are often investigated in intervention studies (Waitoller & Artiles, 2016).

Hypotheses

Overall, we expect positive influences of professional development participation on all four categories of outcome variables. We expect smaller effects on student-level outcomes than on teacher-level outcomes (Desimone, 2009) because these are expected to occur through teachers' behavior changes. Regarding the study design, we expect larger effects in intervention studies than in cross-sectional studies, as the former often assesses the program's effect shortly after its completion, while the latter does not control the time between the program and assessment. Additionally, professional development effects assessed in cross-sectional studies can be expected to be rooted in commonly provided short-term one-shot programs compared to intensive programs investigated in intervention studies. When examining professional development intervention studies, we expect effect sizes to be associated with the number of design criteria described by Garet et al. (2016) and Desimone (2009) met by the training. More specifically, we expect content focus, active learning opportunities, coherence with additional learning activities, longer duration of the training, and collective participation with colleagues to enhance the effectiveness of the professional activities. Some professional development programs offer certification after successful participation. We include this as an additional design aspect because receiving certification can enhance motivation and learning effects (Larsen et al., 2008).

Method

The PRISMA guidelines (Salameh et al., 2020) were used to plan and conduct all phases of the meta-analysis to ensure a transparent process (see preregistration <https://osf.io/jyw5z/>). Supplementary information, including data and code, is available via OSF (<https://osf.io/ehjc3/>).

Literature Search

A systematic search of the literature was conducted in April 2021 using the databases PsycINFO, Web of Science, and ProQuest (ERIC, Education Database, Dissertations & Theses) using the following search terms: inclusion OR inclusive

education OR inclusive classroom AND professional development OR teacher training OR workshop OR teacher education AND teacher OR pedagogical staff OR pedagogical personnel OR teaching assistants OR educators AND school OR K-12 OR kindergarten OR preschool OR vocational college. To reduce the likelihood of publication bias, which refers to the overrepresentation of non-null results in published literature due to selective publishing practices, unpublished studies were screened using the Dissertations & Thesis database of ProQuest and conference abstracts in the search process. In addition, journals and conferences relevant to research on inclusive education were manually searched (see supplement A). After removing duplicates, the literature search revealed 12,050 results, of which 253 were derived solely from journals and 81 from the manual search of conference abstracts.

Inclusion Criteria and Screening

We included all publications that met the following criteria: Studies had to (1) measure the impact of professional development, (2) regarding the topic of inclusive education, (3) among in-service teachers and school personnel (e.g., administrative staff, teaching assistants) on (4) knowledge (assessed with knowledge tests and self-ratings), skills (concerning implementation quality, use of inclusive teaching methods, and self-efficacy for inclusive teaching), beliefs (attitudes, concerns, and perceptions of inclusive education), or student behavior (academic achievement, on-task behavior, school attendance, and attitudes toward school) and (5) had been reported as cross-sectional data, pre- versus post-comparisons of participant data, or comparisons with a control group.

Studies were excluded if preservice teachers were investigated (e.g., Lee et al., 2015; Mulvey et al., 2016) or if professional development consisted solely of coaching, referring to training that took place exclusively in a one-to-one setting (e.g., Gorton et al., 2022). If a specific study was described in both a journal article and a dissertation, the dissertation was included in the meta-analysis because data are commonly reported in more detail in dissertations than in journal articles.

Three coders screened the search results. Two raters independently screened a subsample of 550 abstracts. Divergent decisions concerning the inclusion or exclusion of studies were resolved through discussion and arriving at a consensus. Krippendorff's alpha (2011) indicated high inter-rater reliability ($\alpha = 0.912$). The screening identified 947 abstracts that met the inclusion criteria (see Fig. 1). Initially, we also planned to include qualitative studies that met the mentioned criteria. However, due to the large number of studies identified in the screening process, we decided to exclude the qualitative studies after the screening process. From the 947 studies, 281 qualitative studies were excluded, 65 studies did not fulfill the inclusion criteria when we examined the full text, 209 studies did not report sufficient data for the meta-analysis (e.g., only reported accurate data one time during data collection, did not report accurate data for the control group). Additionally, 27 studies were identified as duplicates and therefore excluded. The authors of studies for which full texts were not available ($k = 34$) were contacted. Thus, we obtained 11 further studies. The remaining 23 studies had to be excluded. Thus, 342 studies were finally included in

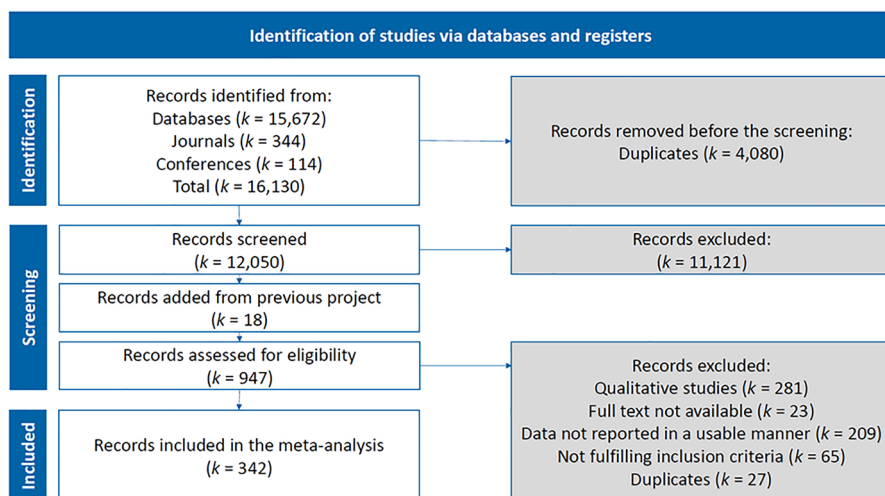


Fig. 1 PRISMA flowchart representing study selection

the meta-analysis. Of these, 14 studies were published in languages other than English (Bulgarian $k=1$, French $k=1$, German $k=3$, Italian $k=2$, Russian $k=1$, Spanish $k=5$, and Turkish $k=1$). Studies in German and Spanish were directly coded, and studies in other languages were coded with the support of translation software.

Coding of Moderator and Control Variables

To ensure transparency of the coding, a codebook was developed in advance and adjusted during a test phase until all coders were proficient with it (see Supplement B). A pre-configured *M.S. Excel* table was used for the final coding process. The publications identified in the screening process were then coded based on the characteristics of the source of information (e.g., type of publication, country) and study design (e.g., sample size, sampling procedure), participant attributes (e.g., profession, experience with inclusive education), design of the professional development program (e.g., duration, topic, practice opportunities), obtained results (e.g., type of data collection, instrument, analysis method), and type of outcome measure (knowledge, skills, beliefs, student behavior). Again, a subsample of 38 studies was independently coded by two coders. Discrepancies in coding decisions were resolved through discussion and after arriving at a consensus. Inter-rater reliability was high on average (mean Krippendorff's alpha across all coded items $M_\alpha = 0.903$, $SD = 0.088$, $Min = 0.529$, $Max = 1$).

Professional development programs were rated based on design criteria as suggested by Desimone (2009) and Dunst et al. (2015): duration, content focus, coherence with other learning activities, active learning, and collective participation. We used the number of contact hours of the program to determine *duration*. We rated *content focus*, *coherence*, *active learning*, and *collective participation* drawing on the information provided in the studies on scales comprising three criteria, with

scores ranging from 0 to 3. A score of 0 implied that the program did not meet any criterion, a score of 1 implied that the program met one criterion, a score of 2 implied that two criteria were met, and a score of 3 implied that the program met all criteria. The scale *content focus* was rated from 0=general topic to 3=addressing a specific topic (e.g., a specific type of special educational needs) within a specific subject and inclusive teaching method. The *active learning* scale was rated from 0=input session to 3=when the program provided practice opportunities within the sessions, used case studies for explanations and practice, and provided alternating input and praxis phases (compared to blocked design). On the *coherence* scale, a score of 3 was given when implementation was planned in the professional development session, additional coaching was provided, and teachers had to fulfill specific prerequisites to participate in the program (mainly referring to having at least one child with the diversity feature addressed in the program in their classroom). *Collective participation* was rated by the number of colleagues participating in the program, with 0=single participation, 1=participation with at least one colleague, 2=participation with the class team, and 3=participation of (almost) all school staff.

Effect Size Calculation

Cohen's *ds* were chosen as effect sizes and calculated from reported means and standard deviations (Lipsey & Wilson, 2001). If these data were not provided, reported test statistics were used to calculate the effect sizes. The correction factor *J* was applied to correct for the small-sample bias of *d* (Borenstein et al., 2021), resulting in Hedge's *g* (1981) as the effect size metric of the current meta-analysis. The R package *esc* (Lüdtke, 2019) was used to calculate the effect sizes. Effect sizes larger than 2 in absolute value were assumed to be outliers that arose from reporting mistakes. In such cases, we contacted the study authors; if the authors did not respond, effects were replaced by estimates that were two standard deviations from the mean in the respective outcome categories (see Lipsey, 2009; Tukey, 1977). In total, 14 effects were thus replaced.

Summary Effects and Heterogeneity Tests

Summary effects were estimated for each outcome category separately. Effect sizes of $g=0.2$ will be interpreted as small effects, $g=0.5$ as medium effects, and $g=0.8$ as large effects (Cohen, 1977). We expected high heterogeneity in the data, so all analyses were performed with random-effects models. We applied multi-level analyses (Assink & Wibbelink, 2016) to account for the dependency of effect sizes within studies. The (observed) sampling variance of the effect sizes was modeled on level 1, the within-study variance on level 2, and the between-study variance on level 3. The *Q*-test (Borenstein et al., 2021) was used to assess effect-size heterogeneity. Significant values indicated the presence of heterogeneity and suggested conducting moderator analyses to identify potential effect moderators (see below). All analyses were conducted in R with the *metafor* package (Viechtbauer, 2010), and

visualizations were plotted using the *metaviz* package (Kossmeier et al., 2019). Significance was set to $p < 0.05$ (two-tailed).

Moderator Analyses

Moderator analyses were conducted for each outcome category in the case of effect size heterogeneity using the following variables: (1) indicators of study quality (explained in detail below); (2) study characteristics (i.e., intervention vs. cross-sectional study, publication year, years since the legal introduction of inclusive education, continent); (3) data collection (i.e., time between the last session of the professional development program and post-data collection, type of measurement [e.g., observation, questionnaire, vignette] and whether the data collection instrument focused on a specific diversity feature or method); (4) participant characteristics (mean age and teaching experience, school type, percentage of those with experience implementing inclusive education); and (5) professional development design (content focus, active learning, coherence, duration, collective participation, certification). Differences based on the design of programs are analyzed only in intervention studies. We applied the Benjamini–Hochberg procedure (Benjamini & Hochberg, 1995) to control the false-discovery rate when conducting multiple comparisons for each group of tested moderators addressing the same research question. We used a false-discovery rate of 10% for this procedure.

Assessment of Risk of Bias and Publication Bias

To assess the risk of bias in individual studies, we adapted the Medical Education Research Study Quality Instrument (MERSQI; Reed et al., 2007) for our meta-analysis. The MERSQI has shown high inter-rater reliability and assesses the risk of bias based on quality assessments for each outcome. Our adapted version assessed the (1) study design, (2) response rate, (3) sampling procedure, (4) allocation to conditions, (5) type of data, (6) use of a standardized instrument, (7) internal structure of the instrument, and (8) whether the handling of missing data was reported (see Supplement C). As suggested by the PRISMA guidelines, we analyzed the risk of study bias for each category separately through moderator analyses.

As suggested in the literature, several methods were applied to identify and estimate the risk of publication bias (Rothstein et al., 2005; Siegel et al., 2021). Most methods are difficult to apply with multi-level data. We chose four methods to examine typical sources of publication bias: First, to reduce the risk of publication bias in the first place, unpublished studies were explicitly included in the meta-analyses, and moderator analyses were conducted to test whether published and unpublished studies differed in their effects. Second, contour-enhanced funnel plots (Peters et al., 2008) were created for each outcome category and all their subcategories. In the absence of publication bias, the effect sizes should be symmetrically distributed around the mean effect size, typically in the form of an inverted funnel. Third, the Egger regression test for multi-level data, which regresses the effect sizes on their precision (standard errors) to test for small-study effects (Fernández-Castilla et al.,

2021), was used to support the visual analyses. Effect-size asymmetry in the funnel plot results in a significant Egger regression test if large enough. Fourth, power-enhanced funnel plots were created to include information on the power of individual studies to detect the estimated effect size in the present sample (Kossmeier et al., 2020).

Results

Description of Included Studies

In total, 342 studies met our inclusion criteria (see Supplementary D and O for a complete list). In two cases, two publications were based on the same data but reported different outcome measures and were thus treated as one study (Chao et al., 2016, 2017; Machů, 2015; Machů & Lukeš, 2019).

Studies that met the inclusion criteria were conducted on all continents, with the vast majority were conducted in North America ($k=205$), followed by Europe ($k=68$), Asia ($k=45$), Africa ($k=10$), South America ($k=10$), and Australia ($k=4$). Of the included studies, there were 158 journal articles, 166 dissertations, 12 project reports, and 6 conference papers. In total, 158,713 participants were included in the primary studies, including 62,729 students, 77,787 teachers, and 18,197 members from class and school teams including different professions, such as teaching assistants, and administrative staff. Sample sizes in the primary studies ranged from 3 to 31,000 participants, with a median of 77 participants. Twenty-three studies were conducted with preschool teachers, 115 with primary school teachers, and 76 with secondary school teachers; 128 studies did not define the school type where teachers were employed. Moreover, 188 studies applied a cross-sectional design, 99 had a single-group pre-posttest design, 37 had an independent group pre-posttest design, and 18 had an independent group posttest design. Most studies focused on inclusive education for students with special educational needs ($k=288$), with 76 focusing on specific special educational needs (e.g., autism, learning disabilities). The remaining 54 studies focused on other diversity features, such as, second language learners and gifted students, or addressed multiple categories of heterogeneity.

The professional development programs investigated in the 154 intervention studies ranged from 2 to 750 h, with a median of 20 h, and lasted between half a day and 3 school years, with a median of 3 months. Most programs addressed a specific topic ($k=112$; primarily specific types of special educational needs) but usually did not target a specific subject ($k=126$). Most intervention studies assessed the professional development program's impact immediately after its end ($k=98$); 24 programs offered a certificate to the participants after completing the program, and 51 offered coaching in addition to the training.

In total, 1123 effect sizes were calculated and distributed as follows among the outcome categories: 88 effect sizes for knowledge, 371 for skills, 461 for assessed beliefs regarding inclusive education, and 203 for influences on student behavior (Fig. 2). No differences were observed for effect sizes calculated from means and

standard deviations compared to those calculated from reported test statistics (all $F < 3.8$, all $ps > 0.05$, see Supplement G).

Summary Effects

We calculated summary effects for each outcome category and investigated whether the subcategories within a category differ from each other. We observed significant positive effects in all four outcome categories (Fig. 3). The analysis of knowledge showed a large effect ($g = 0.93$ [0.76; 1.10]), with no difference between self-rated knowledge ($g = 0.96$ [0.70; 1.22]) and knowledge assessed using tests ($g = 0.91$ [0.68; 1.15], $F(1, 86) = 0.50$, $p = 0.48$). A moderate effect was observed on skills to implement inclusive education ($g = 0.49$ [0.41; 0.56]) and on its subcategories (see Fig. 3). The subcategories (implementation quality, use of inclusive methods, self-efficacy for inclusive teaching) did not differ from each other ($F(2, 368) = 0.15$, $p = 0.86$).

We observed a small but positive and significant effect on beliefs toward inclusive education ($g = 0.23$ [0.17; 0.28]), again with no differences between its subcategories ($F(2, 457) = 2.34$, $p = 0.10$). Still, for attitude ($g = 0.23$ [0.18; 0.28]) and perception of inclusive teaching methods ($g = 0.27$ [0.16; 0.39]), a positive effect of professional development participation was observed, while no significant effect was observed for concerns about inclusive education ($g = 0.08$ [-0.14; 0.30]). A small-to-moderate effect of teachers' participation in professional development was observed on student behavior ($g = 0.37$ [0.23; 0.51]), with no differences between

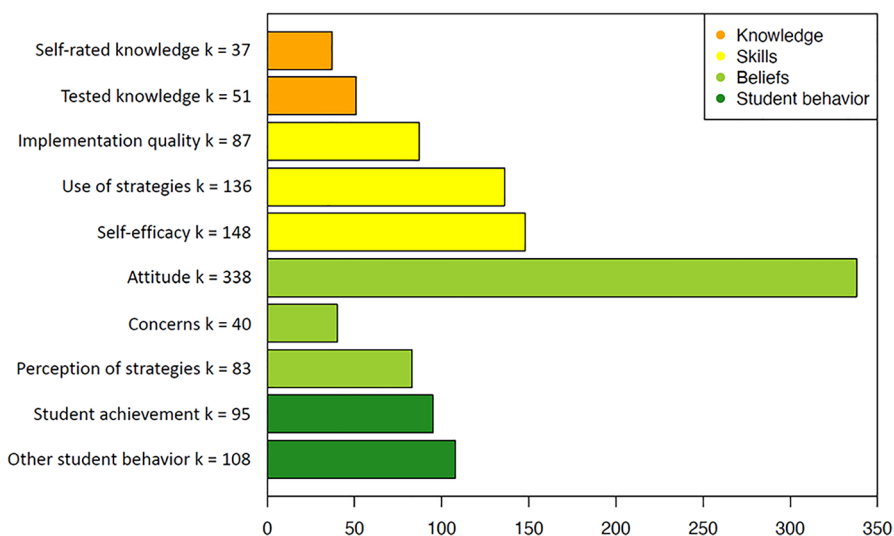


Fig. 2 Distribution of effect sizes by subcategory of outcome categories. Note. k indicates the number of effect sizes in the corresponding outcome category

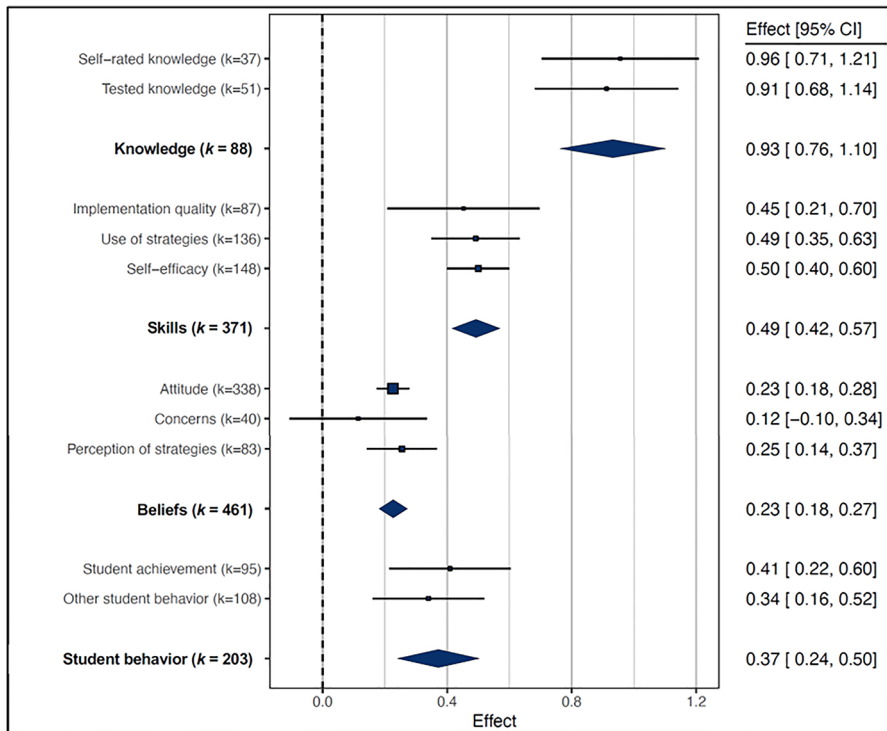


Fig. 3 Overview of summary effects. Note. *k* indicates the number of effect sizes in the corresponding outcome category

student achievement ($g=0.41$ [0.22; 0.61]) and other student behavior ($g=0.29$ [0.11; 0.46], $F(1, 201)=0.001$, $p=0.98$).

Next, we investigated the presence of heterogeneity for each outcome category, and the Q -test was significant for each (Table 1; for more detailed information, see Supplement F). The most variance was found on the between-study level, except for the beliefs category, where variance was mainly present on the within-study level (53.21%). These analyses suggest conducting moderator analyses in all four outcome

Table 1 Overview of summary effects and variance

Outcome category	<i>k</i>	<i>N</i>	Effect size	95% CI	<i>Q</i>	<i>p_Q</i>	Within-study variance (%)	Between-study variance (%)
Knowledge	50	88	0.926	0.76–1.10	1482.96	<.0001	10.24	83.35
Skills	153	371	0.485	0.41–0.56	7446.14	<.0001	34.19	63.76
Beliefs	200	461	0.230	0.18–0.28	2745.3	<.0001	53.21	32.59
Student behavior	51	203	0.372	0.23–0.51	3339.81	<.0001	39.36	58.51

k indicates the number of studies reporting data in the corresponding outcome category and *N* indicates the number of effect sizes per category

categories. The results of moderator analyses across the four outcome categories are summarized in Table 2 (see Supplement K-L for further information), and detailed information on the size and direction of observed effects will be discussed.

Moderator Analyses of Study Characteristics

Publication year, years since the legal anchoring of inclusive education, and the continent where the studies were conducted did not influence the observed effects. Knowledge and beliefs data were not influenced by the control variables describing the study characteristics. Effect sizes reporting effects on skills differed between intervention studies and cross-sectional studies, with the former reporting significantly larger effect sizes ($g=0.56$ [0.46; 0.66]) than the latter ($g=0.36$ [0.27; 0.46]).

Moderator Analyses of Data Collection Characteristics

No differences were observed based on the number of weeks between the last session of the professional development program and post-data collection (Table 2). Effects on knowledge were influenced by the type of instrument used: Studies applying instruments focusing on specific diversity features reported smaller knowledge gains ($g=0.75$ [0.47; 1.02]) compared to instruments that focused on addressing diversity features in inclusive education ($g=1.04$ [0.83; 1.24]). Tested knowledge was larger when assessed with (mainly self-developed) surveys ($g=1.10$ [0.80; 1.39]) than with questionnaires and single-items ($g=0.63$ [0.28; 0.98], $F(2, 48)=3.54$, $p=0.04$).

Effects on skills were not influenced by variables describing the data collection. Regarding beliefs, effects differed based on the applied instruments, with larger effect sizes being observed when instruments focusing on specific teaching methods were used ($g=0.51$ [0.41; 0.60]) compared to instruments focusing on the implementation of inclusive education in general ($g=0.22$ [0.17; 0.27]). The type of measurement influenced data collection on student behavior, with studies applying observational measures reporting larger effects ($g=0.69$ [0.34; 1.03]) than studies using teachers' self-reports ($g=0.16$ [−0.09; 0.40]).

Moderator Analyses of Participant Characteristics

None of the variables describing participant characteristics influenced the observed effect sizes in the categories (Table 2). School type influenced effect sizes assessing the attitudes toward inclusive education subcategory ($F(3, 333)=3.29$, $p=0.02$): We observed positive effects in primary ($g=0.24$ [0.17; 0.32]) and secondary ($g=0.37$ [0.25; 0.48]) school teachers but no effect in kindergarten teachers ($g=-0.03$ [−0.55; 0.49]). Two subcategories—tested knowledge and use of inclusive teaching methods—were influenced by participant characteristics: The higher the mean age, the smaller the effect observed for tested knowledge ($F(1, 23)=8.50$, $p=0.01$, $B=-0.11$, $SE=0.04$), and the more the teachers reported having inclusive teaching

Table 2 Overview of moderator analyses in the outcome categories

Moderator	Knowledge			Skills			Beliefs			Student behavior		
	<i>F</i>	<i>df</i>	<i>p</i>	<i>F</i>	<i>df</i>	<i>p</i>	<i>F</i>	<i>df</i>	<i>p</i>	<i>F</i>	<i>df</i>	<i>p</i>
Study design												
Publication year	1.06	1, 86	.31	3.22	1, 368	.07	0.08	1, 458	.77	2.56	1, 200	.11
Years since legal anchoring	0.22	1, 86	.64	0.12	1, 368	.74	0.91	1, 458	.34	0.60	1, 200	.44
Intervention studies	3.73	1, 86	.06	8.13	1, 369	.005	0.04	1, 458	.84	0.16	1, 201	.69
Continent	0.67	6, 81	.68	1.03	8, 362	.41	1.60	8, 451	.12	2.27	4, 198	.06
Data collection												
Time between training and data-collection	0.38	1, 75	.54	1.63	1, 257	.20	0.41	1, 210	.52	2.72	1, 194	.10
Instrument Focus: diversity feature	6.57	1, 86	.01	0.00	1, 369	.95	6.21	1, 458	.01	1.08	1, 201	.30
Instrument focus: method	0.03	1, 86	.86	0.86	1, 369	.36	6.34	1, 458	.01	0.15	1, 201	.70
Instrument type	1.99	2, 85	.14	1.40	5, 365	.22	1.57	3, 456	.20	8.53	4, 198	< .001
Participant characteristics												
Mean age	1.66	1, 34	.21	0.84	1, 89	.36	0.03	1, 170	.87	0.07	1, 41	.79
Inclusive teaching experience	3.89	1, 39	.06	2.16	1, 214	.14	0.08	1, 281	.77	-	-	-
School type	0.57	3, 84	.64	1.57	3, 366	.20	2.66	3, 456	.048	2.58	3, 198	.06
Professional development												
Content focus	0.01	1, 75	.94	0.02	1, 257	.90	0.38	1, 210	.54	2.55	1, 194	.11
Active learning	0.00	1, 75	.98	7.84	1, 368	.005	2.14	1, 210	.15	0.02	1, 194	.90
Coherence	0.70	1, 75	.41	2.10	1, 368	.15	0.91	1, 210	.34	1.68	1, 194	.20
Duration	0.02	1, 75	.89	0.56	1, 245	.46	1.05	1, 209	.31	0.01	1, 188	.92
Collective participation	1.89	1, 75	.17	0.07	1, 257	.79	0.85	1, 210	.36	3.86	1, 194	.05
Certification	8.27	1, 75	.005	0.74	1, 257	.39	0.93	1, 209	.34	0.07	1, 194	.79

Degrees of freedom differ based on the information available in the studies

experience, the smaller were effects on the use of inclusive teaching methods ($F(1, 88) = 10.91, p = 0.001, B = -0.02, SE = 0.007$).

Moderator Analyses of Professional Development Design

Content focus did not influence any category of outcome variables, but it did influence a subcategory of student behavior: Changes in student achievement were positively influenced by higher content focus ($F(1, 90) = 5.66, p = 0.02, B = 0.25, SE = 0.11$). *Active learning* was a significant moderator for skills ($F(1, 368) = 7.84, p = 0.005$): Programs with more active learning opportunities reported larger effect sizes ($B = 0.11, SE = 0.04$). Specifically, the indicator alternating versus blocked design explained variance in effects sizes reflecting changes in the use of teaching methods ($F(1, 88) = 9.03, p = 0.004$), with larger changes reported in programs with alternating input and praxis phases ($g = 0.78 [0.57; 0.99]$) than in programs with a blocked design ($g = 0.03 [-0.40; 0.46]$).

Coherence with other learning activities had no influence, except for the subcategory changes in the perception of inclusive teaching methods were positively influenced by additional coherent learning activities ($F(1, 60) = 4.80, p = 0.03, B = 0.11, SE = 0.07$). Analyses of the indicators for coherence showed that programs requiring teachers to fulfill prerequisites for participation reported larger changes in the subcategories of perception of teaching methods ($g = 0.60 [0.33; 0.87], F(1, 59) = 13.58, p = 0.005$) and student achievement ($g = 0.71 [0.18; 1.24], F(1, 90) = 5.20, p = 0.03$) compared to programs that were open to all teachers ($g = 0.13 [0.02; 0.24], g = 0.25 [0.09; 0.42]$, respectively).

We limited the analyses on *duration* to programs lasting up to 200 h, representing about two-thirds of all effect sizes (64.6%), to reduce the influence of extreme programs due to large differences between them (range 2–750 h). Following this reduction, we did not observe influences of the duration of training programs on any of the outcome categories and subcategories (Table 2 and Supplement K-L). *Collective participation* did not influence any outcome category but negatively influenced the subcategory of student achievement ($F(1, 90) = 7.71, p = 0.01, B = -0.21, SE = 0.08$). When all school personnel participated, no effects on student achievement were observed ($g = 0.06 [-0.06; 0.17]$); however, small-to-moderate effects were observed when class teams participated ($g = 0.3 [0.1; 0.5]$) and moderate effects were noted when teachers participated with one colleague ($g = 0.66 [0.16; 1.15]$) and without colleagues ($g = 0.74 [0.1; 1.39]$). Studies offering *certification* after successful completion of the program observed larger effect sizes for knowledge gain ($g = 1.39 [1.07; 1.72]$) than did programs without certification ($g = 0.86 [0.65; 1.08]$), but this did not influence the other categories of outcome variables.

Study Quality

Study bias in the included studies was generally high ($M = 3.74, SD = 1.36, Min = 1, Max = 8.5$). Although moderation analysis of study bias indicated that study quality did not influence the observed effect sizes in the four outcome categories (all

$F < 1.4$, all $ps > 0.2$, see Supplement H), its influence was observed in the subcategories of self-rated knowledge ($F(1, 35) = 11.06$, $p = 0.002$, $B = -0.25$, $SE = 0.08$) and use of inclusive teaching methods ($F(1, 133) = 4.89$, $p = 0.03$, $B = -0.12$, $SE = 0.05$), where less risk of bias was related to smaller effect sizes.

Publication Bias

Regarding the presence of publication bias, visual analyses of the contour-enhanced funnel plots indicate that the individual effects are roughly symmetrical (see Supplement G, I, and J). Most fall within the 99% confidence interval, and outliers stem from published and unpublished studies. Egger regression tests suggested symmetry for the funnel plots for all outcome categories and subcategories (all $F < 1.3$, all $ps > 0.2$). The power-enhanced funnel plots (see Fig. 4) illustrate substantial differences in detecting the estimated effect sizes between studies. Moreover, a few studies with very low power were included, but these fall within the normal range of effect sizes. Most studies have low power, especially those assessing beliefs ($\text{med}_{\text{power}} = 21.5\%$) and student behavior ($\text{med}_{\text{power}} = 41.8\%$). Power in studies

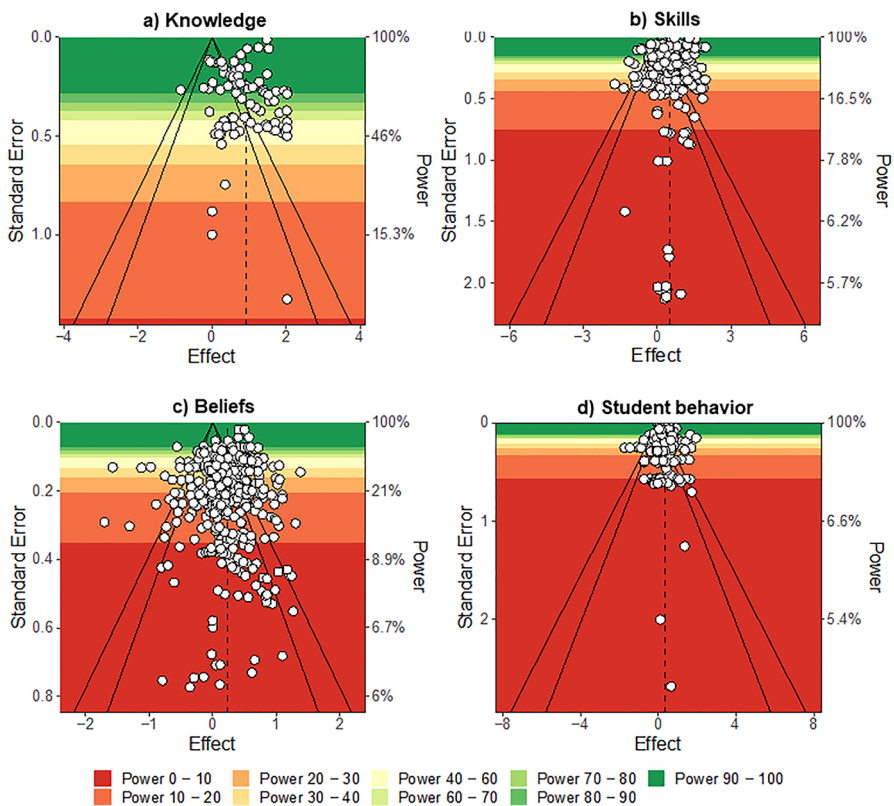


Fig. 4 Power-enhanced funnel plots

assessing skills was rather moderate ($\text{med}_{\text{power}}=69.2\%$) and sufficient in studies assessing knowledge ($\text{med}_{\text{power}}=90.2\%$). Publication status was an inconsequential predictor of knowledge ($F(1, 86)=0.88, p=0.35$) and skills ($F(1, 368)=2.07, p=0.15$), but it moderated effects on beliefs ($F(1, 457)=6.85, p=0.01$) and student behavior ($F(1, 200)=4.77, p=0.03$). Larger effects were reported in published studies (beliefs, $g=0.30$ [0.22; 0.38]; student behavior, $g=0.49$ [0.28; 0.71]) than in unpublished studies ($g=0.19$ [0.13; 0.24], $g=0.17$ [0.07; 0.28], respectively).

These methods suggest that publication bias is present, to a varying degree, in the current meta-analysis in outcome categories and subcategories. The analyses reveal that two typical sources of publication bias do not exert a large influence on the estimated effect sizes, as studies with small sample sizes and low power in this meta-analysis report effect sizes within the normal range. Because half of the included effect sizes stem from unpublished studies (53%), the risk of publication bias was reduced by design.

Discussion

This study aimed to investigate the effectiveness of professional development in supporting the implementation of inclusive education by in-service teachers and analyze design aspects of professional development programs in this regard. A comprehensive meta-analysis was conducted to investigate the effects of professional development on four categories of outcome variables. This meta-analysis is the first to consider different indicators for the effectiveness of professional development addressing inclusive education on both the teacher and student levels together because professional development aims to disseminate knowledge and skills to in-service teachers and help them develop positive attitudes toward the topic in order to improve students' behavior and school experiences (Desimone, 2009).

Through a systematic literature search in five databases, relevant journals, and conferences, we identified 342 studies from more than 50 countries across all continents that assessed the effects of professional development addressing inclusive education on at least one of the outcome variables on in-service teachers and reported quantitative data. As inclusive education is a complex field with varying indicators for good implementation depending on the context and focus, we included outcome variables that reflected the described outcome categories. In sum, we collected 1123 effect sizes spread via the four outcome categories of teachers' knowledge ($k=88$), skills ($k=371$), beliefs ($k=461$), and students' behavior ($k=203$). Overall, we observed the hypothesized positive influence of professional development participation on all four outcome variables. The expected larger effect sizes on the teacher-level outcomes compared to student-level outcomes were observed for teachers' knowledge and skills but not for teachers' beliefs. Contrary to our hypothesis, we observed larger effect sizes in intervention studies compared to cross-sectional studies only in teachers' skills, while no difference was observed in the other outcome categories. Regarding the design principles of professional development, we observed little support for the hypothesized larger effect sizes in programs fulfilling

more criteria of good design compared to programs fulfilling fewer criteria. These results will be discussed in detail in the following sections.

Does Professional Development Improve Teachers' Knowledge, Skills, Beliefs, and Students' Behavior?

The primary approach to improving teaching practices through professional development is disseminating information to in-service teachers. Our study reveals that professional development improves teachers' knowledge, as expressed by the large effect sizes ($g = 0.93$ [0.76; 1.1]). Knowledge gains were smaller among older teachers. This could be due to older teachers perhaps having more existing knowledge and therefore profit less from mere information dissemination or who may be less willing to engage with new information and practices (Saborit et al., 2016; Thomas, 2012).

In sum, assessments using knowledge tests reveal that teachers have more information about inclusive education, while assessments using self-reports show that teachers also perceive themselves as more knowledgeable when participating in professional development. Hence, concerns about the lack of knowledge, which teachers often consider an obstacle to implementing inclusive education, can be addressed via professional development programs.

Another goal of professional development is to improve teachers' skills, and our analysis reveals that professional development considerably improved teachers' skills ($g = 0.49$ [0.41; 0.56]). This finding is in line with Dignath et al. (2022), who observed a large effect ($d = 0.63$) but based their analysis on five studies that mainly included preservice teachers whose confidence in their teaching skills was still developing. Further, the smaller effect observed in the current study may be rooted in methodological issues. In contrast to Dignath and colleagues, the current meta-analysis included studies with control groups to adjust estimated effect sizes for typical developments. We also included unpublished studies and observed that published studies reported larger effect sizes for self-efficacy than unpublished ones, as expected, due to the tendency that positive, statistically significant findings and large effects are more often prioritized by researchers in peer-reviewed studies (i.e., file-drawer-effect, Rosenthal, 1979). Estimated effects in the current study can therefore be interpreted as more realistic. Our study reveals that professional development supports the self-perceived capability to implement inclusive education and actual execution, as implementation quality, variance in the use of teaching methods, and frequency in using evidence-based practices increased. However, improvement does not necessarily mean that the implementation was sufficient, and many practices still need to improve (Nilholm, 2021; Ramberg & Watkins, 2020).

Regarding teacher belief changes, we observed a small positive effect size ($g = 0.23$ [0.17; 0.28]). In detail, we observed this effect on attitudes toward inclusive education and perceptions of teaching methods, while concerns about inclusive education were not influenced by professional development. Professional development aims to provide teachers with information but does not impact the implementation in schools, whereas the hurdles against implementation being faced by teachers in

the schools themselves are often the main focus of teachers' concerns (Abakah et al., 2022; Sharma et al., 2018). Therefore, it is not surprising that concerns about inclusive education are not influenced by professional development. Teachers perceive many obstacles regarding implementing inclusive education; these concerns are likely to inhibit implementation intentions (Miesera et al., 2019) and should therefore be addressed in future programs. In general, changing beliefs requires much effort as it is expected to result from acquiring new knowledge and having positive experiences (Gregoire, 2003). However, the small effects observed for beliefs may also be due to the self-selection of participants in professional development and research, as these participants are expected to have somewhat positive beliefs about the topic of interest in the first place. When teachers had to fulfill specific criteria to participate in the program—usually having a child with a specific type of special educational needs in their classroom—changes regarding the perception of teaching methods were larger compared to programs open to all teachers. This supports the assumption that applying newly acquired knowledge and skills is relevant to change beliefs.

Teachers undergo professional development to improve students' behavior, academic performance, learning behavior, and school experiences. In the current study, we observed a small-to-moderate effect on students' behavior ($g = 0.37$ [0.23; 0.51]). Finding positive effects on the student level is in line with the meta-analysis by Brock and Carter (2017), who observed large effect sizes ($g = 1.08$). However, the programs investigated in the meta-analysis by Brock and Carter (2017) were more intensive than those in the current analysis. They included interventions with pre-service teachers, who are expected to benefit more from professional development programs as they cannot rely on teaching practice (e.g., Kimanen et al., 2019; Lautenbach & Heyder, 2019; Rumalutur & Kurniawati, 2019). In this study, we included different study designs and observed positive effects on students in all designs. Contrary to expectations, effects assessed with objective measures were larger than effects assessed via teacher reports or students' self-reports. This may be caused by teachers' problems in accurately and sensitively identifying changes in students' behavior while teaching that class.

How Should Professional Development Be Designed to Enhance Effectiveness?

Desimone (2009) identified five design criteria that affect the efficacy of professional development: content focus, coherence with other learning activities, opportunities for active learning, collective participation of teachers from one institution, and longer duration. Our study revealed little empirical support for these design criteria, echoing recent finding (Sims & Fletcher-Wood, 2021). Active learning was the only design principle with a significant influence on one outcome category, change in teachers' skills, while the other design principles merely influenced different sub-categories. We analyzed certification after completing the program as an additional design aspect. Not surprisingly, it was found to influence teachers' knowledge gains as people tend to concentrate more on learning provided information when receiving certification (Larsen et al., 2008).

However, the lack of support for these design principles should not be overstated, as descriptions of the programs were scarce. For example, when the description did not provide information on the content, we coded the program as addressing inclusive education in general, although this might not have been the case. Therefore, we expect that design of the programs has more influence on their effectiveness than observed in our study. Further, we lack data from short-term programs, most commonly offered to in-service teachers but rarely addressed by research. Intervention studies primarily focus on assessing the effects of intensive programs, and our moderator analyses are therefore limited to identifying aspects that enhance efficacy within such programs. This might explain the lack of support for influences of program duration. However, we observed some design features that may improve the programs' efficacy:

Although content focus did not influence data on the overall student level, we observed that when the topic addressed in the programs was more specific, students' achievement improved. Coherence with other learning activities improved teachers' perception of inclusive teaching methods. When teachers had to fulfill specific criteria to participate in the program, larger effect sizes were observed in students' achievement. These prerequisites mainly involved teachers having at least one child in their classroom with specific special educational needs addressed in the program. This indicates that teachers apply learned content more easily when they can relate the provided information to their classroom and are probably more motivated because these teachers come with specific questions and needs.

Providing more opportunities for active learning positively affected change in teachers' skills particularly in their use of inclusive teaching methods. The opportunities to apply newly learned content and methods seem to support the development of teaching skills. This effect was influenced by designing the program as a blocked session or alternating input and praxis phases. Skills in general and their use of inclusive teaching methods, in particular, improved when teachers attempted new methods in their classroom, reflected on their process, and received feedback in the next session. This supports the finding of Brock and Carter (2017), who observed that implementation quality improved, especially when teachers had a chance to observe modeling and receive performance feedback.

In our study, collective participation hurt students' achievement. The more teachers from one school participated, the smaller the positive effect on students' achievement. We attribute this to the fact that more teachers are required to participate in the program unlike single participation, which is mainly based on teachers' willingness to do so. This indicates that forcing teachers to participate in professional development can undermine positive changes. It has also been shown that attitudes can be contagious among colleagues (Pedaste et al., 2021). Hence, negative attitudes toward professional development can spread within the collegiate and undermine the implementation intentions of individual teachers.

In summary, intensive professional development programs positively influence teachers' knowledge, skills, and beliefs, as well as students' behavior. The present analysis also provides directions for the design of future professional development programs: Since we assume that effects at the student level occur through improved teaching practices, we suggest providing opportunities for active learning, especially

designing it with alternating input and practical phases. According to our data, asking participating teachers to think of specific students they seek to support can also enhance learning effects.

Limitations

About two-thirds of the integrated works considered in this review were intervention studies. With a median duration of 3 months, the professional development programs investigated in those studies were relatively intensive to programs usually offered to teachers (Cramer et al., 2019). As we expect the intensity of programs to enhance effectiveness, the effect sizes estimated in this study may have overestimated the true effects of professional development. Further, intervention studies tend to measure the program's effects shortly after its end, reflected in a median of zero weeks between the end of the program and post-evaluation. We observed significant positive effects of professional development in both intervention and cross-sectional studies. Differences were observed only for the category of teachers' skills, although we calculated moderate effect sizes for both. Hence, the estimated effects exist but may be overestimated.

Previous reviews investigating the effect of professional development with regard to inclusive education limited their inclusion criteria to one study design. For example, randomized controlled trials, as investigated by Brock and Carter (2017), are more often applied in intensive professional development programs, while more expensive evaluations are applied for expensive programs. Dignath et al. (2022) only included single-group studies whose effects can be overestimated as there is no chance to control for natural development. This assumption is supported by our analyses, as intervention studies tended to report larger effect sizes than did cross-sectional studies, especially single-group studies. Therefore, we chose to include different study designs to not only investigate differences in reported effect sizes but also balance strengths and weaknesses. As mentioned, our analyses indicated significant positive effects for all study designs.

Overestimation of effects can also be rooted in publication bias. As more than half of the included literature was unpublished, the risk of publication bias for our meta-analysis was reduced by design. We did not discover notable indications for the presence of publication bias. The difference between published and unpublished studies was substantiated, yet again confirming the file-drawer effect (Rosenthal, 1979). We observed low power among many included studies. Against assumptions based on publication bias, the effects reported in studies with very low power lay within the range of the remaining studies and reported small effect sizes. Therefore, studies with low power did not inflate the estimated effects. Still, the small number of studies with large power was disappointing.

Implications for Future Research

Concerning the significance of supporting teachers in implementing a more inclusive school system, the results reveal that professional development is a helpful

building block. However, teachers need more support and adapted school frameworks to achieve satisfactory implementation. Moreover, to assess the effectiveness of short-term events commonly offered as professional development, more data from these kinds of programs and their long-term effects are needed. Researchers should not only focus on intensive programs but also investigate real-life learning opportunities for teachers.

Based on our work, we highly recommend that researchers consider statistical power when planning a study. When assessing beliefs or other self-reported variables, we recommend using instruments that generate imaginations of concrete situations, such as including a child with ADHD in the classroom, to reduce the influence of socially desired response behavior. To improve transparency and replicability, providing a more detailed description of the professional development programs and making learning materials easily available are essential, as it would allow more detailed analyses of the program design.

Our study observed positive effects on all outcome categories and subcategories but on concerns about inclusive education. These could not be addressed adequately in such programs. However, since worries are a barrier to implementation and are communicated by teachers, researchers and trainers should examine how to reduce concerns in professional development.

Conclusion

Our study investigated the effectiveness of professional development to improve the implementation of inclusive education, revealing that professional development is a promising strategy to improve not only teachers' knowledge, skills, and beliefs but also students' behavior. This review is the first to investigate the effects of professional development on the teacher and student levels simultaneously. Compared to previous studies, we applied a comprehensive literature search considering different characteristics of professional development programs and research practices, which allowed us to identify a vast number of effect sizes in all four outcome categories and estimate small confidence intervals, reiterating the positive influence of professional development addressing inclusive education. Our analyses show that, in particular, knowledge transfer is effective via professional development. The study findings align with previous reviews and provide new insights regarding the design aspects of professional development programs. The analyses reveal that in-service teachers can and should be supported via professional development to improve their implementation of inclusive education.

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Data Availability Data and code are available via OSF (<https://osf.io/chjc/3>).

Declarations

Conflict of Interest The authors declare no competing interest.

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5.2 Study 2

Donath, J. L., Lüke, T., Tran, U. S., Botes, E. & Götz, T. (2025). The transfer of teacher training to inclusive classroom practice: A meta-analytic SEM approach (submitted). *Educational Psychology Review*.

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Note

The study was preregistered via OSF (<https://osf.io/cgm2p>). Data and supplementary material are available via OSF (<https://osf.io/x3cdq/>)

The Transfer of Teacher Training to Inclusive Classroom Practice: A Meta-analytic SEM Approach

Abstract

Teachers need support to implement inclusive education efficiently, and teacher training is the key to cost-effectively providing this support. However, while education research has established theories on student learning, there is still a lack of understanding regarding how teachers learn and integrate new ideas, making it essential to investigate the transfer process to improve the implementation of school reforms. The many overlapping theories on teachers' learning in in-service training from the literature have been summarized here in five models. These five models were tested regarding their fit to empirical data in secondary analyses using meta-analytic SEM. The literature search revealed 228 studies that fit the inclusion criteria with 244 samples and 117,609 participating teachers and students. Only one model had an acceptable model fit. This model is earmarked by the assumption that teacher training affects willingness to change, which affects the subsequent transfer process. Further research should be theory-based, testing theories using primary data, particularly on willingness to change.

Keywords: inclusive education, teacher training, MASEM, learning transfer, transfer theories

The Transfer of Teacher Training to Inclusive Classroom Practice: A Meta-analytic SEM Approach

Inclusive education (IE), digitalization, data-based decision-making, and large language models—schools are constantly confronted with political reforms, technological developments, and similar societal changes that require adjustments in their organization and daily practice. However, it is not a given that principals and teachers necessarily implement these reforms and changes and that the systemic changes result in improvements for students. Therefore, investing in processes of implementing change in school environments is important to close the ‘implementation gap’ (Gouëdard et al., 2020). Teachers play a central role in realizing school reforms as they engage with the content of these programs and the school and classroom environments where these programs are expected to be implemented. In such contexts, teachers’ agency is situated within complex, multi-dimensional, and multi-level work environments (Imants & Van der Wal, 2020). The principal tool to support teachers in this highly demanding change process is to offer training (Popova et al., 2022; Scott et al., 2024), however, understanding the effectiveness of training and the mechanisms through which knowledge is transferred and learning occurs is opaque, with many competing theories found in the literature. To effectively research teacher training, developing a concept of how learning and transfer processes occur in this highly complex environment is essential (Kennedy, 2016). This study aims to collect and summarize existing theories of learning transfer in this context and test these theories using empirical data.

Inclusive education

IE refers to a school reform and a teaching approach that impacts all aspects of school life, affecting the entire school environment and individual classrooms. Educating all students together and considering the needs of all learners involves all educational staff and goes far beyond simply adding a new method or tool; it fundamentally alters the approach to teaching and learning (Suprayogi et al., 2017). This reform is the subject of global discourse (Somma, 2020) and is particularly challenging as it affects the entire school framework and requires profound, systemic changes. It is not a matter of teachers deciding whether to use a particular tool. Instead, the way teachers implement IE influences the learning of all students. Therefore, well-trained teachers are crucial—not only for students with special needs but for all students—since implementing IE ultimately impacts the entire school climate and the learning process.

Teacher training for school reforms

Effective schools impart cultural skills and social competencies to students to enable all students to live self-determined and independent lives. To get closer to this goal and adapt school education to social changes, school reforms are decided at the political level to initiate widespread change. They are to be implemented by teachers at the local schools. For successful implementation, teachers must be well-informed about these reforms, have acquired the necessary skills, and have positive beliefs regarding this school reform (Bransford et al., 2005; Lipowsky & Rzejak, 2015). This is to be achieved by addressing the training of prospective teachers and—even more relevant in terms of numbers—by offering further training for in-service teachers to familiarize them with the reforms (Doppelt et al., 2009; Popova et al., 2022). Unfortunately, providing teachers with information about the current reform is not enough effort to sufficiently address the implementation gap (Copur-Gencturk & Papakonstantinou, 2016; Cohen & Mehta, 2017) with many training programs reporting little to no improvements in teachers and students (e.g., Loyalka et al., 2019; Cohen & Hill, 2000; Scott et al., 2024). However, some studies did find that training efforts can be successful in bringing about change (Chalmers & Gardiner, 2015; Donath et al., 2023).

To create effective training programs, it is important to identify design characteristics that enhance the effectiveness of training programs and to know how the transfer of learning proceeds from training to students' achievement improvements (Clarke & Hollingsworth, 2002). Although training designs can differ widely (Cramer et al., 2019) and many training programs do not fulfill the criteria for effectiveness (Popova et al., 2022), it has been shown that training participation, in general, can bring about development in the desired direction, in teachers as well as in their students (Didion et al., 2019; Donath et al., 2023). However, teacher training evaluation is usually investigated only at the teacher level (i.e., assessing teachers' knowledge and skill acquisition; Dreer et al., 2017) and assumes successful transfer later (Dunst et al., 2015). This may be due to the difficulties in evaluating transfer in individual classrooms, as teachers usually work alone in front of the class, and implementation can be highly individualized and may unfold later on (Sasson & Miedijenski, 2020). Nevertheless, one should refrain from assuming that successful implementation can be achieved through mere participation in training courses (Darling-Hammond et al., 2009; Doherty, 2011). The design, as well as the effectiveness, of teacher training has been observed to vary much more than in education programs in other contexts (Evans & Popova, 2016; McEwan, 2015), and yet the general recognition of the importance of teacher training is not questioned (Kennedy, 2016). In a longitudinal study, Doherty (2011) observed that most

participating teachers did not apply what they had learned in the training. These transfer processes require time for teachers to deepen their understanding of reform practices (Guskey & Yoon, 2009). This necessitates a closer look into the transfer processes from information acquisition to improvements in students' school experiences (Florian & Camedda, 2020; Castillo et al., 2018).

Furthermore, teacher trainings are typically held for groups of teachers to reduce costs, enable exchange between in-service teachers, and spread coherent information to many individual teachers (Darling-Hammond et al., 2017). Although there are some similarities with students' learning in schools, as one person with expertise usually teaches groups of learners, it is inappropriate to apply learning theories from school contexts to professional teachers' learning and change processes (Kennedy, 2016). Due to their expertise in the professional field and, in particular, their personal responsibility for the learning process and individualized implementation (Moon, 2004), fundamentally different demands are placed on the learners. Therefore, it is important to closely examine the description of learning and transfer processes in models addressing professional training.

Models of learning in teacher training

Numerous theories describe the transfer processes from (teacher) training to reform implementation (Desimone, 2023), with no widely accepted framework available (Nimante et al., 2025). Some attempts have been made to describe overarching frameworks to study professional training (e.g., Darling-Hammond et al., 2017; Desimone, 2009; Kennedy, 2005; Sims et al., 2023; Timperley et al., 2008), but these are often only concerned with the design and circumstances of the training. Lists of effective design features can be helpful when designing a training program; following the logic of providing a good product will automatically lead to good outcomes (Opfer & Pedder, 2011). However, focusing on structural features, such as a specific number of hours, can distract from identifying the relevant learning processes and how to best support them (Sztajn et al., 2011).

Among theoretical considerations on professional learning in in-service training, there is consensus that external and internal factors influence the learning process. These include personal predispositions, such as intelligence and learning motivation, and contextual conditions, such as the design of professional development programs and the provision of external support in the learning process (Nimante et al., 2025). This support encompasses spatial and material conditions within the school, the role of school leadership, collaboration among staff, and other school resources. However, theories differ in whether and how they incorporate these factors into their models (Desimone, 2023). Furthermore, researchers have

often argued that efforts for school reform are continuous processes (e.g., Clarke & Hollingsworth, 2002; Imants & Van der Wal, 2020; Shulman & Shulman, 2004), assuming a cyclical pattern where the individual learning steps are mutually influencing one another (Imants & Van der Wal, 2020). This assumption is supported by the study of Shaha et al. (2015), who found that repeated participation in teacher training has increasing positive effects on students' learning behavior.

Existing theories differ in the number of steps involved in the transfer process and the directional influence of these steps (Boylan et al., 2018; Kennedy, 2016; Sims et al., 2023), as there is a tendency to increasingly delineate the indicators in transfer theories and to analyze increasingly finer stages in the learning process. Although numerous studies have employed professional learning models to explore how teacher change occurs within their contexts, often selecting models that require comparably little effort in the evaluation process focusing on change in teachers (Desimone, 2023; Kowalski et al., 2020), only a few have specifically focused on investigating the process of change transfer itself as a central research topic (Strang, 2022). Furthermore, many studies evaluating the effects of teacher training do not use transfer models to assess teacher change (Ahadi et al., 2024; Basma & Savage, 2023). There is a broad consensus that a comprehensive theory describing professional learning processes and their application remains lacking (Nimante et al., 2025; Basma & Savage, 2023; Boylan et al., 2023). The following section will describe five typical models of the learning and transfer process.

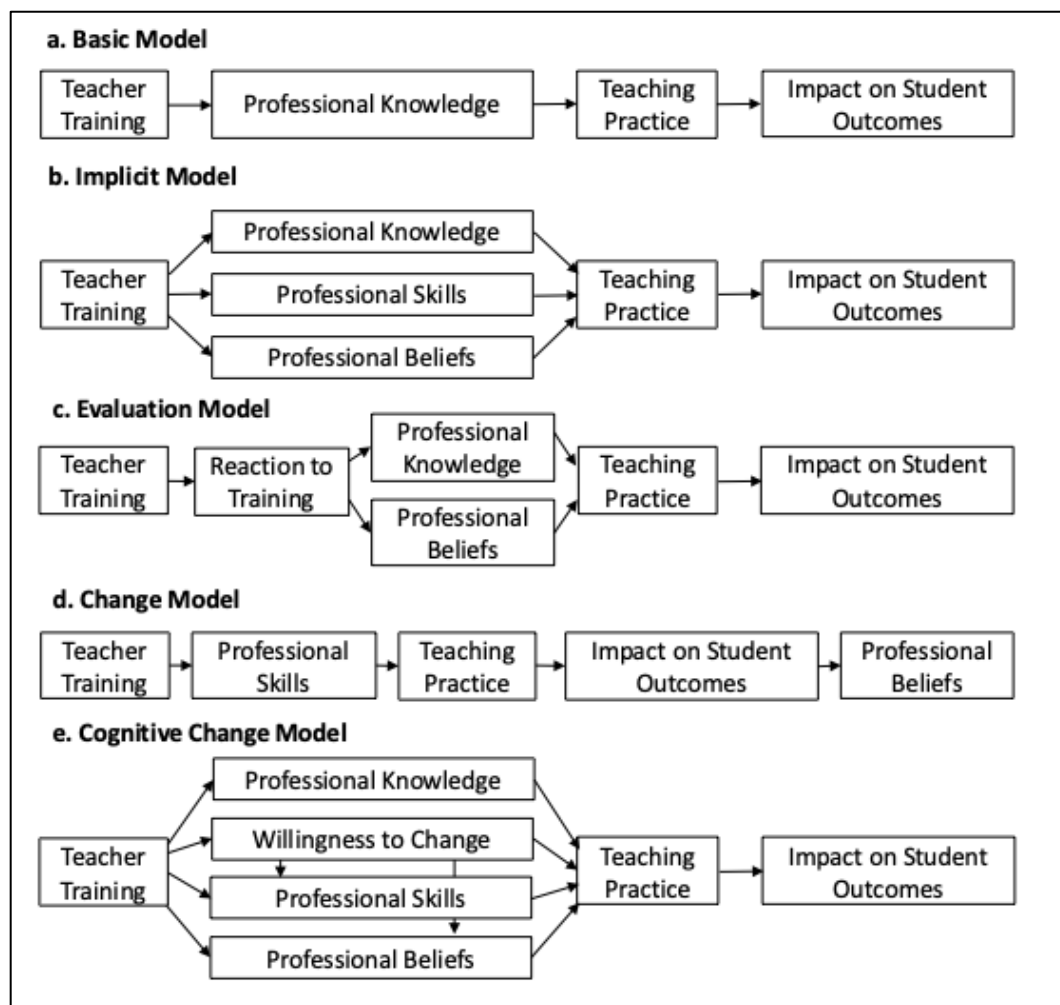
Basic Model

The simplest transfer models assume that knowledge acquisition changes classroom practices, improving students' learning outcomes (e.g., Baldwin & Ford, 1988; Koehler & Lieberman & Miller, 1990; Mishra, 2009; Meiers & Ingvarson, 2005; see Figure 1A). According to this assumption, knowledge transfer reflects learning effectiveness and implies successfully applying the acquired knowledge (Baldwin & Ford, 1988; Ignatavicius & Chung, 2016). This model is advantageous in its simplicity. One example of this kind of model is the technological pedagogical content knowledge model (TPACK; Koehler & Mishra, 2009), which is commonly applied in the context of teacher training regarding digitalization. It mainly describes relevant knowledge structures but ignores the subsequent transfer process. Being informed about the reform practices is an important step for implementation. Still, even though teachers had heard about the positive effects and were more knowledgeable after the training, many never end up putting what they had learned into practice (Doherty, 2011; Hargreaves, 2005), thus having little impact on students'

achievement (Randel et al., 2016). Since knowledge acquisition does not seem sufficient to explain learning transfer, transfer models should include further links between knowledge and teaching practice (Osman & Warner, 2020).

Figure 1

Five Models of learning transfer from teacher training to the classroom



Implicit Model

The following more complex models assume that training not only impacts teachers' professional knowledge acquisition but also affects the skills and beliefs of teachers regarding the reform (e.g., Blume et al., 2010; Clarke & Hollingsworth, 2002; Desimone, 2009; Egert et al., 2018; Wißhak, 2022; see Figure 1B). These changes in teachers' knowledge, skills, and beliefs trigger changes in teaching practices, resulting in positive effects on students (Clarke & Hollingsworth, 2002; Desimone, 2009; Egert et al., 2018). Often, researchers do not use previously described learning models but use models that fit intuitively into the current training program to be evaluated (e.g., Egert et al., 2018). Therefore, this kind of model is called an Implicit Model (Clarke & Hollingsworth, 2002) and is most commonly applied in

evaluation research (Sancar et al., 2021). It aligns with findings from studies showing that training also impacts teachers' professional skills and beliefs (e.g., Donath et al., 2023) and mere knowledge about a new teaching approach is not enough to bring about changes in teaching practices (Cohen et al., 2020; Cohen & Wiseman, 2019). However, empirical studies debate whether correlations exist between changes in professional skills and beliefs and changes in teaching practices (Boeve-de Pauw et al., 2022; Boyle et al., 2020; Castillo et al., 2018; Wu, 2021).

Evaluation Model

Another type of transfer model commonly described and applied in training evaluation assumes that teachers' engagement in the learning process is mainly influenced by their perception of the training program (Kirkpatrick & Kirkpatrick, 2006; Lipowsky, 2010; Moore et al., 2009; Wade, 1985; see Figure 1C). Indeed, satisfaction with the training is associated with self-efficacy regarding implementation and predicting changes in practice, although with small effect sizes (Rutherford et al., 2017). However, other studies could not find predictive associations between teachers' training satisfaction and knowledge gain (Goldschmidt & Phelps, 2007; Alliger et al., 1997). When applying this kind of transfer model, researchers often limit themselves to the first steps of this model (Steele et al., 2016), investigating the training effect solely focusing on teachers' opinion of the training program and self-perceived gains on professional knowledge (Cahapay, 2021).

Change Model

Change Models (e.g., Guskey, 2002; Gregoire, 2003; Cobb et al., 1990; Fogaca et al., 2024) focus on the transfer process to the classroom rather than what is learned within the training. They assume that professional skills are acquired in training, enabling the implementation of reform practices, and observing positive impacts on students can enable changes in teachers' professional beliefs (Guskey, 2002; see Figure 1D). Since belief change assessed directly after the training has seldom been a good predictor for actual change in teaching practice (Doherty, 2011; Jones & Hayes, 1980; Strang, 2022), Change Models refrain from the assumption that first teachers' professional beliefs need to be changed in order to enable change in teaching practice (Joyce, 1987; Ewing et al., 2018). The key point is that it is not the training itself but rather the experience of successfully implementing new practices that influence teachers' attitudes and beliefs (Guskey, 2002). Moreover, beliefs about teaching are shaped mainly by classroom experience and work as an incentive for continuing with the changed practice (Meiers & Ingvarson, 2005). Several studies empirically support Change Models (Voelkel & Chrispeels, 2017; Zambak et al., 2017). For example, training

programs could predict teacher knowledge and practice changes but not attitudes (Strang, 2022).

Cognitive Change Model

One component often mentioned as crucial for the learning and transfer process in teacher training is teachers' motivation for learning (Grohmann et al., 2014; Reinhold et al., 2018). Although it is commonly mentioned as a prerequisite to the learning process and not as a component of the learning process that can be influenced through participation in teacher training (Scott et al., 2024), a growing number of researchers has proposed that teachers' willingness to change, as opposed to their learning motivation, should be included in transfer models for teacher training as a link between knowledge acquisition and implementation (Wu, 2021; Herawati et al., 2022; Osman & Warner, 2020; Scott et al., 2024). One possible explanation for the lack of transfer in teacher training may also be that it fails to awaken participants' motivation to engage in change processes (Sims et al., 2023). Kennedy (2016) describes that this motivation can be activated through provocative questions that require deep reflection on one's behavior, creating 'aha' moments that can influence teachers' in-the-moment decisions. Models reflecting this call will be referred to as 'Cognitive Change Models' (CCM; e.g., Azazitur et al., 2021; Gregoire, 2003; Kennedy, 2016; Lipowsky & Rzejak, 2015; Sims et al., 2023; see Figure 1E). These models assume that teacher training can enhance teachers' willingness to change and professional knowledge through provoking aha moments and supporting changes in professional skills and beliefs. Changes in teaching practices triggered by this approach can improve student outcomes. Support for this model can be found in recent studies showing that readiness for change is a significant predictor for teachers' change in teaching practices (Azazitur et al., 2021) and attitudes (Akin-Sabuncu & Calik, 2023). Accordingly, teacher trainings with compulsory participation, a practice that reduces or even ignores teachers' motivation to engage in change processes, reported lower effect sizes (Donath et al., 2023; Kennedy, 2016).

Research question

Teachers need to be supported to continue improving their teaching practices, and when asked to implement school reforms, this support should be provided efficiently. Teacher training is important to provide this support cost-efficiently to teachers. In order to investigate the effectiveness of teacher training, it is important to be aware of relevant steps in the learning and transfer process. Education research has established strong theories on student learning. However, a lack of a well-developed understanding of how teachers learn and how they can effectively integrate new ideas into their teaching practices still remains (Kennedy,

2016). Currently, there is a consensus in models on learning transfer that teachers need to acquire knowledge in order to be able to change their current way of practice and enable improvements on the student level (Boylan et al., 2018; Nimante et al., 2025). In addition to this very simple model, numerous models include additional elements and describe them as relevant, differing in the number of elements described, the number of steps, and the sequence in which the elements influence one another. A discussion about the existing theoretical foundation of teacher training is needed to improve and systematize research in this field (Nimante et al., 2025). However, no empirical synthesis of transfer theories has been conducted (Blume et al., 2022). In order to design training evaluations effectively, it should be investigated if more detailed descriptions of learning processes provide added value and which indicators can be identified as most predictive for the transfer process. To address this research gap, the current study aims to test if the described models differ in their predictive value of data on teacher training for school reform.

The current study used secondary data to apply meta-analytic structural equation modeling (MASEM). MASEM refers to applying structural equation models (SEM) on meta-analytic data using correlation matrices and allows for investigating complex hypotheses using secondary data analysis (Bergh et al., 2016). This method allows for combining results from multiple primary studies to increase statistical power and generalizability and further facilitate testing complex theoretical models that are challenging to assess in individual studies. Investigating learning and transfer processes in the context of teacher training with meta-analysis is also more general than looking into one specific training program alone. Since teacher trainings can be designed in very different ways, meta-analysis can further investigate whether features of the training design influence the transfer process. MASEM further allows testing the explanatory value of different theoretical models by comparing competing models (Bergh et al., 2016). This is what was done in the present study, which investigated which of the five models of learning in teacher training (Figure 1) had the best fit on the available accumulated data.

Methods

The systematic literature search, screening and selection of studies as well as the data collection followed the PRISMA guidelines (Salameh et al., 2020).

Literature search

The data collection process was based on a previous study (Donath et al., 2023). The systematic literature search used the same databases and search terms but different study

inclusion criteria. The databases PsycINFO, Web of Knowledge, and ProQuest (ERIC, Education Research Complete, Dissertation & Thesis) were searched using the following search terms: inclusion OR inclusive education OR inclusive classroom AND professional development OR teacher training OR workshop OR teacher education AND teacher OR pedagogical staff OR pedagogical personnel OR teaching assistant OR educators AND school OR K-12 OR kindergarten OR preschool OR vocational college (for more detailed information see Supplement C). To reduce the risk of publication bias, unpublished studies were included intentionally. The first literature search was done in April 2021, revealing 12,050 search results after removing duplicates, and updated in July 2024, adding 2,176 records after removing duplicates. In sum, 14,226 records were screened.

Dependent variables

For the above-described theoretical models (Figure 1), seven relevant dependent variables were identified. These variables had in common that teacher training should influence them in some way or another for a successful transfer process. Since the operationalization of these variables could vary, especially in field studies, eligibility criteria for the measures of all these variables were set (for additional information, see Supplement C). To be included, teachers' knowledge needed to be assessed via knowledge tests or self-reports, and teachers' skills via the assessment of self-efficacy for IE or perceived competence. Eligible measures of teaching practices assessed either the implementation quality or the use of inclusive teaching methods via self-reports, in-person observations (time sampling or quality ratings), or student ratings. Teachers' beliefs regarding IE (general attitudes towards IE and perceptions of inclusive teaching methods), willingness to change (motivation to engage in change processes towards IE), and satisfaction with the training were always based on self-reports. Measures on the student level could reflect either the students' achievement or behavior. Student achievement needed to be assessed using standardized tests, performance in tasks given by the teacher, or meeting the individual education plan goals. Assessments of students' behavior needed to be based on students' self-reports, teacher reports, or observational measures assessing on-task behavior and engagement in classroom tasks, attendance in school, challenging behaviors and supportive behavior towards other students.

Inclusion criteria

Studies had to fulfill the following criteria to be included in the analysis: Studies had to (1) report data on teacher training for IE of (2) teachers and/or their students with (3) quantitative measures, (4) either in cross-sectional designs, longitudinal within-group (pre vs.

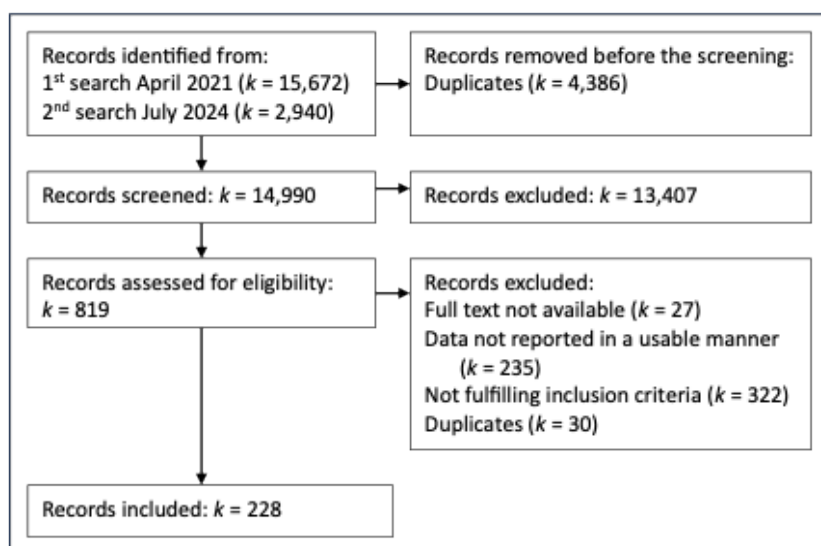
post) change designs, or in comparisons with a control group. Studies had to (5) provide data on at least two of the following variables: teacher knowledge, skills for IE, teaching practices, beliefs regarding IE, willingness to change, satisfaction with the program, and student achievement and learning behavior.

Studies were excluded when the teacher training was solely based on coaching (i.e., one-on-one training of teachers). Studies comparing special with general education teachers were excluded because the current study was interested in teacher training on IE and not in comparing the two main professions involved in implementing IE in schools. When results were reported in more than one publication, the publication with the more detailed information was included in the analysis (e.g., Kuok et al., 2022; Yada et al., 2018). Further, if data from one study was split across several publications, and it was clear data stemmed from the same study, the data from the various publications were summarized and treated as one study in analysis (see Supplement E).

To ensure the reliability of the screening process, two raters independently screened a sample of 500 abstracts. Disagreements regarding the inclusion or exclusion of studies were resolved through discussion and consensus. Inter-rater reliability was assessed using Krippendorff's alpha (2011), indicating a high agreement between the raters ($\alpha = 0.907$). Eight hundred nineteen records were assessed for eligibility after the screening. Of these, 30 were excluded because the data were already reported elsewhere, 27 because the full text was unavailable, data were not reported in a usable manner in 235 records, and 322 did not fulfill the inclusion criteria when looking at the full text. In sum, 228 studies were included in the analysis (see Figure 2).

Figure 2

PRISMA Flowchart representing study selection



Coding

For a transparent coding process, a shortened version of the coding handbook from Donath et al. (2023) was used (see Supplement A). The publications selected during the screening process were subsequently coded according to various characteristics, including the source of information (publication type, country), study design (sample size, sampling method, allocation to conditions, attrition, conduct with missing data), participant characteristics (profession, experience with IE, school type), the design of the teacher training (duration, topics covered, practice opportunities, certification received, participation with colleagues), obtained results (data collection method, instrument, analysis approach), and the intercorrelations of various outcome measures (teachers' knowledge, self-efficacy, teaching practices, beliefs, willingness to change, satisfaction with teacher training, student achievement and behavior).

When several samples were reported in one study, all samples fulfilling the inclusion criteria were included. Samples were used as the unit of analysis in the present study as the effect size metric Pearson's r was used to quantify the associations between training, teachers' knowledge, self-efficacy, teaching practice, professional beliefs, willingness to change, satisfaction with the training and students' achievement and behavior. When correlations were not reported, but other data were available on relations between variables of interest, the R package *esc* (Lüdtke, 2019) was used to calculate the effect size in the required metric. For publications after 2010, authors were contacted when data of interest were not reported. In sum, 76 authors were contacted; 18 responded, and 14 provided the missing data.

To evaluate risk of bias in individual studies, we modified the Medical Education Research Study Quality Instrument (MERSQI; Reed et al., 2007) for use in the present meta-analysis (see Supplement B). The MERSQI was chosen because of its reported high inter-rater reliability. Our adapted version included an assessment of the following aspects: (1) study design, (2) response rate, (3) sampling method, (4) allocation to conditions, (5) use of standardized instruments, (6) internal structure of the instrument, and (7) reporting of missing data handling (see Supplement C).

Analysis

First, descriptive statistics regarding the number of extracted correlations and the characteristics of included studies were created. Second, potential moderators (study quality, study design, participants) were analyzed regarding their influence on the reported effect sizes using meta-regression. Further, we analyzed the potential influence of publication bias. This is described in more detail below. Third, MASEM was used to test the theoretical models

(Figure 1), applying random-effects one-stage MASEM (Jak & Cheung, 2020). It offers a streamlined and integrated approach to simultaneously synthesize effect sizes and test structural models, making it particularly useful for complex datasets or heterogeneous studies. Random-effects modeling was chosen to account for expected between-study heterogeneity because of the variety in sample characteristics and training designs of included studies. Further, one-stage MASEM can deal with missing data in the correlation matrices using full information maximum-likelihood (FIML), which is the case in the presently included set of studies. One-stage MASEM is applied to the pooled correlation matrix of all correlations reported in the primary studies. A separate pooled correlation matrix therefore was calculated for each theoretical model (Figure 1), as studies differed in the number of reported correlations and could not be used for each model but only for models for which they provided at least one of the required associations (see Supplement F). To enhance the comparability of model calculations, the analyses are repeated using a dataset that allows for the computation of all models. Additionally, as study design and study quality can also influence effect sizes, the analyses are repeated using only data from studies with randomized or quasi-experimental assignment to conditions (RCTs and quasi-experimental controlled trials). Model fit was evaluated as acceptable/good when CFI and TLI were higher than 0.9/0.95, RMSEA smaller than 0.06, and SRMR smaller than 0.1 (Hu & Bentler, 1999). The MASEM analyses were conducted using WebMASEM (Jak et al., 2021). In the path models standardized path coefficients are reported. Effect sizes of $r = 0.1$ were interpreted as small effects, $r = 0.3$ as medium effects and $r = 0.5$ as large effects (Cohen, 1988).

Publication Bias

Several methods were applied to evaluate risk of publication bias, as suggested in the literature (Rothstein et al., 2005; Siegel et al., 2021) and since there is no well-established way to detect publication bias in MASEM (Cheung, 2014). To reduce publication bias in the first place, unpublished studies were intentionally included in the present study, and moderator analyses were conducted to investigate potential differences between published and unpublished studies. Although correlational meta-analysis is relatively robust against the effects of publication bias (Chow & Ekholm, 2018), Egger's regression tests and funnel plot analyses were conducted with the data from published studies to assess potential bias. For these analyses, dependencies among effect sizes from one sample were accounted for using multilevel models to calculate Eggers' regression test (Fenández-Castilla et al., 2021) and create the funnel plots. In Egger's regression test, the standard errors of the effect sizes served as the predictor variable, and the tests examined the relationship between effect sizes from

each study and their corresponding standard errors to test for small-study effects. Power-enhanced funnel plots (Kossmeier et al., 2020) were used to inspect potential asymmetry in the effect size distribution visually and to obtain information on the power of the individual studies to detect the presence of effects.

Results

Description of included studies

The literature search revealed 228 studies that fit the inclusion criteria (see Supplement D), reporting data on 244 samples and providing 1084 effect sizes. Sixty two percent ($k = 142$) of the included studies were journal articles, and the remaining studies were unpublished dissertations ($k = 72$), project reports ($k = 7$), conference proceedings ($k = 6$), and preprints ($k = 1$; see Table 1). The majority of studies were conducted in North America ($k = 109$; 47.6%), followed by Asia ($k = 48$) and Europe ($k = 39$). In total, 61,766 teachers participated in the study and 55,843 students, of which 21% had the diversity feature of interest in the individual studies. Regarding the study design, most studies had a cross-sectional design ($k = 111$). Seventy-one studies investigated pre/post changes in intervention groups and 46 compared intervention and control groups (19 provided only data after the intervention). Eighteen studies allocated teacher participants randomly, and 36 studies allocated them quasi-experimentally to the conditions. The sampling of participants was done with random sampling in 23 studies, clustered sampling in 66 studies, purposive sampling in 55 studies (training open only for teachers who, for example, had a student with ASD in their classroom), and convenience sampling in 84 studies. Regarding the profession of the participating teachers, 74.7% were general education teachers, 8% were special education teachers, 6% were administrators, 1.4% were teaching assistants, and 9% were pre-service teachers. 77% of the participating teachers had experience with IE, and 74% were teaching in an inclusive classroom. Twenty-four studies were conducted in kindergarten, 71 in primary school, and 45 in secondary school. The remaining 88 studies did not indicate information regarding the school type. Fifty-nine percent of the intervention studies with pre-post designs reported information on teachers' attrition with an average of 10% dropout (range = 0-56.67%) and 64% on students' attrition with an average of 6.8% dropout (range = 0-44.9%).

Most studies focused on special educational needs (SEN; $k = 189$); among these, 51 addressed one type of SEN specifically. Twenty-seven studies focused on other diversity features, mainly at-risk students ($k = 6$), second language learners ($k = 6$), and LGBTQ ($k = 5$), and 13 studies addressed the presence of several diversity features together. Twenty

percent of the training programs investigated in intervention studies addressed IE in general, while 93 studies addressed a more specific topic (e.g., Universal Design for Learning in science class, promoting physical activity to students with ASD). In addition, 23 training sessions addressed IE within specific school subjects, while the remaining training sessions were open to all teachers. Most training programs ($k = 85$) were spread across several weeks, with practice phases in their classrooms between training sessions.

Table 1

Descriptive statistics for the meta-analytic sample

Characteristics	Number of studies	%
Continent		
Africa	12	5
Asia	49	21
Australia	7	3
Europe	39	17
North America	109	48
South America	10	4
World	3	1
Publication Type		
Journal article	142	62
Dissertation	72	32
Project report	7	3
Conference proceeding	6	3
Preprint	1	<1
Study Design		
Cross-sectional	112	49
Pre/post change in intervention group only	71	31
Intervention/control group comparison only after training	19	8
Pre/post change comparison with intervention and control-group	27	12
Age Group/School Type		
Kindergarten	24	5
Primary	72	29
Middle/secondary/high	45	18
K-12	104	42
Focus of IE		
Special educational needs	190	76
At-risk students	6	2
Multicultural background + second language learners	6	2
Combination of diversity features	14	3
Other	29	12

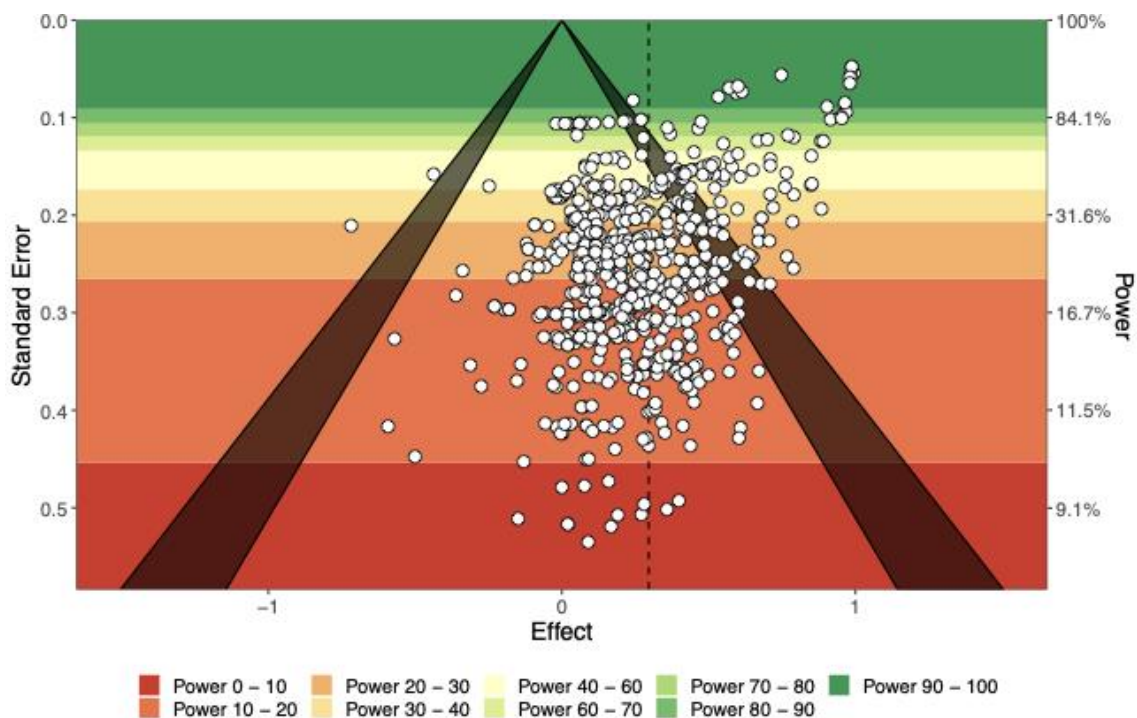
Most of the data were assessed with validated scales (57.64%). Teachers' knowledge was assessed in 113 samples, using validated instruments in 29 samples (25.7%). In 52

samples, knowledge was assessed via tests while via self-rating in 61 samples. Teachers' perception of their skills was assessed in 178 samples, primarily via assessments of teachers' self-efficacy for IE using validated scales (66%; $k = 118$). Teaching practice was assessed in 120 samples, mainly with self-developed instruments ($k = 77$), half of which related to implementation quality and half to the use of inclusive teaching methods.

Study Quality and Publication Bias

Figure 3

Power-enhanced funnel plot



Study quality among the included studies was generally low ($M = 3.24$, $SD = 1.15$, range = 1 - 7.5), with no study reaching the possible maximum of 9.5. However, study quality was not associated with the reported effect sizes ($F[1, 1041] = 0.19$, $p = .66$). Publication status was also not associated with the reported effect sizes ($F[1, 1041] = 0.67$, $p = .41$). However, Egger's regression test was significant among the published studies ($F[1, 681] = 118.28$, $p < .001$), and there was a clear asymmetry in the funnel plot (see Figure 4). Yet, the direction of this observed asymmetry was *contrary* to small-study effects, as studies with *larger* samples reported *larger* effect sizes. Further analyses showed that this might have been due to the fact that most studies with higher power investigated also more extended training programs. Accordingly, smaller standard errors of effect sizes were associated with both with larger effect sizes ($r = -.14$ [-.22; -.05], $p = 0.002$) and longer training durations in the studies ($r = -.19$ [-.27; -.10], $p < 0.001$). The median power of studies appeared to be generally low

(22.3%). However, this estimate was based on the summary estimate of all correlations overall. As bivariate associations were not the same for all pairs of variables (see Table 2), this estimate should not be considered accurate for the associations between all variables in the tested models.

Moderation analyses

Intervention studies reported larger effect sizes (overall $r = 0.35$, 95% CI [.31; .39]) than cross-sectional studies (overall $r = 0.24$ [.21; .27]; $F[1, 1041] = 22.36$, $p < .001$). Among the intervention studies, study design (cross-sectional, within-group pre vs. post, control group) was not associated with the reported effect sizes ($F[2, 510] = 0.41$, $p = 0.66$). Publication year, the continent where the study was conducted, and school type did not significantly influence the reported effect sizes (all $F < 3.4$, all $p > .06$). The educational background of the teachers had no effect (all $F < .6$, all $p > .4$). However, studies that included teaching assistants reported larger effects (overall $r = 0.39$ [.21; .57]) than those that involved only teachers (overall $r = 0.29$ [.26; .32]) and the more teaching assistants were included, the larger the reported effect sizes ($F[1, 1041] = 7.05$, $p = .008$, $\beta = .22$). Whether teachers were teaching inclusive classrooms or having inclusive teaching experience did not show significant influence (all $F_s < 1.1$, all $p_s > .35$). For additional analyses regarding possible moderators see Supplement I.

Table 2

Meta-analytic pooled correlation matrix

	1	2	3	4	5	6	7	8
Training	x	81	160	102	174	46	17	52
Knowledge	.371	x	41	26	44	13	5	6
Skills	.265	.241	x	31	80	22	9	6
Teaching Practice	.269	.180	.284	x	33	13	7	17
Beliefs	.183	.147	.282	.199	x	22	10	12
Willingness to Change	.199	.059	.318	.391	.350	x	5	7
Satisfaction with Training	.216	.288	.310	.235	.425	.368	x	4
Student Behavior	.236	.218	.284	.249	.315	.197	.415	x

Note. Pooled correlation coefficients are shown in the lower triangle, and sample size (number of samples) is shown in the upper triangle.

Testing transfer models

We created a pooled correlation matrix using the correlation coefficients from the collected studies to test the five models of transfer processes. The pooled correlation matrix is shown in Table 2, along with the sample size (number of samples) for each correlation. However, the analysis of each model was based on separate correlation matrices, including only the variables of the respective model.

The fit indices of the different models are shown in Table 3 (for additional information, see Supplement F). CFI was below .9 for all models except for the Cognitive Change Model, which achieved an acceptable model fit. None of the models met the .9 threshold for the TLI, which can be interpreted as a variant of the CFI that considers model parsimony. Low values in this index may have been due to, among other factors, the relatively small size of the models compared to their large number of parameters. However, the Cognitive Change Model came closest to the threshold with a value of .808. RMSEA was below the cut-off value of .06 for all models, indicating a good model fit. This indicator again suggests the best model fit again for the Cognitive Change Model, as it had the lowest value. Regarding the SRMR, only the Cognitive Change Model achieved a value below the cut-off of 0.1. The fit indices indicated that the Cognitive Change Model had the best fit in comparison to the other models (three out of four indicators meeting the criteria for an acceptable or even good model fit). However, it needs to be noted that some path coefficients were based on small databases (table 2), in especially path including teachers' satisfaction with the training and student outcomes.

Table 3

Goodness-of-Fit statistics for the five models

Model	CFI	TLI	RMSEA	SRMR
Basic Model	0.749	0.248	0.015	0.166
Implicit Model	0.859	0.698	0.011	0.114
Evaluation Model	0.722	0.479	0.011	0.201
Change Model	0.812	0.647	0.012	0.197
Cognitive Change Model	0.918	0.808	0.008	0.099

Since the fit indices were based on (slightly) differing data sets, which may distort direct model comparisons, the analyses were repeated, using strictly the same data for all models ($k = 163$, Supplement G). The results with these data yielded lower fit indices overall; however, the Cognitive Change Model had still the best fit. Two indices indicated a good fit, while two fell slightly below the cut-off value for an acceptable fit; however, all indices had higher values than in the other models.

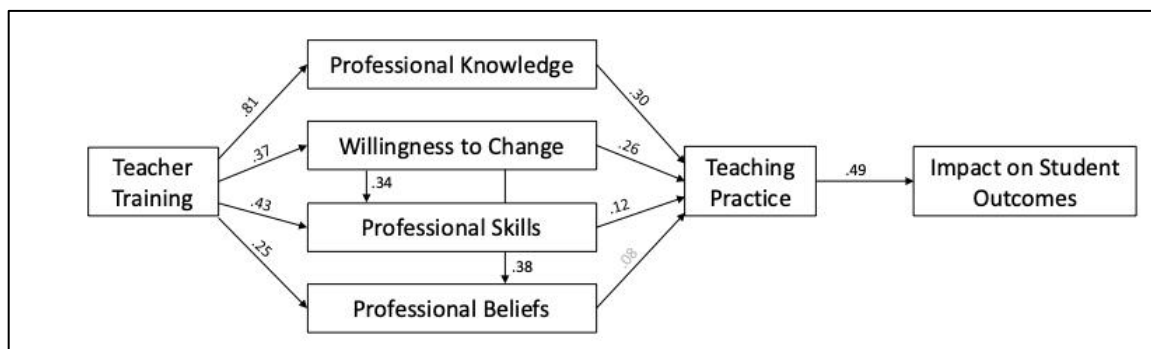
In the analysis using only data from studies with randomized or quasi-experimental assignment to conditions (RCTs and quasi-experimental controlled trials, $k = 58$), the Cognitive Change Model demonstrated the best fit as well, although the values were again lower, compared to the main analysis (see Supplement H). Three out of four fit indices indicated a good fit, while one fell slightly below the cut-off value for an acceptable fit. Based

on this analysis, a second model, the Implicit Model, also showed good fit in three out of the four indices with only slightly lower values than the Cognitive Change Model.

In summary, based on the three analyses (main analysis, analyses with the same database for all models and the RCTs only), the Cognitive Change Model had the best fit with the available empirical data. The associations between the variables in the Cognitive Change Model are shown in Figure 3. Participation in teacher training had a large effect on teachers' professional knowledge ($\beta = 0.81$, 95% CI [.64, .97]) and moderate effects on teachers' willingness to change ($\beta = 0.37$, 95% [.23, .51]), self-perceptions of professional skills ($\beta = 0.43$, 95% [.28, .57]) and a small to moderate effect on teachers' professional beliefs ($\beta = 0.25$, 95% [.15, .36]). Teachers' willingness to change positively and significantly influenced perceptions of their professional skills ($\beta = 0.34$, 95% [.24, .45]) and their professional beliefs ($\beta = 0.38$, 95% [.30, .46]), both with moderate effect sizes. Changes in teaching practices were influenced with small to moderate effect sizes by teachers' knowledge ($\beta = 0.30$, 95% [.15, .44]) and willingness to change ($\beta = 0.26$, 95% [.06, .46]) and with a small effect size by teachers' perception of their skills ($\beta = 0.12$, 95% [.001, .25]). Teachers' professional beliefs did not significantly influence their teaching practice ($\beta = 0.08$, 95% [-.09, .25]). Changes in the teaching practice had a moderate, significant effect on student outcomes ($\beta = 0.49$, 95% [.26, .72]).

Figure 4

Path results of the Cognitive Change Model



Discussion

This study aimed to compare models that describe transfer processes in the context of teacher training on inclusive education regarding their fit to the currently available empirical data. For this purpose, data from primary studies were collected in which teachers' participation in training programs on IE was examined in relation to seven variables described in the theories as relevant to the transfer process. IE was chosen as the topic for the teacher training

programs as it aims to improve learning conditions for all students and serves as a useful first step in examining the transfer processes of teacher training. In addition, IE presents teachers with the challenge of navigating complex learning processes in their daily professional lives since it requires fundamental changes in the approach to teaching. Since teacher training is the most common method to support in-service teachers in this change process, gaining insight into the transfer process is important. The present study tested models that describe this transfer process using secondary data analysis.

The models were calculated three times: first, based on all available data resulting in different sample sizes; second, based on all studies providing data for all models; and third, based on studies with random and quasi-experimental designs. Based on these analyses, the Basic Model, the Evaluation Model, and the Change Model all appeared to be not well-suited to explain the available empirical data on the transfer process. The analyses suggested that knowledge acquisition during training alone cannot predict transfer processes into the classroom and ultimately to the students, as described in the Basic Models. Furthermore, the analyses indicated that the evaluation of the training itself may not be the sole determining factor for subsequent learning and transfer processes, as proposed by the Evaluation Models, since these models also failed to explain the empirical data satisfactorily. Change Models assume that shifts in attitudes occur gradually and require significant effort, primarily resulting from positive experiences with changed behavior. This assumption was not supported by the analyses either. Regarding the Implicit Model, results differed based on the data the model was fit on: Based on the RCT and quasi-experimental studies only, model fit was reasonable based on three criteria, one being close to the cut-off value. However, the Implicit Models—which assume that, in addition to acquiring knowledge, participants develop skills and more positive beliefs toward the training content—failed to achieve an acceptable model fit to describe the data adequately based on the full available data and the studies that provided data for all models.

However, one group of models, the Cognitive Change Models, achieved a good model fit in three out of four indices and, therefore, represented a framework well-suited to describing the available data on the transfer processes. However, attention should be paid to the factors distinguishing the suitable models from the less suitable ones. Models summarized in the current study under the term Cognitive Change Model differed from the other models primarily regarding the assumption that teacher training programs can influence the willingness to make changes in practice and that this willingness can drive changes in internal beliefs and teaching practices. The current analysis supported this assumption as teacher

training showed a significant influence on changes in teachers' willingness to engage in the change process, and this further resulted in significant influences on changes in teachers' skills, beliefs, and teaching practices and is in line with previous research (Azazitur et al., 2021; Akin-Sabuncu & Celik, 2023). This finding highlights that the design of training programs is relevant to their success as it encourages participants to reflect on which content applies to their practice, where processes can be made more efficient, or where methods can be improved (Nimante et al., 2025). If the training motivates participants to actively attempt changes in their teaching, this increases the likelihood that these changes will also positively impact students. Multiple reviews have suggested that teachers' motivation to participate in teacher training should be strengthened (Dunst et al., 2015; Kennedy, 2016; Timperley et al., 2008). However, it may be that the motivation to implement concrete changes—triggered during the training itself—is the key factor in achieving long-term improvements for students.

However, our analyses did not support all the assumptions described in the Cognitive Change Model. Although the models suggested that changes in teachers' professional beliefs are important to realize changes in the teaching practice, our results did not support this assumption. Empirically, teachers' professional beliefs were influenced by participation in teacher training and teachers' willingness to change, but these beliefs did not predict realized teaching practices. Interestingly, the same assumption was made in the Implicit Model, which was also not supported by the present results. This suggests that the assumption that teaching behavior is driven by internal beliefs, as proposed by the Theory of Planned Behavior (Ajzen, 1991), is overrated. The influence of attitudes on behavior has been questioned before (Gülsün et al., 2023) and the present findings thus align with previous findings showing that attitudes towards IE show relatively little influence on teaching behaviors (Sharma & Mannan, 2015; Gülsün et al., 2023). Still, attitudes and changes in attitudes are most used to measure the success of teacher training participation to improve student outcomes (Donath et al., 2023). Instead, self-efficacy should be assessed, as it aligns more with behavior and can exhibit more predictive value (Gülsün et al., 2023). Even though the beliefs regarding IE in the present study did not significantly influence changes in teaching behavior, it is still conceivable that teachers' attitudes affect how they interact with students alongside their teaching methods. The results of this study contradict the literature on inclusive education, which repeatedly argues that attitude is crucial for the implementation of IE (Lindner et al., 2023). Therefore, the significance of attitude for teaching practice and, in particular, its effects on students should be further examined in detail in future studies.

In general, the proposed factors influencing teaching practice, knowledge, willingness, skills, and beliefs did not show large effect sizes on changes in teaching practices, and 73% of the observed variance of changes in teaching practices remained unexplained. A possible explanation could be that what is realized in the classroom is not only influenced by the proposed variables but also by the circumstances in the school, such as supportive administration and colleagues, available resources and materials, which do not change just because one teacher participated in a teacher training program. Future studies utilizing and examining the Cognitive Change Model could, for example, incorporate school framework conditions into their analyses. Although these conditions, along with teachers' individual learning prerequisites, were not considered in the present analysis, they should not be overlooked. Since actions never take place in a vacuum, and school environments can vary significantly while also having a strong impact on implementation (Nimante et al., 2025), these factors should be investigated, and may also contribute to explaining variance in the effectiveness of training programs.

The results revealed that teachers' educational backgrounds did not significantly impact observed effect sizes. However, when teaching assistants were included in the training, effect sizes tended to be larger. Several factors could explain this pattern. First, teaching assistants may enhance collaboration between teachers and support staff, leading to more effective implementation of new practices. Second, teaching assistants often have less formal training than teachers, which may make them more receptive to new learning. Unlike experienced teachers, they may not need to reconcile new knowledge with previously acquired professional beliefs and practices, allowing for a more straightforward application of training content.

In summary, these present results suggest that professional development may positively affect teachers and students. Since the most complex model had the best fit, it can also be concluded that learning and transfer processes accordingly are rather complex as well. The present results also support a recent research trend emphasizing the importance of teachers' willingness to change and suggesting that this motivation should be strengthened in training programs. Without a focus on willingness to change, teacher training may increase teacher knowledge but fail to produce concrete changes in classroom practice.

Limitations

A key limitation of this meta-analysis is rooted in the considerable variability of the included studies, as data were drawn from rather diverse contexts. While the applied MASEM approach allowed for synthesizing findings across studies, it cannot replace direct hypothesis

testing using primary data. This is particularly relevant for the Cognitive Change Model and other tested models, which should ideally be evaluated using datasets specifically designed to capture all relevant variables. However, no single study among the collected studies included all variables necessary to test the Cognitive Change Model directly—nor was a complete dataset available for most of the other models. This also influenced the number of samples the models were based on. To address this issue, the analyses were repeated with samples providing data for all models. Their results suggested the same conclusions as the main analysis, although fit indices for all models were lower. Additionally, the calculation of certain paths in the models were based on limited data, particularly the paths on teachers' reactions to the training and student-level data were only rarely collected. Although assessments on the student level are often complex to plan, (Kowalski et al., 2020), they are highly relevant to evaluating the success of teacher training as this is the level where improvements are aimed at.

Secondly, many of the included studies had low statistical power. However, study quality was not associated with the reported effect sizes. Still, effect sizes were likely overestimated, as much of the data comes from intervention studies that often conduct post-measurements immediately after the intervention (Donath et al., 2023; Kennedy, 2016). This tends to inflate effect estimates, as the impact of training programs typically diminishes over time (Sims et al., 2023). However, others have argued that the effects of teacher training might unfold with time (e.g., Clarke & Hollingsworth, 2002; Imants & Van der Wal, 2020), again suggesting that the effects of teacher training are best not directly assessed after its ending. Furthermore, intervention studies usually examined more intensive programs than those commonly implemented in practice (Donath et al., 2023; Cramer et al., 2019), which could have further contributed to the overestimation of effect sizes. To address this issue, the model calculations were repeated based only on data from studies with randomized and quasi-experimental allocation to conditions. The comparison based on this database suggested again that the Cognitive Change Model has the best fit to empirical data. However, it also suggested that the Implicit Model fits the data well. These factors highlight the need for further primary research with comprehensive data collection and robust study designs to validate and refine the tested models.

A third potential concern is slight study bias, although the bias appears to manifest in an unexpected direction in this case. In the current study, higher power of the studies was related to the longer duration of the investigated teacher training, which might explain the observed bias. No differences were observed between published and unpublished studies.

These factors highlight the need for further primary research with comprehensive data collection and robust study designs to validate and refine the tested models.

Conclusion

Future research should integrate established theories on transfer processes when designing and evaluating teacher training programs (Ahadi et al., 2024), with the current study suggesting Cognitive Change Model as a promising framework. Aligning research designs and professional development models more closely with teacher motivation and learning motivation can lead to deeper insights and more effective training outcomes (Kennedy, 2016). All models discussed in this study share that knowledge acquisition is necessary for the change process (Sims et al., 2023). However, on its own, it is insufficient to predict successful transfer. Knowledge may fail to drive lasting change if it cannot be meaningfully integrated with prior understanding or fully grasped to make classroom application feasible (Gregoire, 2003; Sims et al., 2023). Therefore, training effectiveness should be evaluated across multiple teacher-related dimensions (Ahadi et al., 2024).

To enhance impact, professional development should be designed to create ‘aha’ moments (Kennedy, 2016) that inspire teachers to engage in change processes. Training success depends mainly on teachers’ ability to assess what is valuable for their classrooms and what is not (Nimante et al., 2025). This ability should be actively fostered through training design by encouraging reflection on current practices, evaluating them in light of new approaches, and identifying meaningful changes. Most importantly, teachers need dedicated time and space to plan implementation—determining first steps, adapting methods to their specific contexts, and developing concrete integration strategies. Kennedy (2016) found that training programs focused solely on knowledge transfer tended to produce smaller effect sizes than those designed to spark insight and motivation. If motivation is a key driver of change, it is worth reconsidering the role of mandatory professional development, as simply requiring participation does not guarantee meaningful learning (Kennedy, 2016). Instead, whole-school training should prioritize fostering motivation, emphasizing the benefits of new practices, and actively engaging educators in the change process.

In terms of evaluation, it is essential to assess teachers’ willingness to change as a key variable for predicting the success of training programs. Additionally, meaningful assessments should extend beyond immediate post-training evaluations, as these provide limited insights into long-term impact. Instead, long-term follow-ups and assessments at the student level are crucial for a comprehensive understanding of training effectiveness (Nimante et al., 2025). As highlighted by the low power of the primary studies in this MASEM study,

large-scale, randomized, and quasi-experimental studies on teacher training remain scarce—particularly those that include student data (Kowalski et al., 2020). Since transfer processes are complex rather than linear, evaluating teacher training poses significant challenges (King et al., 2023). However, it is essential to include data collection at the student level to make meaningful statements on training success. If research continues to neglect conducting high-quality studies with large sample sizes at both the student and teacher levels, as well as comparisons with control groups, conclusions and review studies will remain limited by the lack of high-quality data.

Overall, this study demonstrated that complex processes underlie the transfer of knowledge acquisition to practice in teacher training and improvements in students' behavior and that considerable future research is needed to further understand and support teachers and students in an educational system constantly facing changes implemented by political systems and technological changes. Without a solid grasp on why and how teacher training may be effective, changes across the educational system may at best be inefficiently implemented and, at worst, be a paper-pushing exercise.

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6. Supplement to the Publications

6.1 Supplement to Study 1

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Supplement A Search Strategy

Eligibility criteria	
Study type	- impact of participation in professional development on inclusive education (general, specific topics or subjects) is investigated, - with quantitative measures - using either comparisons of pre-post measures, comparison of intervention and control group or cross-sectional analyses
Report criteria	- published from 1975 on (first legal anchoring of inclusive education with the Education for All Act in the US), - all types of publications (journal articles, dissertations, book chapters, project reports, conference proceedings), - no language restrictions (automated electronic translation services will be used for languages other than German, English and Spanish) - no restrictions of country of implementation
Participants	- in-service educators (general educators, special educators) and other pedagogical staff actively involved in the implementation of inclusive education (i.e., teaching assistants, administrative staff)
Intervention	- professional development on inclusive education - any intervention with in-service educators designed to change or improve implementation (Brock et al., 2017) of inclusive education - not solely received in 1:1-settings
Outcome measures	- knowledge of inclusive education /strategies (self-reported, objective tests) - beliefs (attitude towards inclusive education, perception of inclusive strategies, self-efficacy) - skills (implementation fidelity of inclusive strategies, frequency of inclusive strategy use, observation)
Exclusion	- student data (learning achievement, behavior) - pre-service educators, therapists - coaching as main type of professional development - intervention with students - influence of professional development only measured post intervention without control group - qualitative measures
Information sources	
Databases	Proquest (ERIC, Education Database, Dissertations & Theses Global), Web of Science, PsycInfo
Journals	Teaching and Teacher Education (TATE), International Journal of Inclusive Education (IJIE), European Journal of Special Needs Education (EJSNE), Journal of Research on Special Needs Education (JORSNE), Scandinavian Journal of Educational research, Zeitschrift für Heilpädagogik
Conferences	European Educational Research Association (ECER; NW01 Professional Learning and Development, NW04 Inclusive Education), European Association for Learning and Instruction (EARLI, SIG11 Teaching and Teacher Education, SIG14 Learning and Professional Development, SIG15 Special Educational Needs, SIG21 Learning and Teaching in Culturally Diverse Settings), Tagung der Integrations- und Inklusionsforscher*innen (IFO)
Journal and conference search	The journals and conferences were hand-searched for eligible studies. They were selected with a focus on European context to counter-balance existing reviews in this field that focus on US-studies.
Search strategy	
Search term	(inclusion OR “inclusive education” OR “inclusive classroom”) AND (“professional development” OR “teacher training” OR workshop OR “teacher education” OR) AND (teacher OR “pedagogical staff” OR “teaching assistants” OR educators OR “pedagogical personnel”) AND ("school" OR "K-12" OR “kinder garden” OR "kindergarden" OR "kinder garden" OR "preschool" OR "vocational college")
Screening for study selection	Title & Abstract (if not clear full text search for inclusion criteria), review papers will be used for forward and backward publication search, at least 10% will be screened by 2 reviewers clarification of disagreements through discussion, Krippendorff's Alpha will be used to calculate the inter-rater reliability, visualization of the search process via a flow-chart

Supplement B Codebook

Publication and study			
Name	type	description	coding
coderID	categorical	initials of coder	
studyID	numeric	study ID	
authors	string	last names of authors	
pubyear	numeric	year of publication	
title	string	title of publication	
doi	string	Doi of the publication	
pubtype	categorical	Type of publication	1 - journal article 2 - dissertation 3 - conference proceedings 4 - project report
country	string	Country where the study was conducted	
studyyear	numeric	year in which study was conducted for intervention study: start of professional development program	
design	categorical	please indicate the design of the study <u>single-group design</u> : intervention study without control group, can also account for studies with several intervention groups <u>independent groups pretest-posttest design</u> : intervention study with control group and pre- and posttest assessment in both groups <u>independent groups posttest design</u> : intervention with control group and assessment in both groups after the intervention <u>cross-sectional study</u> : assessment of an outcome measure that is related in analyses to former participation in professional development (e.g. correlation analysis, anova, t-test, etc.)	1 - single-group design 2 - independent groups pretest-posttest design 3 - independent groups posttest design 4 – cross-sectional study
samplesize	numeric	number of participants included in the study in all samples, please indicate the number of valid data sets, hence the number of participants that were included in the analysis	
sampledef	string	Please define a number to each sample and indicate the differences between the samples, e.g. 1 – general educators, 2 – special educators	
sampling	categorical	Sampling strategy used in the study	1 - random 2 – non-random
allocation	categorical	Allocation of the participants to the different conditions, only relevant for intervention studies	1 – non-random 2 – quasi-experimental 3 – random
responserate	numeric	If a survey was sent out to a certain number of people, please report the percentage of people responding to the survey	
missings	dummy	Does the publication provide any information about dealing with incomplete data or excluding data? For example, amount of people excluded from the analysis because of incomplete data, imputation of missings, etc.	Yes/No

Participants			
Name	type	description	coding
sampleN	numeric	size of this sample	
profession	categorical	Profession of the participants in this sample, if you choose 'other' or 'combination' indicate this information in the variable 'partcomment'	1 - general educators 2 - special educators 3 - general and special educators 4 - kinder garden educators 5 - teaching assistants 6 - administrative staff (includes principles) 7 - combination 8 - other 9 - students
percgeneral	numeric	percentage general educators in this sample	
percfemale	numeric	Percentage of female participants in this sample	
ageM	numeric	Mean age of participants	
ageSD	numeric	Standard deviation of the sample age	
teachexpM	numeric	Mean years of teaching experience	
teachexpSD	numeric	Standard deviation of teaching experience in this sample	
schooltype	categorical	School type where participants work at	1 - kinder garden 2 - primary school 3 - secondary school 5 - K-12 (participants from all school types can participate)
expIE	numeric	Percentage of participants with experience implementing inclusive education (e.g., teaching SEN students)	
attrition	numeric	percentage of participants of the professional development program leaving study, only relevant for pretest-posttest designs	
Professional development			
Name	type	description	coding
percPD	numerical	Percentage of study participants that participated in professional development (only relevant for correlational studies)	
divfeature	categorical	please indicate the diversity feature that was focused on in the professional development program for correlative studies: the diversity feature the study focused on if you select 'combination' or 'other' please indicate the information on the diversity feature in the variable <i>PDcomment</i>	1 -SEN 2- gender 3 - migration 4 - second language learners 5 - religion 6 - low socio-economic status 7 - at-risk students 8 - giftedness 9 - combination 10 - sexual orientation 11 - psychological diseases 12 - other
PDtype	categorical	name used in the publication for the type of professional development program, if further terms are being used please choose 'other' and indicate it in the next column	1 - informative seminar 2 - workshop 3 – training 4 - university course

			5 - on-site training (<i>placed at school</i>) 6 - online course 7 - blended learning course (<i>mixture of attendance and online sessions</i>)
PDduration	numeric	Hours spent in professional development program	
PDtimespan	string	Time span from first to last session in weeks	
practice opportunity	dummy	Does the professional development program provide opportunity to practice inclusive strategies in the professional development session?	Yes/No
casestudies	dummy	Are case studies used for practice in PD sessions?	Yes/No
Implementation planning	dummy	Is the implementation of content provided planned in the PD sessions?	Yes/No
certification	dummy	Do participants receive a certification after finishing the professional development program?	Yes/No
jointPD	dummy	Is it mentioned that joint participation in the professional development program was required? With whom were educators asked to participate?	1 - single participation 2 - joint participation (at least two colleagues) 3 - team participation 4 - school participation (all/most school staff)
coaching	dummy	Does the professional development program offer additional coaching?	Yes/No
topic	dummy	Does the professional development program address inclusive education in general or a specific topic related to it?	Yes/No
topicsubject	string	if the professional development program addresses educators teaching a certain school subject please indicate this subject	Yes/No
topicmethod	string	if a specific inclusive teaching method is addressed in the professional development program (e.g., UDL), please note this method	Yes/No
prereq	dummy	Do educators need to fulfill certain prerequisites in order to participate in this professional development program (e.g., motivational letter)?	Yes/No
postdata	string	Time between pre- and posttest in weeks	

Outcomes			
Name	type	description	coding
effectsizeID	string	Please indicate the number for the effect size for each sample (studyID_sampleID_effectsizeID), please number them consecutively	
studydesign	categorical	please indicate the study design again for automatically filling out irrelevant variables	
dv	string	indicate what type of dependent variable is being reported, if several dependent variables are reported in the study fill out a line for each dV	
dvtype	categorical	can the dependent variable be assigned to one of the categories?	1 - knowledge 2 - beliefs 3 - skills 4 - student behavior
measurement	categorical	type of measurement used to assess the indicated variable in 'dV'	1 - questionnaire (<i>validated scales/questionnaires</i>)

			2 - survey (no validated scales/questionnaires)
			3 - single-items
			4 - observation
			5 - test scores
instrument	string	instrument used to measure the indicated dV	
reliability	string	Type of reliability measure	
reliability	numeric	Value of the reliability measure	
items	numeric	indicate number of items used in the questionnaire/survey	
statistic	string	statistical test used to calculate difference between groups/measurement times	
pexact	numeric	reported exact p-value of the statistical test of interest	

Supplement C Risk of Study Bias Assessment

Domain	Item	score
(1) Study design	Cross-sectional design	1
	Single-group design	1.5
	Independent groups posttest design	2
	Independent groups pre-posttest design	3
(2) Response rate	Not reported or not applicable	0
	< 50%	0.5
	50% - 75%	1
	>75%	1.5
(3) Sampling procedure	Non-random	0
	random	1
(4) Allocation to conditions	Non-random or not applicable	0
	random	1
(5) Type of data	Assessment by study participant	0
	Objective measurement	1
(6) Use of standardized instrument	Single-items or self-developed instrument	0
	Standardized instrument	1
(7) Reporting quality	Reliability data not reported	0
	Reliability data reported	1
(8) Handling of missing data	Not reported	0
	reported	1

Supplement D List of Included Studies

Authors and date	type	Country	Study design	N	Outcome type
Abdulaziz Alhamad (2006)	Dissertation	USA	Cross-sectional	205	Beliefs – attitude Skills – self-efficacy
Adhabi (2018)	Dissertation	Saudi Arabia	Cross-sectional	202	Beliefs – attitude Skills – self-efficacy
Aerni (2009)	Dissertation	USA	Single-group	96	Skills – self-efficacy, use of strategies Beliefs – attitude Beliefs – attitude
Ahmmed, Sharma & Deppeler (2012)	Journal article	Bangladesh	Cross-sectional	408	Beliefs – attitude
Akcan & Ilgar (2016)	Journal article	Turkey	Cross-sectional	252	Skills – use of strategies
Al-Assaf (2017)	Dissertation	Saudi Arabia	Posttest	59	Beliefs – perception of strategies, attitude
Al-Faiz (2006)	Dissertation	Saudi Arabia	Cross-sectional	231	Beliefs - attitude
Alasim (2017)	Dissertation	Saudi Arabia	Cross-sectional	300	Beliefs – attitude

Albulayhi (2018)	Dissertation	Saudi Arabia	Cross-sectional	516	Beliefs – attitude
Alhassan & Abosi (2014)	Journal article	Ghana	Cross-sectional	387	Skills – self-efficacy
Alhudaithi (2015)	Dissertation	Saudi Arabia	Cross-sectional	497	Beliefs – attitude
Alnemary (2017)	Dissertation	Saudi Arabia	Cross-sectional	135	Knowledge – tested Skills – self-efficacy
Alquraini (2012)	Journal article	Saudi Arabia	Cross-sectional	303	Beliefs - attitude
Alsedrani (2018)	Dissertation	Saudi Arabia	Cross-sectional	237	Beliefs – attitude
Alshahrani (2014)	Dissertation	Saudi Arabia	Cross-sectional	120	Beliefs – attitude
Alshenaifi (2018)	Dissertation	Saudi Arabia	Cross-sectional	209	Beliefs – attitude, concerns, perception of strategies
Amundson (1993)	Dissertation	USA	Posttest	223	Beliefs – attitude
Anderson (2016)	Journal article	USA	Cross-sectional	31 000	Student behavior – other behavior
Angiulo (2014)	Dissertation	USA	Cross-sectional	154	Skills – self-efficacy
Armstrong, Cusumano, Todd & Cohen (2008)	Journal article	USA	Single-group	95	Knowledge – tested Beliefs – perception of strategies
Arcangeli, Baccherini, Gaggioli, Sannipoli & Balboni (2020)	Journal article	Italy	Cross-sectional	307	Skills – self-efficacy Beliefs – attitude Knowledge – self-rated
Atanasova-Trifonova, Alexandrova- Karamanova & Peneva (2018)	Journal article	Russia	Cross-sectional	906	Skills – self-efficacy
Avramidis & Kalyva (2007)	Journal article	Greece	Cross-sectional	155	Beliefs – attitude
Avramidis, Bayliss & Burden (2000)	Journal article	UK	Cross-sectional	81	Beliefs – attitude
Bae (2012)	Dissertation	South Korea	Cross-sectional	76	Beliefs – attitude
Bakkaloglu, Sucuoglu & Yilmaz (2019)	Journal article	Turkey	Cross-sectional	47	Skills – quality of implementation
Baldiris Navarro, Zervas, Fabregat Gesa & Sampson (2016)	Journal article	Colombia	Single-group	47	Skills – quality of implementation
Bang (1993)	Conference proceeding	USA	Cross-sectional	110	Skills – use of strategies
Barnes (2008)	Dissertation	USA	Cross-sectional	93	Beliefs – attitude
Barnes (2020)	Dissertation	USA	Cross-sectional	34	Skills – use of strategies
Barrett (1996)	Dissertation	USA	Control-group	324	Beliefs – concerns Knowledge – tested
Bartholomaeus, Riggs & Andrew (2017)	Journal article	Australia	Cross-sectional	75	Beliefs – attitude Skills – self-efficacy
Baxter (2014)	Dissertation	UK	Single-group	3	Student behavior – other behavior
Beasley (2012)	Dissertation	USA	Cross-sectional	22	Beliefs – attitude
Benayon (2012)	Dissertation	Canada	Single-group	23	Beliefs – attitude
Bender, Boon, Hinrichs & Lawson (2008)	Journal article	USA	Cross-sectional	91	Skills – use of strategies Beliefs – attitude
Bertuccio, Runion, Culler, Moeller & Hall (2019)	Journal article	USA	Single-group	87	Knowledge – tested Skills – self-efficacy
Bhatnagar & Das (2014)	Journal article	India	Cross-sectional	470	Beliefs – attitude

Blauer Ziegler (2002)	Dissertation	USA	Posttest	279	Skills – use of strategies Student behavior – achievement, other behavior
Boudah, Schumacher & Deshler (1997)	Journal article	USA	Posttest	72	Skills – quality of implementation Student behavior – other behavior
Bourke (2014)	Dissertation	USA	Cross-sectional	29	Skills – self-efficacy
Boyle, Topping & Jindal-Snape (2013)	Journal article	UK	Cross-sectional	391	Beliefs – attitude
Brady & Wolfsoon (2008)	Journal article	UK	Cross-sectional	118	Beliefs – attitude
Breslow (1996)	Dissertation	USA	Cross-sectional	473	Beliefs – attitude, perception of strategies
Brewer (1996)	Dissertation	USA	Posttest	32	Skills – use of strategies, self-efficacy
Brown, Straub, Bohnacker & Plener (2018)	Journal article	Germany	Single-group	603	Beliefs – attitude Knowledge – self-rated Skills – self-efficacy
Bruce (2011)	Dissertation	USA	Cross-sectional	156	Beliefs – attitude
Brusca-Vega, Brown & Yasutake (2011)	Journal article	USA	Single-group	62	Student behavior – achievement
Brusca-Vega, Alexander & Kamin (2014)	Journal article	USA	Single-group	58	Skills – use of strategies, quality of implementation Student behavior – other behavior
Bussue (2015)	Dissertation	USA	Cross-sectional	100	Beliefs – attitude
Butler (2019)	Dissertation	USA	Single-group	165	Beliefs – attitude Student behavior – achievement
Carew, Deluca, Groce & Kett (2018)	Journal article	Kenya	Single-group	123	Beliefs – attitude, concerns Skills – self-efficacy
Catellani, Ilyasov, Cherepov, Sevryukova, Selivanova, Kudinov & Nikolov (2018)	Journal article	Russia	Control-group	378	Skills – self-efficacy
Cefai, Ferrario, Cavioni, Carter & Grech (2014)	Journal article	Malta	Control-group	75	Student behavior – other behavior
Cestaro (2008)	Dissertation	USA	Cross-sectional	42	Beliefs – attitude
Chao, Forlin & Ho (2016), Chao, Wing Sze, Forlin & Ho (2017)	Journal article	Hong Kong	Single-group	417	Knowledge – self-rated Skills – self-efficacy
Chatman (2018)	Dissertation	USA	Cross-sectional	74	Beliefs - attitude
Cheen (2007)	Dissertation	Taiwan	Cross-sectional	532	Beliefs - attitude
Christiansen, Hirsch, Knig, Steinmayr & Roehrle (2015)	Journal article	Germany	Control-group	457	Skills – self-efficacy Student behavior – other behavior
Chu, Craig, Yeworiew & Xu (2020)	Journal article	USA	Cross-sectional	143	Student behavior – achievement
Chung (1998)	Dissertation	USA	Cross-sectional	386	Beliefs – perception of strategies Skills – use of strategies
Ciraci & Isidori (2017)	Journal article	Italy	Posttest	198	Skills – implementation quality, self-efficacy
Clench & Smyth King (2014)	Book chapter	UK, Australia	Single-group	13465	Knowledge – self-rated Skills – use of strategies, self-efficacy

Cohen (2015)	Journal article	Israel	Cross-sectional	96	Beliefs – attitude, concerns
Cole (2012)	Dissertation	UK	Control-group	204	Skills – self-efficacy Beliefs – attitude Skills – self-efficacy Student behavior – other behavior
Colling, Fishbaugh & Hermanson (2003)	Conference proceeding	USA	Posttest	490	Beliefs – attitude Skills – self-efficacy
Coombs-Richerdson & Mead (2001)	Journal article	USA	Single-group	34	Knowledge – tested
Cooney (2017)	Dissertation	USA	Cross-sectional	76	Beliefs – attitude
Cooper-Jones (2013)	Dissertation	UK	Single-group	24	Knowledge – tested, self-rated Skills – self-efficacy
Coutsocostas & Alborz (2010)	Journal article	Greece	Cross-sectional	138	Beliefs – attitude Knowledge – tested Skills – self-efficacy
Crossett (1993)	Dissertation	USA	Cross-sectional	95	Beliefs - attitude
Crotteau (2009)	Dissertation	USA	Single-group	31	Skills – self-efficacy
Currie (2005)	Dissertation	USA	Cross-sectional	45	Beliefs - attitude
Dalanon & Matsuka (2017)	Journal article	Phillipine	Cross-sectional	30	Skills – self-efficacy
Davis (1993)	Dissertation	USA	Cross-sectional	285	Beliefs – perception of strategies
De Wet (2006)	Journal article	USA	Cross-sectional	308	Beliefs - attitude
Dea & Negassa (2019)	Journal article	Ethiopia	Cross-sectional	100	Skills – use of strategies
Dedrick, Marfo & Harris (2007)	Journal article	USA	Cross-sectional	288	Beliefs - concerns
Delkamiller, Swain, Ritzman & Leader-Janssen (2016)	Journal article	Nicaragua	Single-group	14	Knowledge - tested
Dellicarpini & Alonso (2014)	Journal article	USA	Single-group	33	Beliefs - attitude
Detzer (2016)	Dissertation	USA	Single-group	26	Beliefs – attitude Knowledge – self-rated Skills – self-efficacy
Dev (1996)	Dissertation	USA	Cross-sectional	278	Beliefs - attitude
Dias (2015)	Journal article	Portugal	Cross-sectional	150	Beliefs - attitude
Dickens-Smith (1995)	Project report	USA	Single-group	30	Beliefs - attitude
Drandic & Paic (2020)	Journal article	Croatia	Cross-sectional	170	Skills – use of strategies
Durtschi (2005)	Dissertation	USA	Cross-sectional	566	Beliefs - attitude
Dyer (2003)	Dissertation	USA	Cross-sectional	67	Beliefs - attitude
Edwards, Carr & Siegel (2006)	Journal article	USA	Single-group	34	Beliefs – perception of strategies Skills – use of strategies, self-efficacy
Ellis & Rowe (2020)	Journal article	UK	Single-group + posttest	7170	Student behavior – achievement
Engstrand & Roll-Pettersson (2014)	Journal article	Sweden	Cross-sectional	21	Skills – self-efficacy
Ernst & Rogers (2009)	Journal article	USA	Cross-sectional	134	Beliefs - attitude
Eskridge (2009)	Dissertation	USA	posttest	30	Skills – quality of implementation
Evans (1997)	Journal article	USA	Control-group	345	Skills – use of strategies Student behavior - achievement

Faracilas (2015)	Dissertation	USA	Control-group	25	Skills – use of strategies
Farquharson (1995)	Dissertation	USA	Single-group	12	Beliefs – attitude
Ferguson et al. (1992)	Project report	USA	Single-group	68	Student behavior – other behavior
Fernandez-Batanero, Cabero & Lopez (2019)	Journal article	Spain	Cross-sectional	777	Beliefs – attitude, perception of strategies
Ferrara & Pedone (2019)	Journal article	Italy	Single-group	450	Skills – use of strategies, self-efficacy
Finegan (2004)	Dissertation	USA	Cross-sectional	1341	Beliefs - attitude
Fisher (1996)	Dissertation	USA	Control-group	19	Beliefs – attitude
Fisher (2013)	Dissertation	USA	Cross-sectional	52	Knowledge - tested
Flannery, Lombardi & McGrath Kato (2015)	Journal article	USA	Single-group	27	Skills – self-efficacy
Forlin (2001)	Journal article	Australia	Cross-sectional	571	Skills – quality of implementation
Forlin & Sin (2010)	Journal article	Hong Kong	Single-group	567	Beliefs - concerns
Forlin, Loreman & Sharma (2014)	Journal article	Hong Kong	Single-group	737	Beliefs – attitude, concerns
Forlin, Sharma & Loreman (2014)b	Journal article	Hong Kong	Single-group	2361	Skills – self-efficacy
Frumos (2018)	Journal article	Romania	Cross-sectional	126	Beliefs – attitude, concerns
Galano (2012)	Dissertation	USA	Cross-sectional	56	Skills – self-efficacy
Garret & Spano (2017)	Journal article	USA	Cross-sectional	300	Beliefs - attitude
Gayle-Evans (1992)	Dissertation	USA	Cross-sectional	165	Beliefs – attitude
Georgiadis, Nikolajevic & van Driel (2011)	Journal article	Europe	Single-group	27225	Beliefs – perception of strategies
Gertler (1994)	Dissertation	USA	Cross-sectional	201	Skills – use of strategies
Giannopoulou, Pasalari, Korkoliakou & Douzenis (2019)	Journal article	Greece	Single-group	67	Skills – self-efficacy
Giovanetti (1999)	Dissertation	USA	Single-group	62	Beliefs - attitude
Goetz (2001)	Dissertation	USA	Single-group	25	Beliefs – attitude
Goley (2013)	Dissertation	USA	Cross-sectional	96	Knowledge – self-rated
Gonzalez Dekutoski (2011)	Disseration	USA	Cross-sectional	100	Skills – implementation quality, self-efficacy
Gordon (2008)	Dissertation	USA	Cross-sectional	152	Beliefs - attitude
Graham-Young (2004)	Dissertation	USA	Cross-sectional	219	Beliefs – attitude
Green-Causey (1999)	Dissertation	USA	Cross-sectional	153	Skills – use of strategies
Gu (2013)	Dissertation	China	Cross-sectional	203	Beliefs - attitude
Güner (2012)	Journal article	Turkey	posttest	45	Beliefs – attitude, concerns
Hacıibrahimoglu & Kargin (2017)	Journal article	Turkey	Cross-sectional	209	Skills – self-efficacy
Hadjikakou, Petridou & Stylianou (2008)	Journal article	Cyprus	Cross-sectional	367	Skills – use of strategies
Hardin, Lower, Smallwood, Chakravarthi, Li & Jordan (2010)	Journal article	USA	Single-group	40	Beliefs – perception of strategies

Harris, Lane, Graham, Driscoll, Sandmel, Brindle & Schatschneider (2012)	Journal article	USA	Control-group + single-group	282	Student behavior – achievement Beliefs – perception of strategies
Harris, Graham & Adkins (2015)	Journal article	USA	Control-group	53	Student behavior – achievement, other behavior
Haegele, Hodge, Barbosa Gutierrez Filho & Goncalves de Rezende (2018)	Journal article	Brazil	Single-group	90	Beliefs - attitude
Healey, Block & Kelly (2020)	Journal article	USA	Control-group	44	Knowledge - tested
Hegler (1995)	Project report	USA	Single-group	181	Beliefs - attitude
Heller (2012)	Project report	USA	Control-group	5541	Skills – self-efficacy Student behavior - achievement
Hellman (2007)	Dissertation	USA	Posttest	1314	Skills – quality of implementation Student behavior - achievement
Hilsenbeck (2000)	Project report	USA	Single-group	30	Knowledge – tested Skills - quality
Holland et al. (1997)	Project report	USA	Single-group	166	Student behavior – other behavior
Houtveen & Van de Grift (2001)	Journal article	Netherlands	Single-group	309	Skills – quality of implementation
Hsieh, Hsieh, Ostrosky & McCollum (2012)	Journal article	Taiwan	Cross-sectional	321	Beliefs - attitude
Huai, Braden & White (2006)	Journal article	USA	Control-group	55	Knowledge – self-rated Skills – self-efficacy
Huddleston (1996)	Dissertation	USA	Cross-sectional	292	Beliefs - attitude
Hurt (2007)	Dissertation	USA	Single-group	50	Beliefs - attitude
Huszar (1997)	Dissertation	USA	Cross-sectional	56	Beliefs - attitude
Hutzler & Barak (2017)	Journal article	Israel	Cross-sectional	94	Skills – self-efficacy
Jäntschi, Jaethu, Bosse & Sporer (2017)	Project report	Germany	Single-group	493	Beliefs – attitude Knowledge self-rated
Jamsai (2018)	Dissertation	Thailand	Cross-sectional	370	Beliefs - attitude
Jimenez-Ruiz, Martinez-mones & Fernandez-Faundez (2020)	Journal article	Spain	Single-group	25	Knowledge – self-rated
Johnson (2000)	Journal article	USA	Posttest	118	Skills – use of strategies
Johnson (2012)	Dissertation	USA	Cross-sectional	97	Beliefs - attitude
Jones-Wilson (2011)	Dissertation	USA	Cross-sectional	70	Beliefs - attitude
Juttner (2001)	Dissertation	USA, UK	Cross-sectional	301	Beliefs - attitude
Kandel (2000)	Dissertation	USA	Cross-sectional	651	Beliefs - attitude
Katz (2015)	Journal article	Canada	Control-group	58	Skills – use of strategies
Katz, Sokal & Wu (2019)	Journal article	Canada	Control-group	736	Skills – use of strategies Student behavior - achievement
Kennedy, Rodgers, Romig, Lloyd & Brownell (2017)	Journal article	USA	Single-group	3	Skills – use of strategies
Kennedy, Rodgers, Romig, Mathews & Peebles (2018)	Journal article	USA	Control-group	279	Skills – implementation quality, use of strategies Student behavior - achievement
Kieran (2012)	Dissertation	USA	Cross-sectional	77	Beliefs – attitude

Kihura (2020)	Dissertation	Kenya	Cross-sectional	200	Beliefs – attitude
Klehm (2013)	Dissertation	USA	Cross-sectional	209	Skills – use of strategies
Klein, Geiss, Kushner & Hill (2003)	Project report	USA	Control-group	57	Student behavior – other behavior
Kovinthan & McPherson (2017)	Journal article	Jamaica	Single-group	36	Student behavior – achievement
Krawec & Huang (2017)	Journal article	USA	Control-group	207	Student behavior – other behavior
Kristiana & Widayanti (2017)	Journal article	Indonesia	Cross-sectional	81	Beliefs – attitude
Kulo (2012)	Dissertation	USA	Cross-sectional	25	Beliefs – attitude
Kuyini, Desai & Sharma (2020)	Journal article	Ghana	Cross-sectional	134	Beliefs – attitude, concerns
Kumar (2019)	Dissertation	USA	Cross-sectional	198	Skills – self-efficacy Beliefs – attitude, concerns Skills – self-efficacy
Kurniawati, Minnaert, Mangunsong & Ahmed (2012)	Journal article	Indonesia	Cross-sectional	208	Beliefs – attitude
Kurniawati, de Boer, Minnaert & Mangunsong (2017)	Journal article	Indonesia	Control-group	67	Beliefs – attitude Knowledge – tested
Kwon, Hong & Jeon (2017)	Journal article	USA	Cross-sectional	26	Beliefs – attitude
Ladner (2009)	Dissertation	USA	Cross-sectional	216	Skills – use of strategies
Lauth-Lebens, Lauth & Rohrsdorfer (2016)	Journal article	Germany	Single-group	25	Skills – use of strategies
Layne, Jules, Kutnick & Layne (2008)	Journal article	Trinidad and Barbados	Single-group	259	Student behavior – other behavior
Leandres-Vaughn (2017)	Dissertation	USA	Cross-sectional	113	Student behavior – achievement
Leckie (2018)	Dissertation	USA	Single-group	13	Skills – use of strategies, self-efficacy
Lee (2012)	Dissertation	USA	Cross-sectional	127	Beliefs – attitude Skills – self-efficacy Beliefs – perception of strategies
Lee (2013)	Dissertation	USA	Cross-sectional	79	Skills – self-efficacy
Leith (2007)	Dissertation	USA	Single-group	2695	Skills – self-efficacy Beliefs – attitude Student behavior – other behavior
Leonard & Smyth (2020)	Journal article	Ireland	Cross-sectional	315	Beliefs – attitude
Lika (2016)	Journal article	Albania	Cross-sectional	146	Beliefs – attitude
Lindsey (2009)	Dissertation	USA	Cross-sectional	120	Beliefs – attitude
Lorenzo (1993)	Dissertation	USA	Control-group	99	Student behavior – achievement, other behavior
Lussi (1996)	Dissertation	USA	Cross-sectional	251	Beliefs – attitude
Lusk (2006)	Dissertation	USA	Cross-sectional	63	Skills – use of strategies
MacAllister (2017)	Dissertation	USA	Cross-sectional	24	Beliefs – attitude
Macfarlane & Woolfson (2013)	Journal article	USA	Cross-sectional	111	Beliefs – attitude
Machu (2015) + Machu & Luke (2019)	Journal article	Czech Republic	Cross-sectional	345	Skills – use of strategies
Main, Chambers & Sarah (2016)	Journal article	Seychelles	Single-group	32	Beliefs – attitude, concerns Skills – self-efficacy

Malinen, Savolainen, Engelbrecht, Xu, Nel, Nel & Tlale (2013)	Journal article	Finland	Cross-sectional	855	Skills – self-efficacy
Maltese (1985)	Dissertation	USA	Cross-sectional	238	Skills – self-efficacy
Marlina (2017)	Journal article	Indonesia	Cross-sectional	150	Beliefs – attitude
Marlow, Hansford, Edwards, Ukoumunne, Norman, Ingarfield, Sharkey, Logan & Ford (2015)	Journal article	UK	Single-group	40	Skills – self-efficacy
Martfeld (2016)	Dissertation	USA	Cross-sectional	45	Beliefs – attitude
Martinez (2015)	Dissertation	USA	Cross-sectional	137	Skills – use of strategies
Raimundo Martins (2014)	Journal article	Portugal	Cross-sectional	53	Beliefs – attitude
Mason, Cramer, Garwood, Varghese, Hamm & Murray (2017)	Journal article	USA	Posttest	555	Student behavior – other behavior
Ryan & Mathews (2022)	Journal article	Ireland	Cross-sectional	139	Skills – self-efficacy
Mauerberg-Decastro, Paiva, Figueiredo, da Costa, de Castro & Campbell (2013)	Journal article	Brazil	Single-group	75	Beliefs – attitude
McBride (2012)	Dissertation	USA	Cross-sectional	503	Student behavior – achievement
McCann (2008)	Dissertation	USA	Cross-sectional	30	Knowledge – self-rated
McCarthy (2019)	Dissertation	USA	Cross-sectional	163	Skills – self-efficacy
McElvany, Schwabe, Hartwig & Iglar (2018)	Journal article	Germany	Cross-sectional	203	Beliefs – attitude
McQuivey & Thorson (1994)	Project report	USA	Single-group	60	Beliefs – attitude, concerns
McQuone Mulholland (2011)	Dissertation	USA	Cross-sectional	440	Skills – implementation quality, use of strategies
Miller & Savage (1995)	Conference	USA	Single-group	135	Beliefs - attitude
Mishra, Siddharth, Bhardwaj, Elhence & Jalan (2018)	Journal article	India	Cross-sectional	169	Beliefs – attitude, perception of strategies
Misoka (2017)	Dissertation	USA	Cross-sectional	679	Skills – self-efficacy
Mitchell (2016)	Dissertation	USA	Cross-sectional	286	Beliefs – attitude, perception of strategies
Mngo (2017)	Dissertation	Cameroon	Cross-sectional	344	Skills – use of strategies
Mobley (2018)	Dissertation	USA	Single-group	56	Beliefs – attitude
Moll (1996)	Dissertation	USA	Single-group	46	Skills – self-efficacy
Montague, Enders & Dietz (2011)	Journal article	USA	Control-group	779	Student behavior – other behavior
Moran (2015)	Dissertation	USA	Cross-sectional	46	Beliefs – perception of strategies
Morgan (2019)	Dissertation	USA	Cross-sectional	93	Student behavior – achievement
Morris (2013)	Dissertation	USA	Cross-sectional	100	Skills – self-efficacy
					Beliefs – attitude

Morrissey (2008)	Dissertation	USA	Control-group	107	Skills – quality of implementation Student behavior – achievement, other behavior
Morrow (2000)	Dissertation	USA	Single-group	7	Beliefs – perception of strategies
Murry & Murry (2000)	Conference	USA	Single-group	30	Skills – use of strategies Beliefs – perception of strategies
Murthy, Rajaram, Mudiyanuru, Marimuthu, Govindappa & Dasgupta (2019)	Journal article	India	Single-group	89	Skills – self-efficacy Beliefs – attitude Knowledge – self-rated Skills – use of strategies Student behavior – other behavior
Mutch-Jones, Puttick & Minner (2012)	Journal article	USA	Cross-sectional	391	Beliefs - attitude
Myhill, Hill, Link, Small & Bunch (2012)	Journal article	USA	Single-group	88	Knowledge – self-rated Skills – self-efficacy
Nordike (2018)	Dissertation	USA	Single-group	22	Beliefs - attitude Knowledge – tested
Nwaesi (2019)	Dissertation	USA	Cross-sectional	32	Beliefs - attitude
Ocampo Gomez & Souto (2012)	Journal article	Spain	Cross-sectional	93	Beliefs - attitude
O'Hara (2018)	Dissertation	USA	Cross-sectional	69	Beliefs - attitude
Ojok & Wormnaes (2013)	Journal article	Uganda	Cross-sectional	125	Beliefs - attitude
Opoku, Cuskelly, Rayner & Pedersen (2020)	Journal article	Ghana	Cross-sectional	457	Beliefs – attitude Skills – self-efficacy
Orr (2016)	Dissertation	USA	Cross-sectional	51	Beliefs – attitude
Owens-Twaites (2013)	Dissertation	USA	Single-group + Posttest	296	Skills – self-efficacy Student behavior - achievement
Ozokcu (2018)	Journal article	Turkey	Cross-sectional	318	Skills – self-efficacy
Özsirkinti & Akay (2019)	Journal article	Turkey	Single-group	14	Beliefs – attitude Skills – self-efficacy
Pancsofar & Petroff (2016)	Journal article	USA	Cross-sectional	70	Skills – use of strategies
Pare (2011)	Dissertation	Canada	Cross-sectional	138	Skills – use of strategies
Park, Dimitrov & Park (2018)	Journal article	USA	Cross-sectional	679	Beliefs – concerns Skills – self-efficacy
Parsons (2014)	Dissertation	USA	Cross-sectional	95	Beliefs - attitude
Patterson (1997)	Dissertation	USA	Control-group	10	Skills – quality of implementation
Pearl, Dieker & Kirkpatrick (2012)	Journal article	USA	Single-group	264	Beliefs – perception of strategies Skills – use of strategies
Peña (2018)	Dissertation	USA	Single-group	32	Knowledge – self-rated Skills – use of strategies
Perez (1997)	Dissertation	USA	Cross-sectional	94	Beliefs – attitude Knowledge – self-rated Skills – self-efficacy
Perold, Louw & Kleynhans (2010)	Journal article	South Africa	Cross-sectional	552	Knowledge – tested Skills – use of strategies Skills – self-efficacy
Persinger (1999)	Dissertation	USA	Cross-sectional	186	Beliefs - attitude
Pigford (1998)	Dissertation	USA	Cross-sectional	304	Beliefs - attitude
Poon, Ng, Wong & Kaur (2016)	Journal article	Singapore	Cross-sectional	131	Beliefs – attitude, concerns

Pryor (2003)	Dissertation	USA	Posttest + single-group	38	Beliefs – attitude Knowledge – tested Skills – self-efficacy
Puchalik (2017)	Dissertation	USA	Cross-sectional	38	Beliefs – attitude
Pursley (2014)	Dissertation	Turkey	Cross-sectional	220	Beliefs - attitude
Rabiola (2021)	Dissertation	USA	Cross-sectional	100	Beliefs – attitude Skills – self-efficacy Knowledge – self-rated
Rae, McKenzie & Murray (2011)	Journal article	UK	Single-group	40	
Rajic, Vorkapic & Mihic (2017)	Journal article	Serbia	Cross-sectional	32	Skills – quality of implementation
Rapanta, Garcia-Mila, Remesal & Goncalves (2021)	Journal article	Portugal, Spain	Single-group	208	Skills – quality of implementation
Reese (2007)	Dissertation	USA	Single-group	18	Beliefs – attitude Knowledge - tested
Reese (2018)	Dissertation	USA	Cross-sectional	59	Skills – use of strategies
Reina, Hemmelmayr & Sierra-Marroquin (2016)	Journal article	Spain	Cross-sectional	102	Skills – self-efficacy
Reina, Healy, Roldan, Hemmelmayr & Klavina (2019)	Journal article	Spain	Control-group	269	Skills – self-efficacy
Resch (2015)	Dissertation	USA	Single-group	99	Student behavior – achievement
Reyes, Hutchinson & Little (2017)	Journal article	USA	Single-group	47	Knowledge – self-rated Skills – self-efficacy
Roberts (1996)	Dissertation	USA	Posttest	378	Student behavior - achievement
Rodriguez & Zozakiewicz (2005)	Journal article	USA	Single-group	40	Student behavior – other behavior
Romer (2004)	Dissertation	Bahamas	Cross-sectional	122	Beliefs – attitude Skills – use of strategies
Royster (2011)	Journal article	USA	Single-group	19	Beliefs – attitude Knowledge - tested
Rulo (1997)	Dissertation	USA	Cross-sectional	180	Beliefs – attitude
Sabella (2016)	Dissertation	El Salvador	Cross-sectional	43	Beliefs – attitude Skills – self-efficacy
Saffar (2020)	Dissertation	Saudi Arabia	Posttest	40	Beliefs – attitude, concerns Student behavior - achievement
Sahbaz (2011)	Journal article	Turkey	Single-group	14	Beliefs – attitude
Salim, Furqon, Permata & Dian (2019)	Journal article	Indonesia	Single-group	30	Knowledge - tested
Samms (2017)	Dissertation	Jamaica	Cross-sectional	191	Beliefs – attitude Skills – self-efficacy
Sanches-Ferreira, Lopes-dos-Santos, Alves & Silveira-Maia (2018)	Journal article	Portugal	Single-group	118	Skills – quality of implementation Skills – use of strategies
Sari (2007)	Journal article	Turkey	Control-group	122	Beliefs – attitude, concerns Knowledge - tested
Scott McNamara (2018)	Dissertation	USA	Single-group	29	Knowledge – self-rated
Schenck, Feighan, Coffey & Rui (2011)	Project report	USA	Single-group + Posttest	396	Skills – quality of implementation Skills – use of strategies Student behavior - achievement

Schmidt (2020)	Dissertation	USA	Single-group	8	Beliefs – attitude Knowledge – tested Skills – use of strategies, self-efficacy Student behavior – other behavior
Schroth et al. (1997)	Conference	USA	Control-group	40	Beliefs - concerns
Schuilwerwe (2011)	Dissertation	Saudi Arabia	Cross-sectional	193	Beliefs - attitude
Scruggs (2018)	Dissertation	USA	Posttest	337	Skills – self-efficacy
Secer (2010)	Journal article	Turkey	Single-group	66	Beliefs – attitude Skills – self-efficacy
Seibert (2003)	Dissertation	USA	Single-group	48	Beliefs – attitude Knowledge – tested Skills – implementation quality, self-efficacy Student behavior – other behavior
Selickaite, Hutzler, Pukenas, Block & Reklaitiene (2019)	Journal article	Lithuania	Cross-sectional	171	Skills – self-efficacy
Shurman (2016)	Dissertation	USA	Single-group	8	Beliefs – attitude, perception of strategies Skills – self-efficacy
Siegel & Jausovec (1994)	Conference	USA	Single-group	23	Beliefs – attitude, concerns
Sims (2010)	Dissertation	USA	Single-group	7	Beliefs – perception of strategies
Smith (2008)	Dissertation	USA	Cross-sectional	173	Beliefs – attitude Skills – self-efficacy
Smith Canter, King, Williams, Metcalf & Rhys Myrick Potts (2017)	Journal article	USA	Single-group	14	Beliefs – perception of strategies Skills – use of strategies
Sucuoglu, Bakkaloglu, Akalin, Demir & Iscen- Karasu (2015)	Journal article	Turkey	Single-group	30	Beliefs – attitude, perception of strategies Knowledge – tested Skills – implementation quality, use of strategies Skills – self-efficacy
Sokal & Katz (2017)	Journal article	Canada	Single-group + Posttest	111	Beliefs – concerns, perception of strategies Skills – use of strategies Skills – self-efficacy
Sokal & Sharma (2014)	Journal article	Canada	Cross-sectional	131	Beliefs – attitude, concerns
Southern (2011)	Dissertation	USA	Cross-sectional	57	Beliefs – attitude
Speicher (1995)	Dissertation	USA	Cross-sectional	390	Beliefs – attitude
Spektor-Levy & Yifrach (2019)	Journal article	USA	Cross-sectional	215	Beliefs – attitude Beliefs – perception of strategies Skills – self-efficacy
Spence (2016)	Dissertation	USA	Single-group	51	Skills – self-efficacy
Spirko (2015)	Dissertation	USA	Cross-sectional	238	Beliefs – attitude
Srivastava, de Boer & Pijl (2015)	Journal article	India	Control-group	79	Beliefs – attitude Knowledge - tested
Staube (2009)	Dissertation	USA	Cross-sectional	182	Beliefs - attitude
Stavroussi, Didaskalou & Green (2020)	Journal article	Greece	Cross-sectional	315	Beliefs – attitude, concerns
Stemberge & Kiswarday (2018)	Journal article	Slovenia	Cross-sectional	261	Beliefs – attitude

Stephens (1993)	Project report	USA	Single-group	65	Skills – quality of implementation Student behavior - achievement
Stoler (1991)	Dissertation	USA	Cross-sectional	182	Beliefs - attitude
Stradford Boyce, Travers, Rothbart, Santiago & Bedell (2018)	Journal article	USA	Control-group	2029	Student behavior – other behavior
Stricker, Logan & Kuhel (2012)	Journal article	USA	Single-group	338	Skills – use of strategies
Strigel (2020)	Dissertation	Ethiopia	Single-group	109	Beliefs – attitude Skills – use of strategies, self-efficacy
Stubbs (2009)	Dissertation	Bahamas	Cross-sectional	234	Beliefs – attitude Skills – self-efficacy
Sun (2017)	Dissertation	China	Cross-sectional	816	Beliefs – attitude Skills – self-efficacy
Sunardi, Maryardi & Sugini (2014)	Journal article	Indonesia	Single-group	50	Knowledge – self-rated Skills – self-efficacy
Sutton (2013)	Dissertation	USA	Cross-sectional	105	Beliefs - attitude
Swanson (1995)	Project report	USA	Posttest	671	Beliefs – perception of strategies Student behavior - achievement
Tabarlet (1994)	Dissertation	USA	Cross-sectional	39	Skills – use of strategies
Tapasak & Walther-Thomas (1999)	Journal article	USA	Single-group	110	Student behavior - other behavior
Thompson (1992)	Dissertation	USA	Single-group	71	Knowledge - tested
Thompson & Byrnes (2011)	Journal article	USA	Posttest	242	Student behavior – other behavior
Thornton (2016)	Dissertation	USA	Single-group	21	Skills – self-efficacy
Todorovic, Stojiljkovic, Djigic & Ristanic (2012)	Journal article	Serbia	Cross-sectional	100	Beliefs - attitude
Tomei (2000)	Dissertation	USA	Cross-sectional	430	Beliefs - attitude
Tur-Porcar, Llorca-Mestre & Mestre-Escriva (2021)	Journal article	Spain	Control-group	555	Student behavior - other behavior
Turner (1996)	Dissertation	USA	Cross-sectional	205	Beliefs - attitude
Turvey (1996)	Dissertation	USA	Single-group	36	Knowledge - tested
Tzivinikou (2015)	Journal article	Greece	Single-group	30	Skills – self-efficacy
Vanfleet (2002)	Dissertation	USA	Single-group	43	Skills – use of strategies, self-efficacy
Vaz, Wilson, Falkmer, Sim, Scott, Cordier & Falkmer (2015)	Journal article	Australia	Cross-sectional	74	Beliefs - attitude
Villa, Thousand, Meyers & Nevin (1996)	Journal article	USA	Cross-sectional	578	Beliefs - attitude
Vincent & Shobha (2020)	Journal article	India	Cross-sectional	82	Skills – use of strategies
Vlachou & Fyssa (2016)	Journal article	Greece	Cross-sectional	96	Skills – quality of implementation
Vrdoljak (2010)	Dissertation	USA	Single-group	22	Beliefs - concerns
Vuorinen, Erikivi & Uusitalo-Malmivaara (2019)	Journal article	Finland	Control-group + single-group	253	Student behavior - other behavior
Webb (1994)	Dissertation	USA	Posttest	113	Beliefs – attitude, perception of strategies Skills – use of strategies

Webb-Kidd (1996)	Dissertation	USA	Control-group	250	Student behavior – achievement
Weisel & Dror (2006)	Journal article	Israel	Cross-sectional Cross-sectional	139	Beliefs – attitude Skills – self-efficacy
Whipple (2012)	Dissertation	USA		81	Knowledge – tested Skills – quality of implementation
Wiese, Mayr, Kramer, Seeger, Muller & Mezger (2017)	Journal article	Germany	Control-group	149	Beliefs - attitude
Wilkerson (2012)	Dissertation	USA	Cross-sectional	635	Beliefs - attitude
Wilkins & Nietfeld (2004)	Journal article	USA	Posttest	89	Beliefs – attitude Skills – self-efficacy
Witherspoon (2005)	Dissertation	USA	Cross-sectional	131	Beliefs – attitude, perception of strategies Skills – self-efficacy
Wogamon (2013)	Dissertation	USA	Cross-sectional	245	Beliefs – attitude
Wong, Chan & Chik (2019)	Journal article	Hong Kong	Cross-sectional	309	Skills – self-efficacy
Woodward (2017)	Dissertation	USA	Control-group	32	Beliefs - attitude
Wright (2015)	Dissertation	USA	Single-group	6	Knowledge – tested Skills – self-efficacy
Wright (2016)	Dissertation	USA	Cross-sectional	173	Knowledge - tested
Wyndham (2010)	Dissertation	USA	Posttest	688	Beliefs - attitude
Yada, Tolvanen & Savolainen (2018)	Journal article	Finland, Japan	Cross-sectional	1231	Beliefs – attitude, concerns Skills – self-efficacy
Yates (1995)	Dissertation	USA	Cross-sectional	261	Beliefs – attitude, concerns
Young (2018)	Dissertation	USA	Cross-sectional	7	Beliefs – attitude Student behavior - achievement
Young, Mannix McNamara & Coughlan (2017)	Journal article	Ireland	Cross-sectional	126	Knowledge – self-rated Skills – self-efficacy
Youngs & Youngs (2001)	Journal article	USA	Cross-sectional	143	Beliefs - attitude
Zhang (2005)	Dissertation	USA	Cross-sectional	283	Skills – use of strategies

Supplement E Effect Sizes from Primary Studies (Forest Plots)

Figure 5a Effect Sizes of the Effects of Teacher Training on Self-rated Knowledge Regarding Inclusive Education

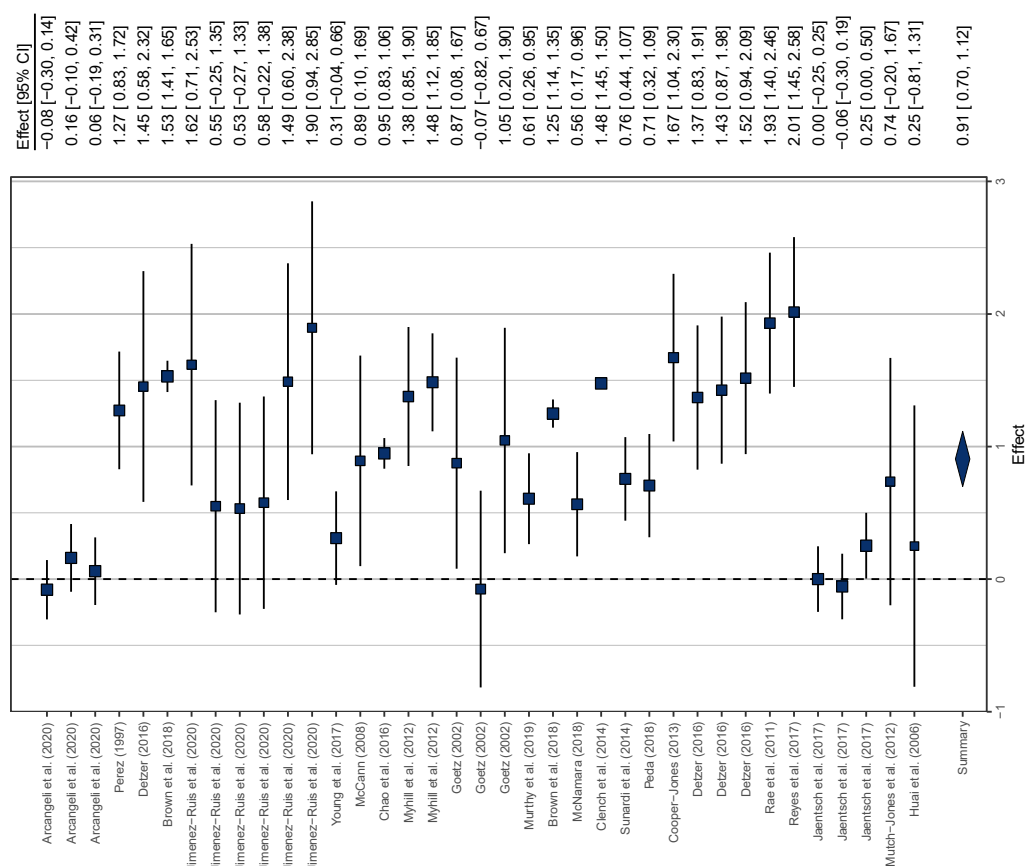


Figure 5b Effect sizes of the effects of teacher training on tested knowledge regarding inclusive education

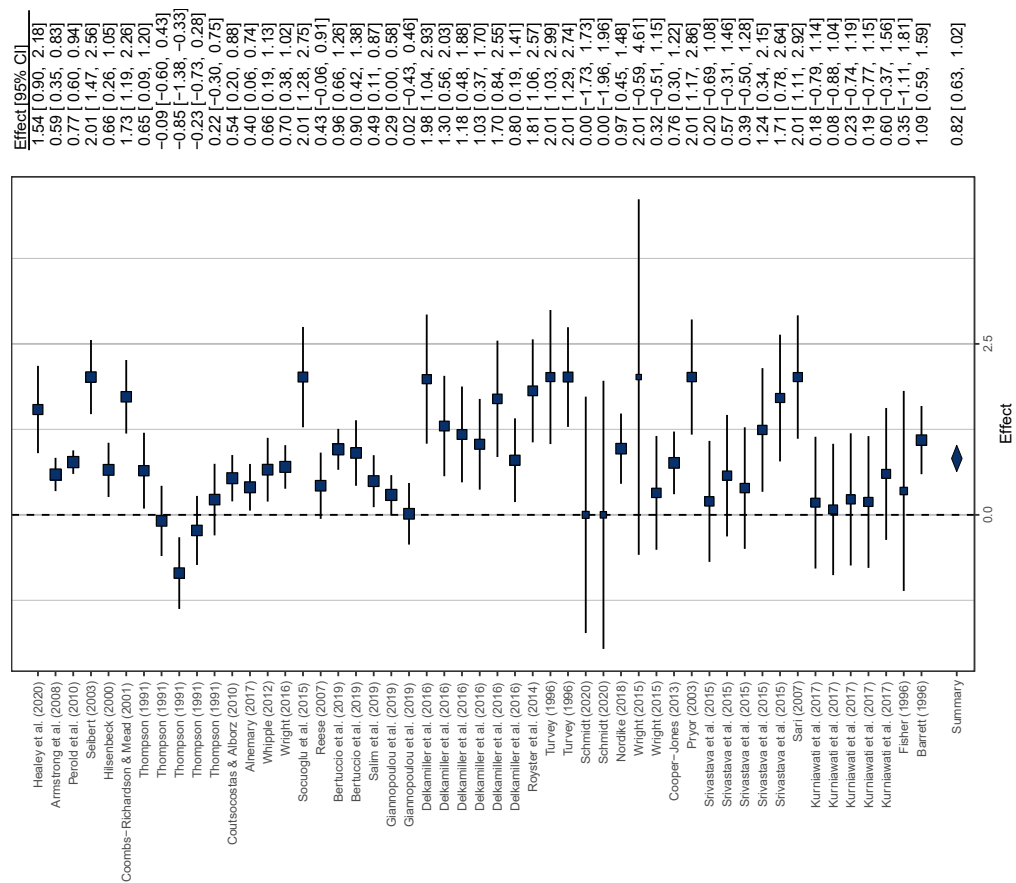


Figure 6b Effect sizes of the effects of teacher training on the use of inclusive teaching strategies, first part

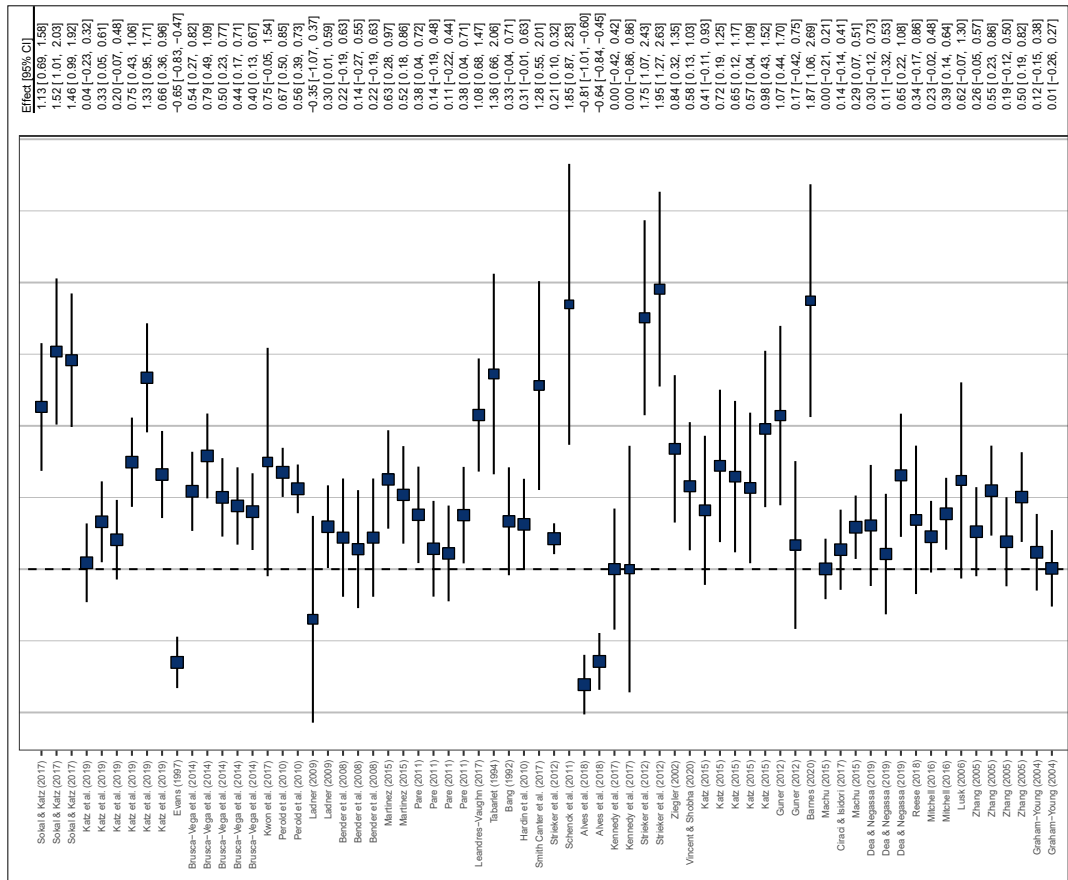


Figure 6a Effect sizes of the effects of teacher training on the implementation quality of inclusive teaching strategies

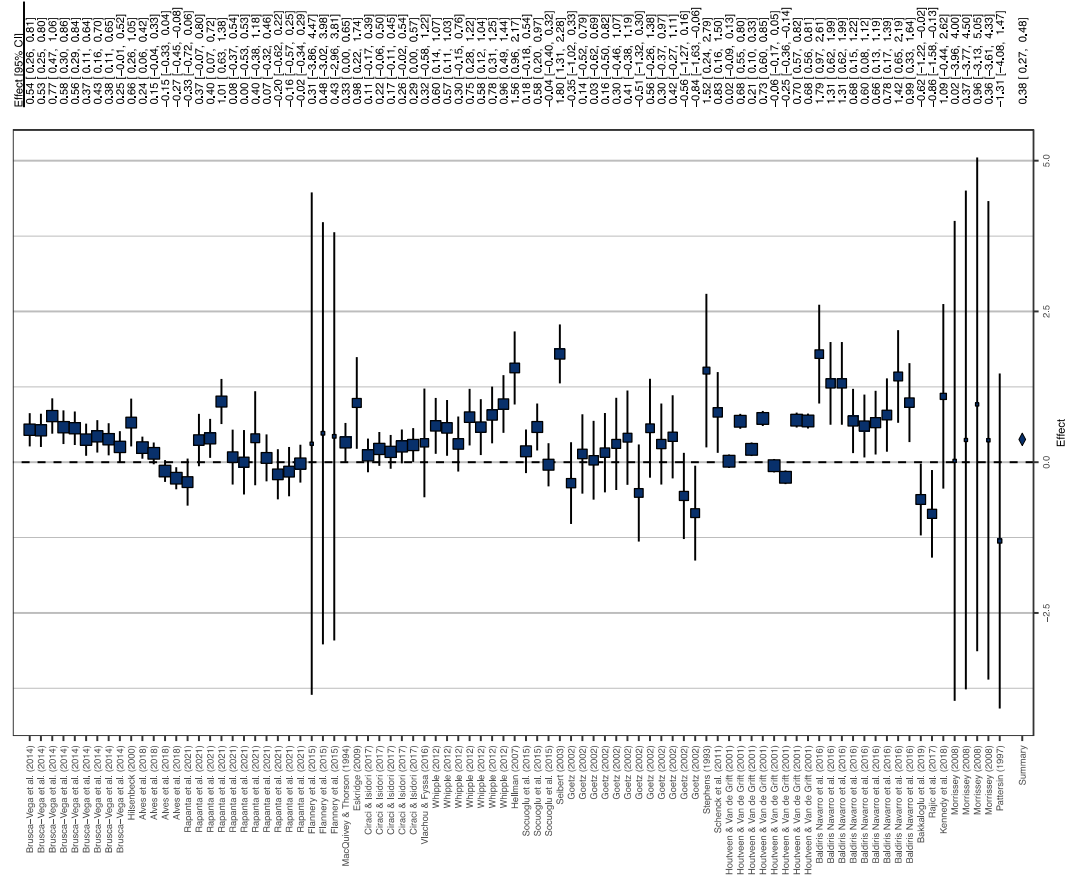


Figure 6c Effect sizes of the effects of teacher training on self-efficacy for inclusive teaching, first part

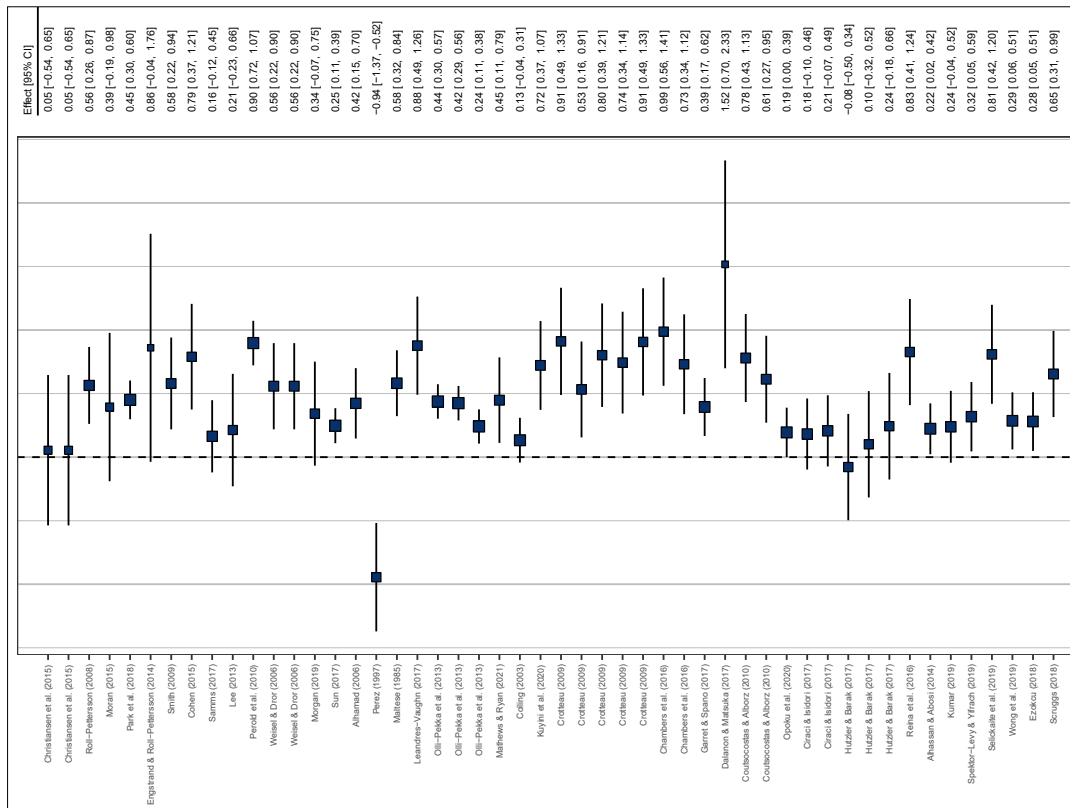


Figure 6b Effect sizes of the effects of teacher training on the use of inclusive teaching strategies, second part

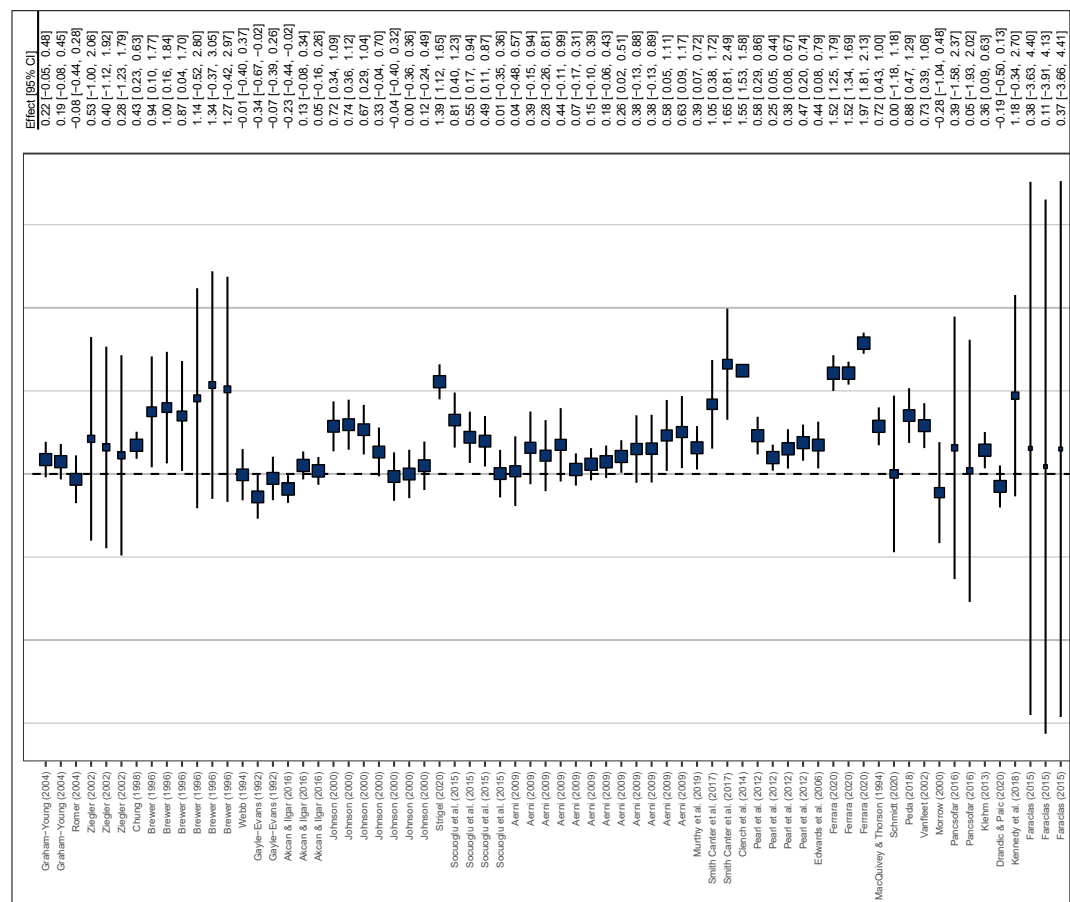


Figure 6c Effect sizes of the effects of teacher training on self-efficacy for inclusive teaching, third part

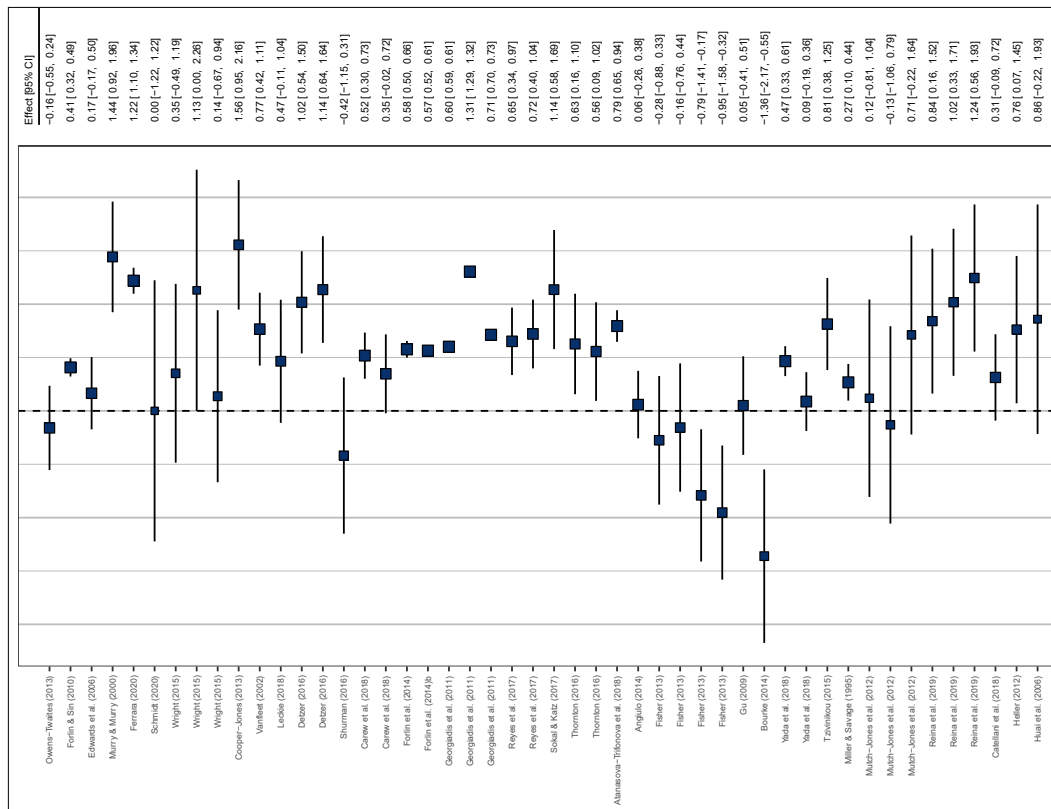


Figure 6c Effect sizes of the effects of teacher training on self-efficacy for inclusive teaching, second part

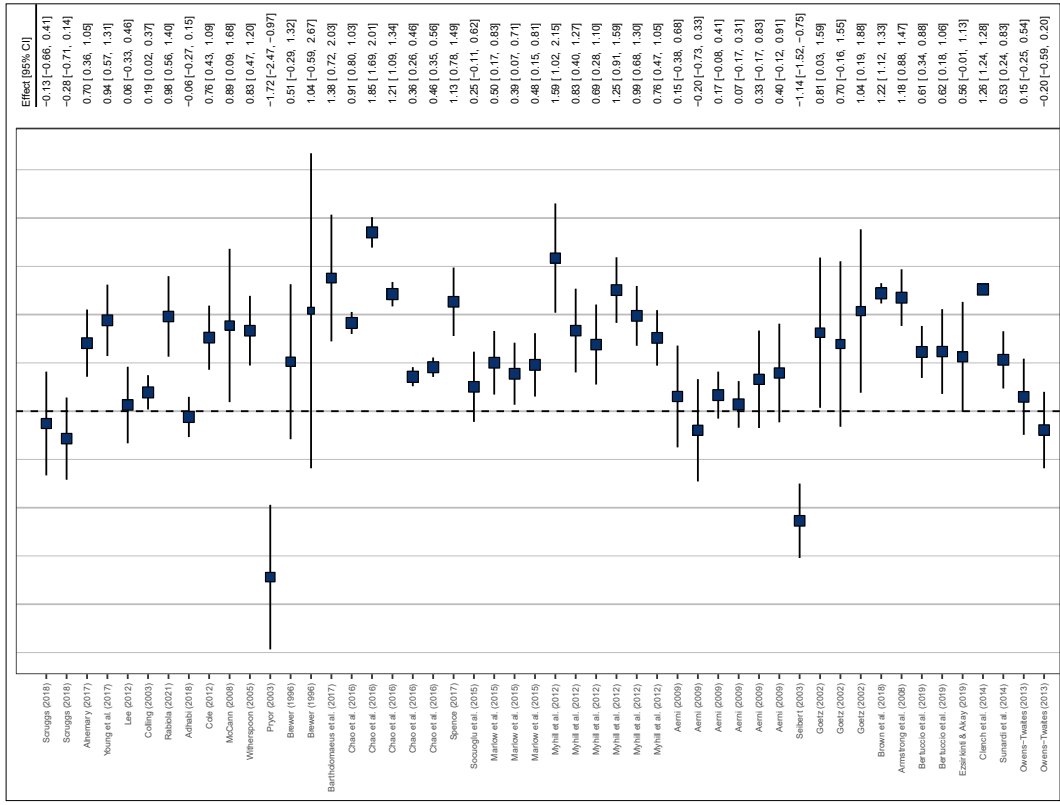


Figure 7a Effect sizes of the effects of teacher training on the attitude towards inclusive education, second part

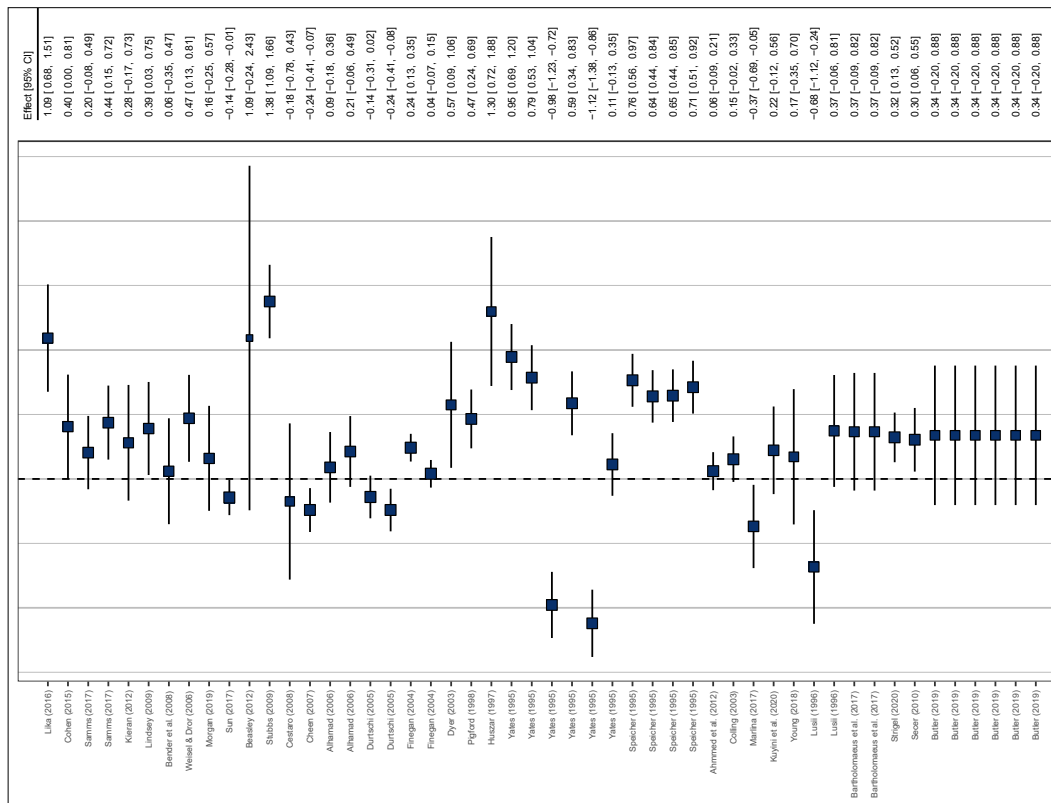


Figure 7a Effect sizes of the effects of teacher training on the attitude towards inclusive education, first part

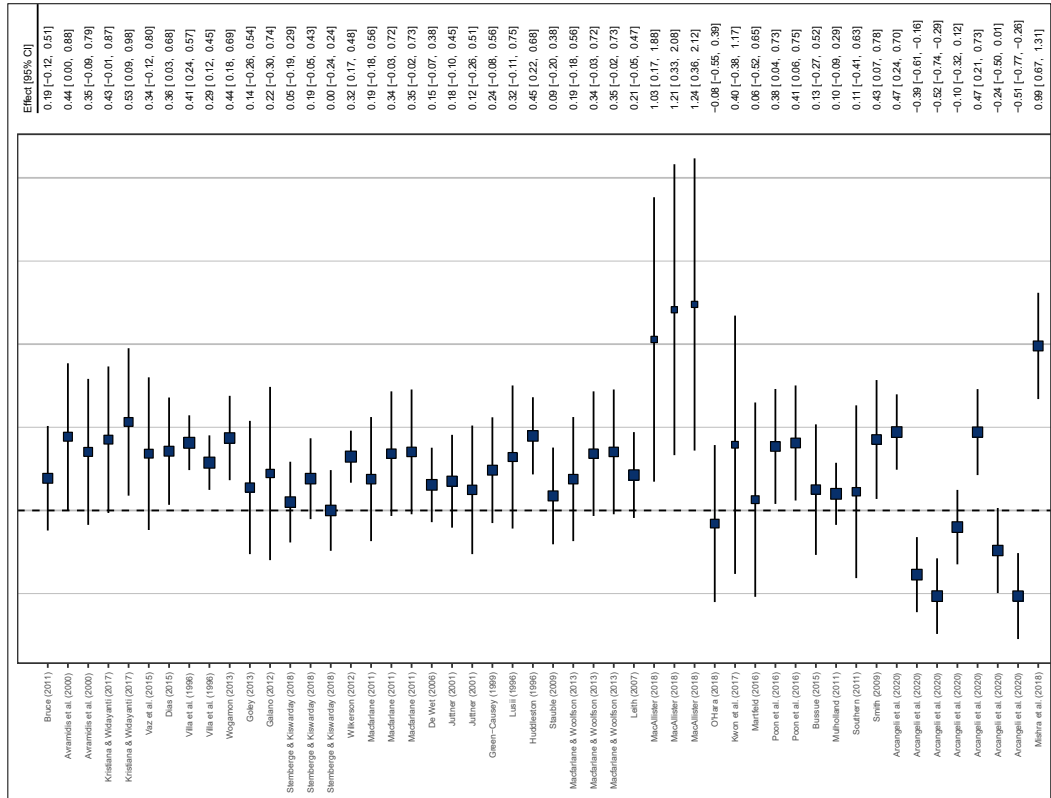


Figure 7a Effect sizes of the effects of teacher training on the attitude towards inclusive education, fourth part

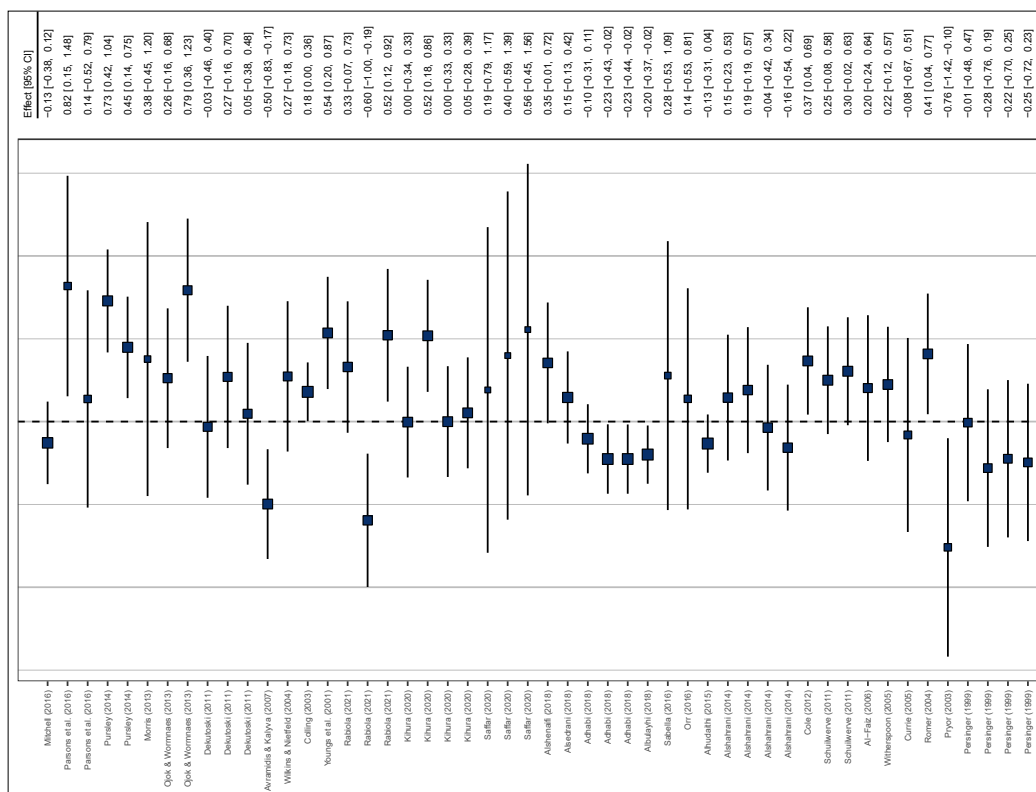


Figure 7a Effect sizes of the effects of teacher training on the attitude towards inclusive education, third part

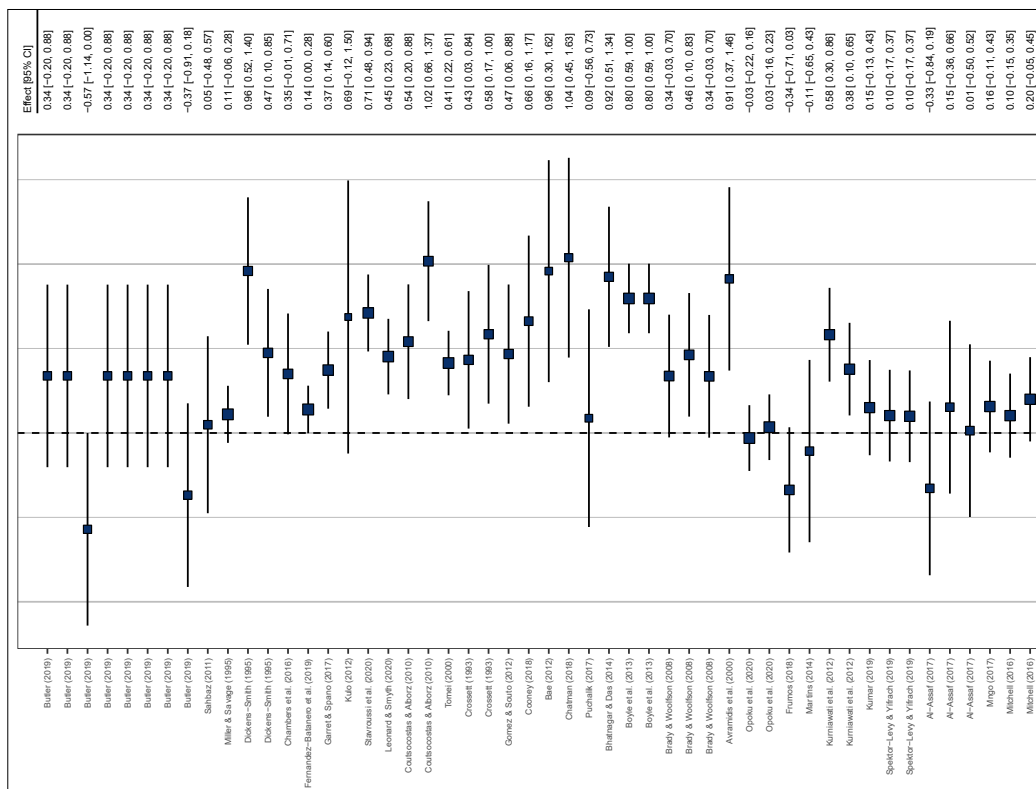


Figure 7a Effect sizes of the effects of teacher training on the attitude towards inclusive education, sixth part

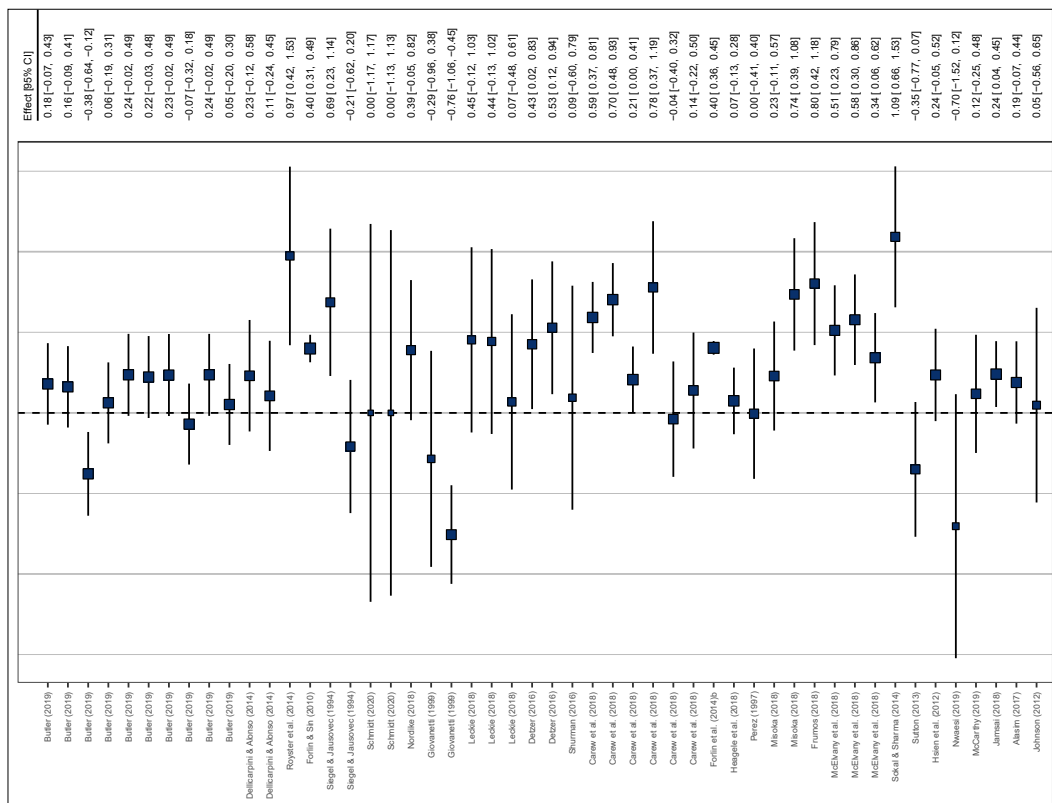


Figure 7a Effect sizes of the effects of teacher training on the attitude towards inclusive education, fifth part

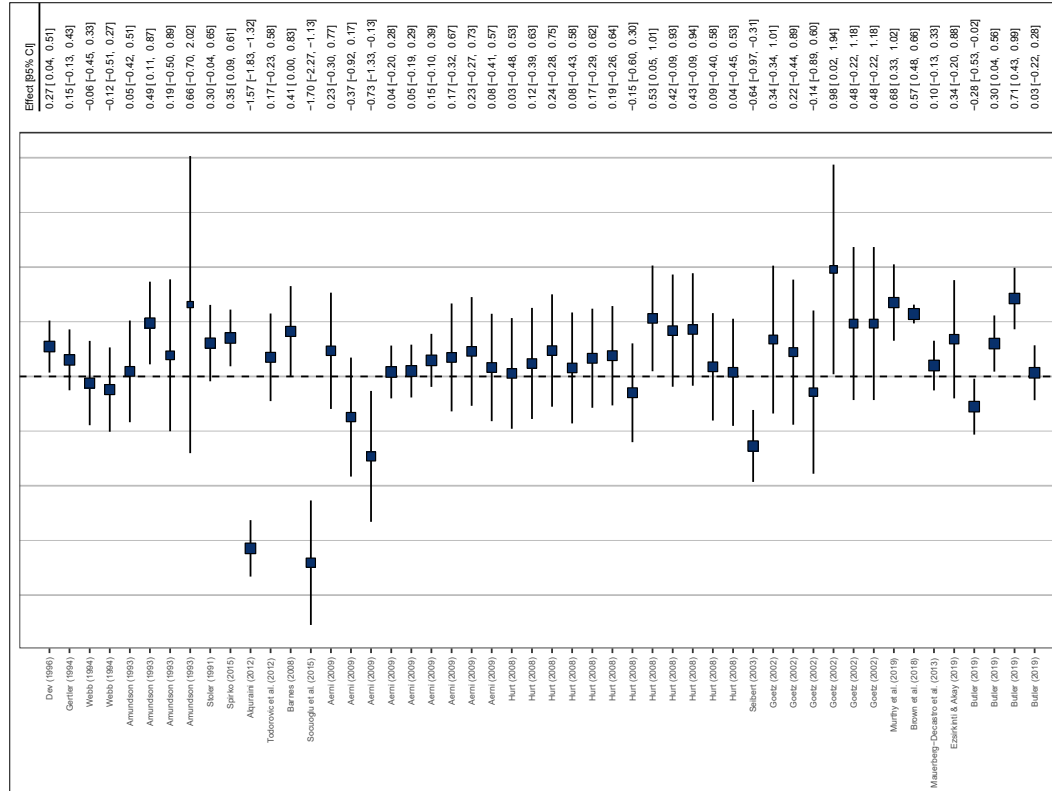


Figure 7b Effect sizes of the effects of teacher training on concerns towards inclusive education

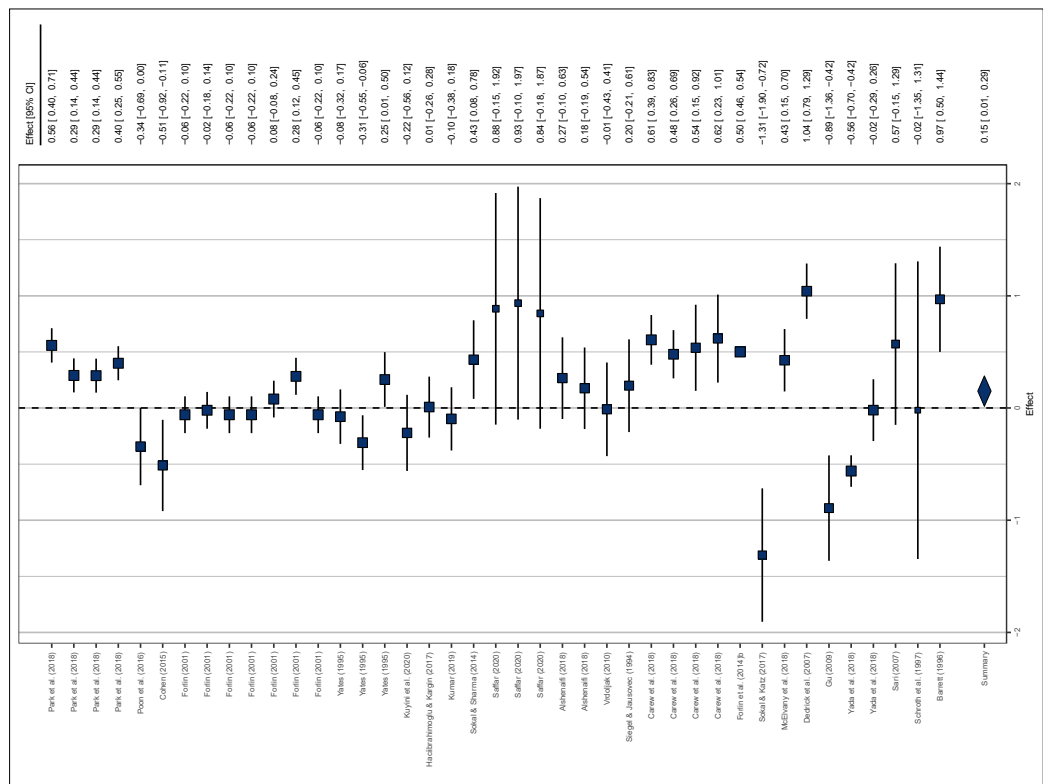


Figure 7a Effect sizes of the effects of teacher training on the attitude towards inclusive education, seventh part

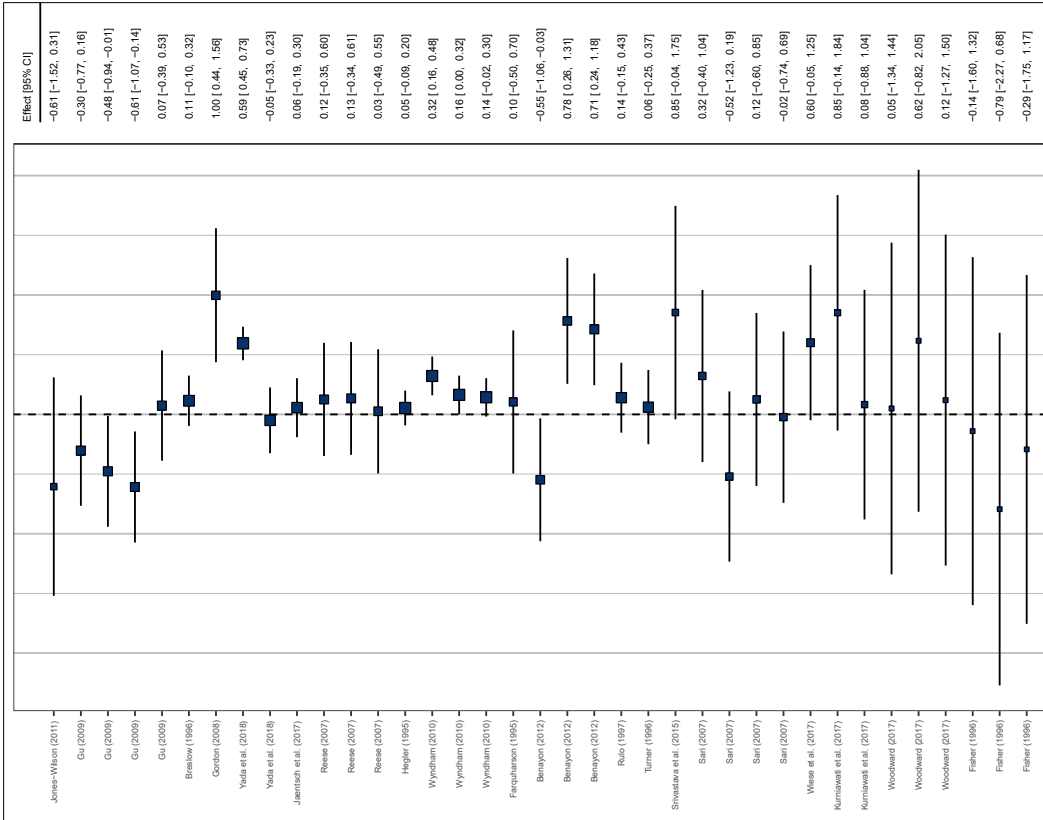


Figure 7c Effect sizes of the effects of teacher training on perspectives about inclusive teaching strategies

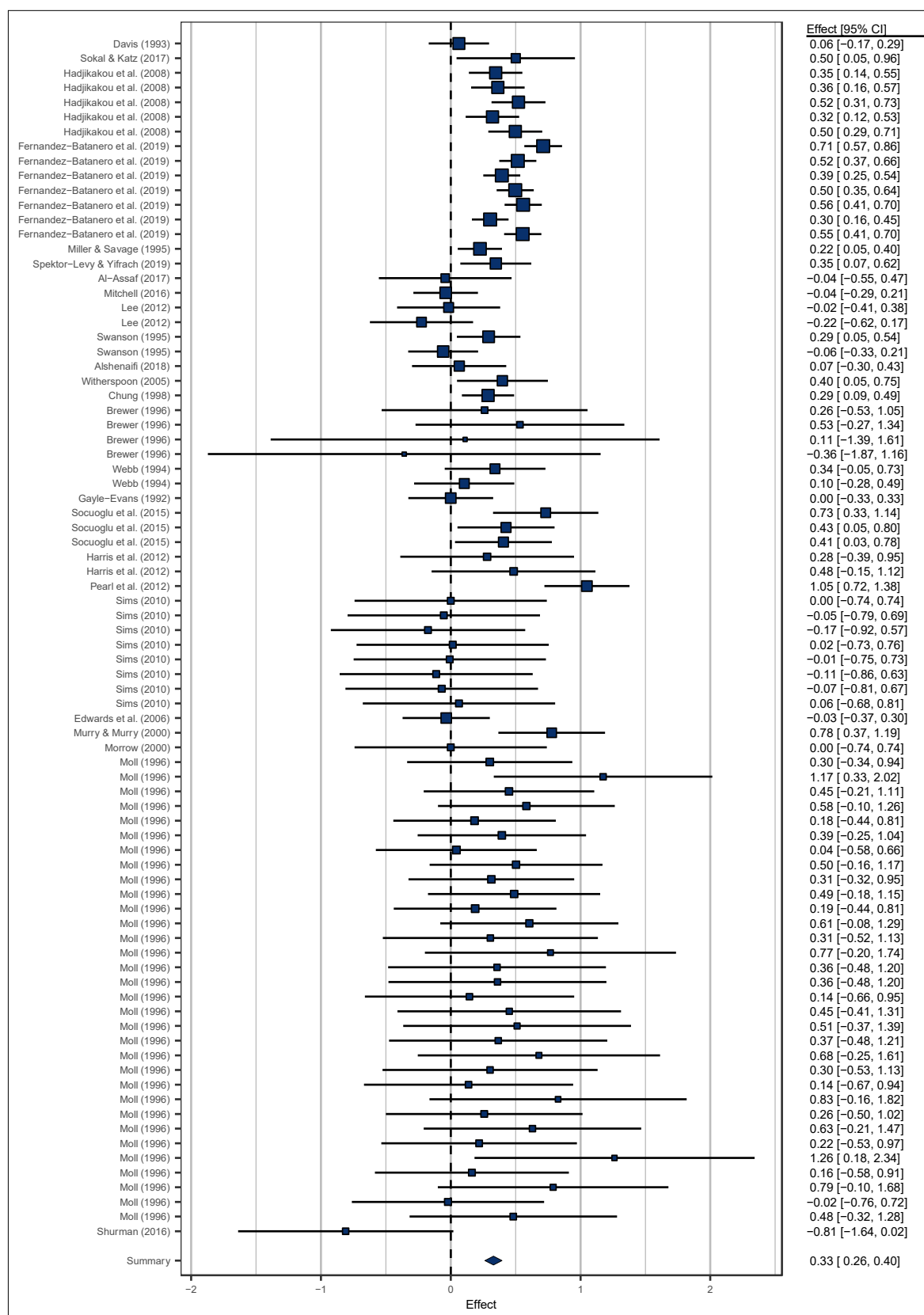


Figure 8a Effect sizes of the effects of teacher training addressing inclusive education on student achievement, second part

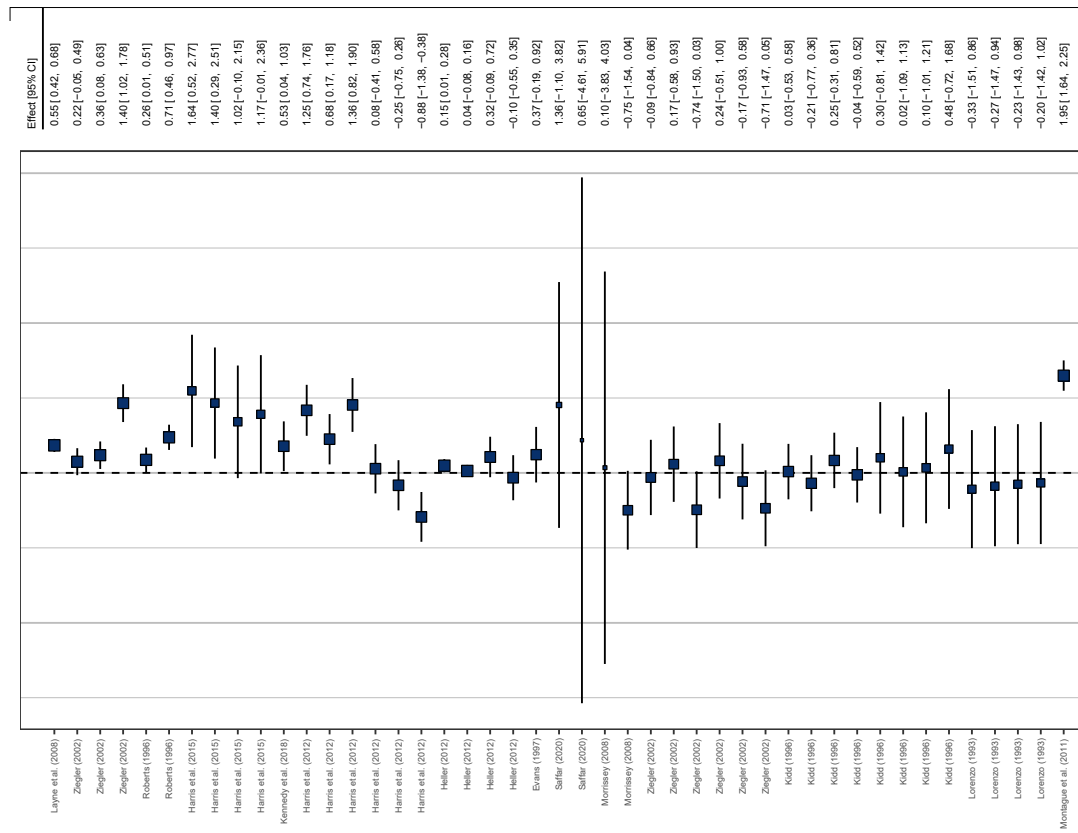


Figure 8a Effect sizes of the effects of teacher training addressing inclusive education on student achievement, first part

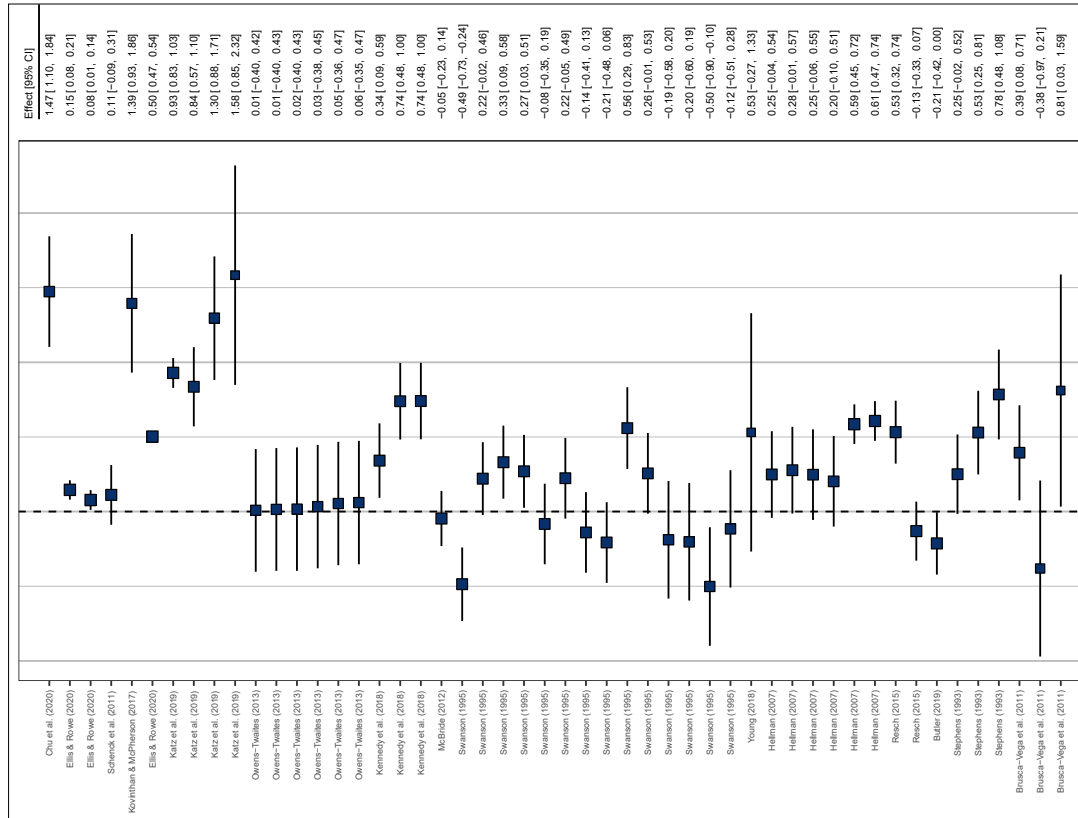


Figure 8b Effect sizes of the effects of teacher training addressing inclusive education on other student behavior, second part

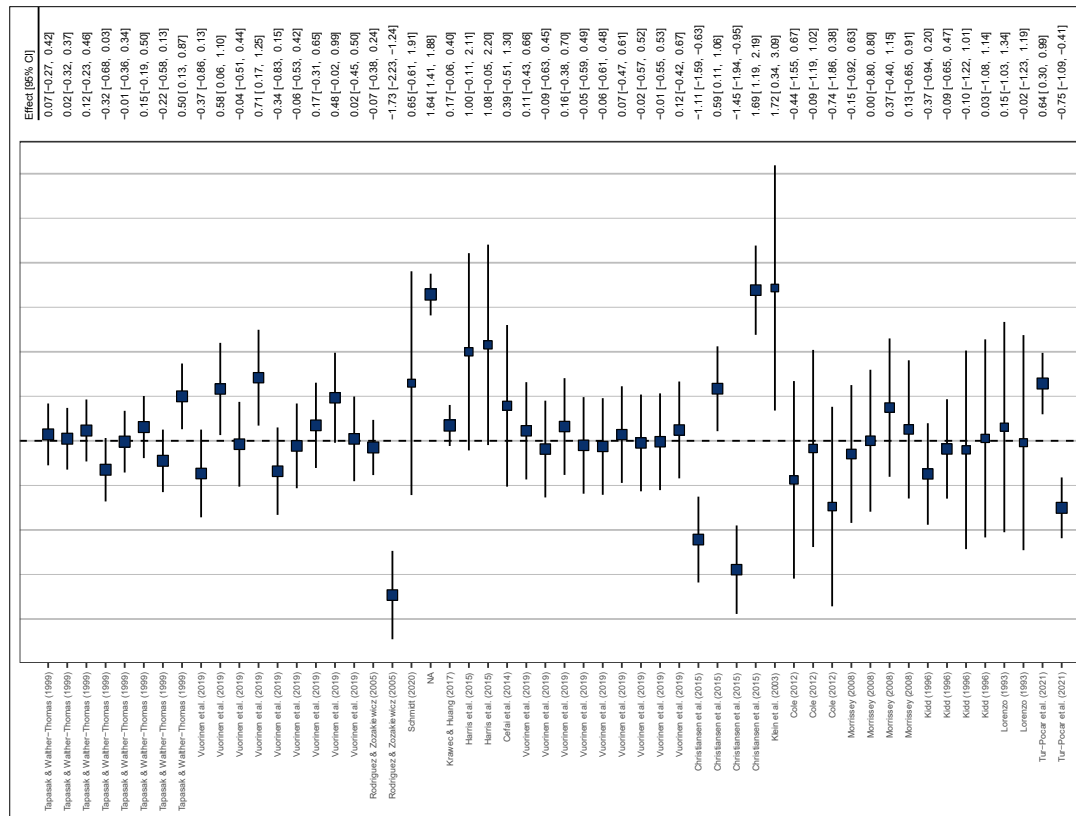
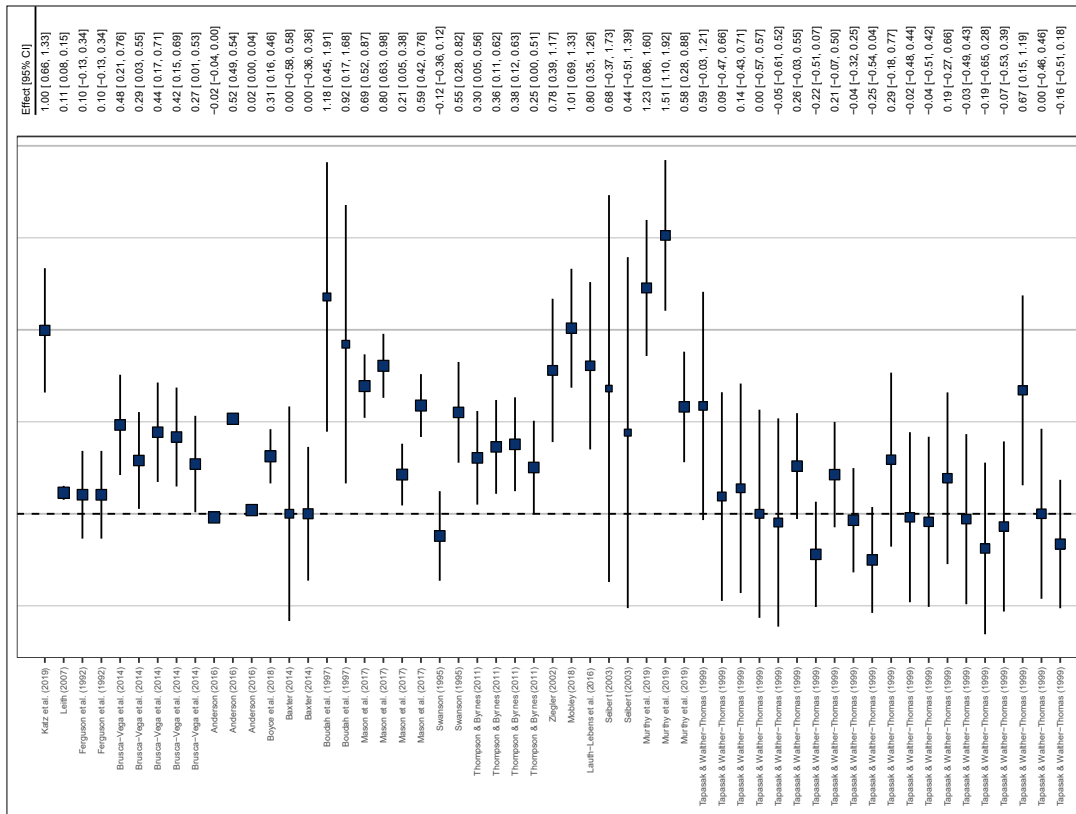


Figure 8b Effect sizes of the effects of teacher training addressing inclusive education on other student behavior, first part



Supplement F Overview of Mean Effects and Variance

Outcome dimension	k	Effect size	95% CI	<i>Q</i>	<i>p_Q</i>	Within-study variance (%)	Between-study variance (%)	Median power (%)
Knowledge	88	0.926	[0.76; 1.10]	1482.96	<0.00001	10.24	83.35	90.2
Self-rated knowledge	37	0.957	[0.70; 1.28]	953.87	<0.00001	5.29	90.75	94.3
Tested knowledge	51	0.913	[0.68; 1.15]	224.49	<0.00001	15.46	68.05	77.5
Skills	371	0.485	[0.41; 0.56]	7446.14	<0.00001	34.19	63.76	69.2
Implementation quality	87	0.469	[0.21; 0.73]	628.49	<0.00001	21.83	71.36	47.7
Use of strategies	136	0.525	[0.36; 0.69]	5191.60	<0.00001	16.06	77.76	73.7
Self-efficacy	148	0.501	[0.40; 0.60]	8458.36	<0.00001	32.75	66.17	71.8
Beliefs	461	0.230	[0.18; 0.28]	2745.3	<0.00001	53.21	32.59	21.5
Attitude	338	0.227	[0.18; 0.28]	1979.4	<0.00001	57.69	27.88	20.6
Perception of strategies	83	0.270	[0.16; 0.39]	167.81	<0.00001	6.81	62.09	8.8
Concerns	40	0.081	[-0.14; 0.30]	533.28	<0.00001	7.61	88.36	12.9
Student behavior	203	0.372	[0.23; 0.51]	3339.81	<0.00001	39.36	58.51	41.8
Achievement	95	0.409	[0.21; 0.61]	987.28	<0.00001	36.69	59.31	50.9
Other Behavior	108	0.328	[0.14; 0.51]	2105.53	<0.00001	43.18	55.13	28.3

Supplement G Moderation Analyses for Effect Size Calculation Methods and Publication Bias

Outcome dimension	Calculation from M(SD)	Egger regression test	Publication status
Knowledge	$F(1, 86)=0.202, p=0.654$	$F(1, 86)=0.016, p=0.900$	$F(1, 86)=0.884, p=0.350$
Self-rated knowledge	$F(1, 35)=0.038, p=0.846$	$F(1, 35)=0.294, p=0.591$	$F(1, 35)=0.267, p=0.609$
Tested knowledge	$F(1, 49)=0.025, p=0.875$	$F(1, 49)=0.004, p=0.953$	$F(1, 49)=0.394, p=0.533$
Skills	$F(1, 369)=2.045, p=0.154$	$F(1, 369)=0.724, p=0.395$	$F(1, 368)=2.074, p=0.151$
Quality of implementation	$F(1, 85)=3.775, p=0.055$	$F(1, 85)=0.400, p=0.529$	$F(1, 85)=5.546, p=0.021$
Use of teaching strategies	$F(1, 134)=0.013, p=0.909$	$F(1, 134)=1.265, p=0.263$	$F(1, 134)=0.002, p=0.967$
Self-efficacy	$F(1, 146)=1.430, p=0.234$	$F(1, 146)=0.109, p=0.742$	$F(1, 146)=9.877, p=0.002$
Beliefs	$F(1, 459)=2.580, p=0.109$	$F(1, 459)=0.155, p=0.694$	$F(1, 457)=6.847, p=0.009$
Attitude	$F(1, 336)=3.158, p=0.077$	$F(1, 336)=0.307, p=0.580$	$F(1, 609)=4.662, p=0.032$
Concerns	$F(1, 38)=0.483, p=0.491$	$F(1, 38)=0.129, p=0.721$	$F(1, 38)=0.109, p=0.743$
Perception of teaching strategies	$F(1, 81)=0.455, p=0.502$	$F(1, 81)=0.073, p=0.788$	$F(1, 81)=11.979, p=0.001$
Student behavior	$F(1, 201)=2.857, p=0.093$	$F(1, 201)=0.608, p=0.436$	$F(1, 200)=4.771, p=0.030$
Student achievement	$F(1, 93)=0.606, p=0.438$	$F(1, 93)=0.250, p=0.618$	$F(1, 93)=17.645, p<0.0001$
Other student behavior	$F(1, 106)=2.684, p=0.104$	$F(1, 106)=0.546, p=0.462$	$F(1, 102)=0.139, p=0.710$

Supplement H Analyses of Study Bias

Knowledge about inclusive education

	Knowledge	Self-rated knowledge	Tested knowledge
Study bias (sum score)	$F(1, 86)=2.741, p=0.101$	$F(1, 35)=11.060, p=0.002$	$F(1, 49)=0.493, p=0.486$
Study design	$F(2, 85)=1.966, p=0.146$	$F(2, 34)=1.691, p=0.200$	$F(2, 48)=0.726, p=0.489$
Response rate	$F(1, 22)=4.281, p=0.051$	$F(1, 7)=9.592, p=0.017$	$F(1, 13)=1.102, p=0.313$
Sampling procedure	$F(1, 86)=0.096, p=0.758$	$F(1, 35)=0.006, p=0.941$	$F(1, 49)=0.228, p=0.636$
Allocation to conditions	$F(1, 75)=0.184, p=0.669$	$F(1, 35)=2.137, p=0.155$	$F(1, 44)=1.864, p=0.179$
Type of data (self-report vs. objective measure)	$F(1, 86)=0.497, p=0.483$	-	-
Standardized instrument	$F(1, 86)=1.435, p=0.234$	$F(1, 35)=5.842, p=0.021$	$F(1, 49)=0.011, p=0.917$
Reliability of the instrument reported	$F(1, 86)=1.402, p=0.240$	$F(1, 35)=7.941, p=0.008$	$F(1, 49)=0.065, p=0.800$
Handling of missing data reported	$F(1, 86)=1.516, p=0.222$	$F(1, 35)=0.042, p=0.839$	$F(1, 49)=2.107, p=0.153$

Skills to implement inclusive education

Moderator	Skills	Quality of implementation	Use of inclusive teaching strategies	Self-efficacy for inclusive teaching
Study bias (sum score)	$F(1, 367)=1.562, p=0.212$	$F(1, 85)=0.326, p=0.569$	$F(1, 133)=4.890, p=0.029$	$F(1, 145)=1.614, p=0.206$
Study design	$F(3, 367)=3.089, p=0.027$	$F(3, 83)=1.212, p=0.311$	$F(3, 133)=0.836, p=0.476$	$F(3, 144)=3.671, p=0.014$
Response rate	$F(1, 107)=2.013, p=0.159$	$F(1, 6)=0.003, p=0.958$	$F(1, 47)=0.393, p=0.534$	$F(1, 50)=1.560, p=0.218$
Sampling procedure	$F(1, 368)=1.982, p=0.160$	$F(1, 85)=0.493, p=0.485$	$F(1, 134)=0.343, p=0.559$	$F(1, 146)=1.617, p=0.206$
Allocation to conditions	$F(1, 257)=0.186, p=0.667$	$F(1, 75)=0.055, p=0.816$	$F(1, 88)=0.299, p=0.586$	$F(1, 91)=1.892, p=0.172$
Type of data (self-report vs. objective measure)	$F(1, 169)=1.780, p=0.183$	$F(1, 85)=0.001, p=0.972$	$F(1, 134)=4.977, p=0.027$	-
Standardized instrument	$F(1, 369)=2.244, p=0.135$	$F(1, 85)=0.653, p=0.421$	$F(1, 134)=7.421, p=0.007$	$F(1, 146)=0.236, p=0.628$
Reliability of the instrument reported	$F(1, 368)=3.209, p=0.074$	$F(1, 85)=0.817, p=0.369$	$F(1, 135)=8.172, p=0.005$	$F(1, 145)=2.608, p=0.109$
Handling of missing data reported	$F(1, 368)=0.530, p=0.467$	$F(1, 85)=0.009, p=0.924$	$F(1, 134)=0.848, p=0.359$	$F(1, 146)=0.432, p=0.512$

Beliefs regarding inclusive education

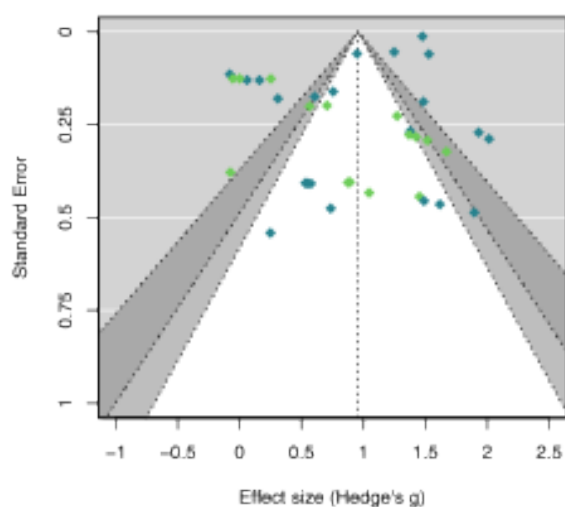
	Beliefs	Attitude	Concerns	Perception of strategies
Study bias (sum score)	$F(1, 457)=0.488, p=0.485$	$F(1, 336)=1.351, p=0.246$	$F(1, 38)=0.096, p=0.758$	$F(1, 81)=0.314, p=0.577$
Study design	$F(3, 456)=0.305, p=0.822$	$F(3, 334)=0.523, p=0.667$	$F(3, 36)=0.853, p=0.474$	$F(2, 80)=1.171, p=0.315$
Response rate	$F(1, 179)=3.603, p=0.059$	$F(1, 149)=3.443, p=0.066$	$F(1, 9)=0.752, p=0.409$	$F(1, 17)=2.101, p=0.165$
Sampling procedure	$F(1, 457)=0.140, p=0.709$	$F(1, 337)=0.635, p=0.426$	$F(1, 38)=0.527, p=0.472$	$F(1, 81)=0.481, p=0.490$
Allocation to conditions	$F(1, 209)=0.001, p=0.973$	$F(1, 136)=0.178, p=0.674$	$F(1, 11)=0.697, p=0.421$	$F(1, 60)=0.604, p=0.440$
Type of data (self-report vs. objective measure)	-	-	-	-
Standardized instrument	$F(1, 457)=0.585, p=0.445$	$F(1, 336)=1.765, p=0.185$	$F(1, 38)=0.685, p=0.413$	$F(1, 81)=0.799, p=0.374$
Reliability of the instrument reported	$F(1, 457)=0.071, p=0.790$	$F(1, 336)=0.045, p=0.831$	$F(1, 38)=0.000, p=0.987$	$F(1, 81)=0.001, p=0.979$
Handling of missing data reported	$F(1, 457)=0.368, p=0.545$	$F(1, 336)=0.120, p=0.729$	$F(1, 38)=2.58, p=0.117$	$F(1, 81)=0.004, p=0.947$

Student behavior

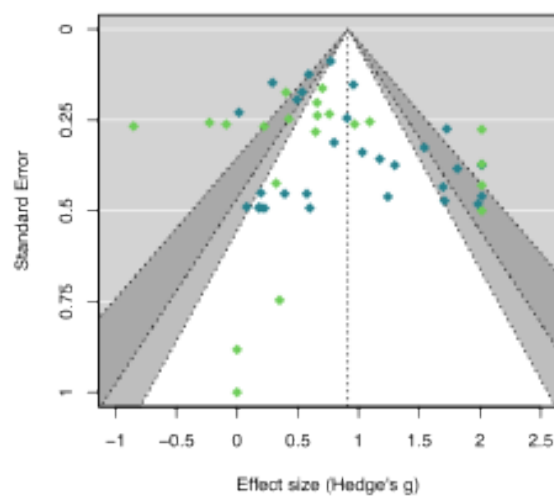
	Student behavior	Student achievement	Other student behavior
Study bias (sum score)	$F(1, 200)=0.276, p=0.600$	$F(1, 92)=0.091, p=0.763$	$F(1, 105)=2.125, p=0.148$
Study design	$F(3, 199)=1.004, p=0.392$	$F(3, 91)=1.891, p=0.137$	$F(3, 104)=0.665, p=0.575$
Response rate	$F(1, 59)=0.091, p=0.764$	$F(1, 20)=0.388, p=0.540$	$F(1, 37)=0.033, p=0.857$
Sampling procedure	$F(1, 200)=0.185, p=0.668$	$F(1, 93)=3.562, p=0.062$	$F(1, 105)=7.872, p=0.006$
Allocation to conditions	$F(1, 194)=0.244, p=0.622$	$F(1, 93)=0.914, p=0.342$	$F(1, 105)=0.120, p=0.730$
Type of data (self-report vs. objective measure)	$F(1, 201)=13.35, p=0.0003$	-	$F(1, 106)=19.474, p<.001$
Standardized instrument	$F(1, 201)=4.462, p=0.034$	$F(1, 93)=5.504, p=0.021$	$F(1, 106)=1.562, p=0.214$
Reliability of the instrument reported	$F(1, 201)=3.522, p=0.062$	$F(1, 93)=15.457, p=0.0002$	$F(1, 106)=0.938, p=0.335$
Handling of missing data reported	$F(1, 200)=0.844, p=0.360$	$F(1, 93)=0.737, p=0.393$	$F(1, 105)=0.049, p=0.826$

Supplement I Traditional Funnel Plots

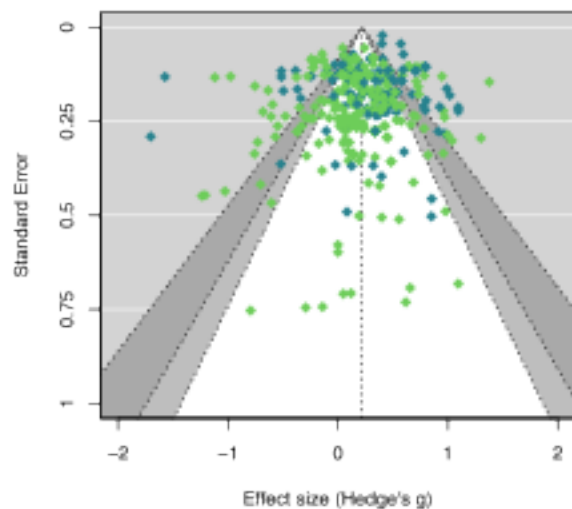
Self-rated knowledge



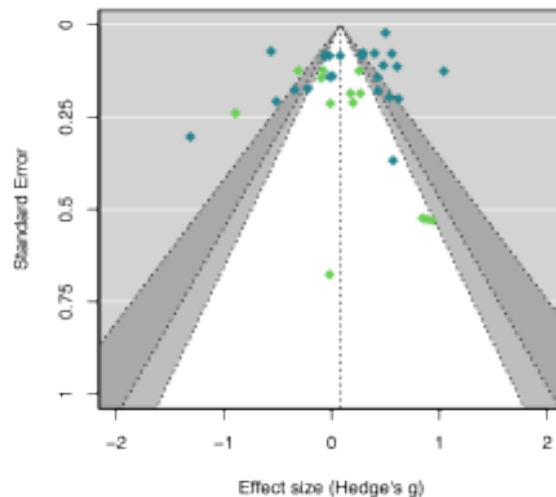
Tested knowledge



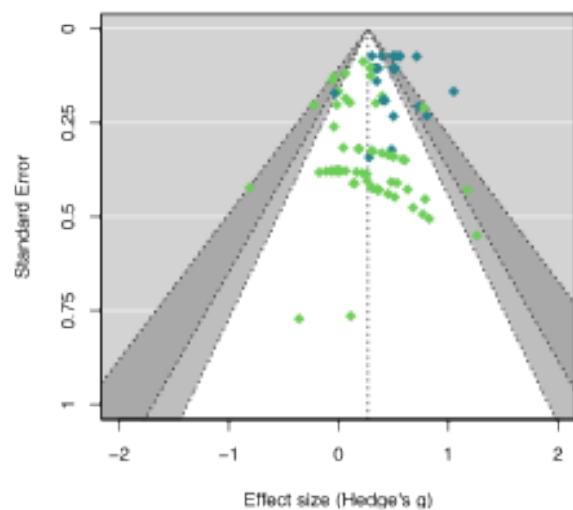
Attitude towards inclusive education



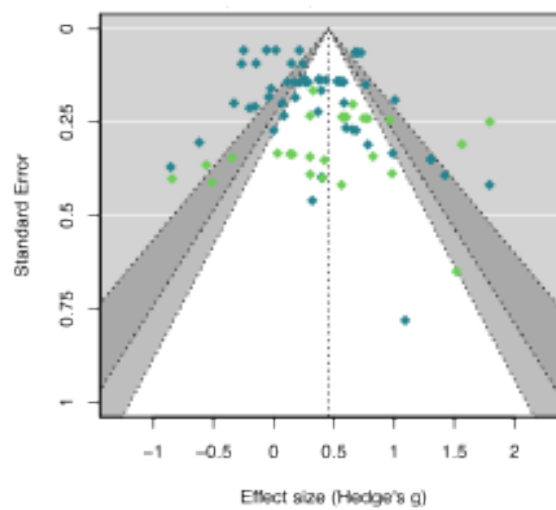
Concerns regarding inclusive education



Perceptions on inclusive teaching strategies



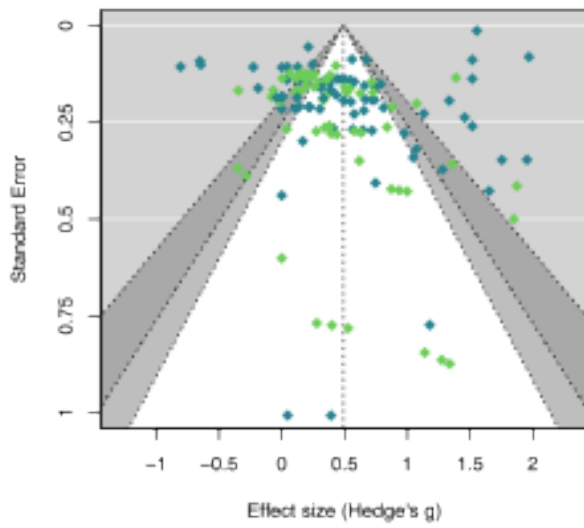
Quality of implementation



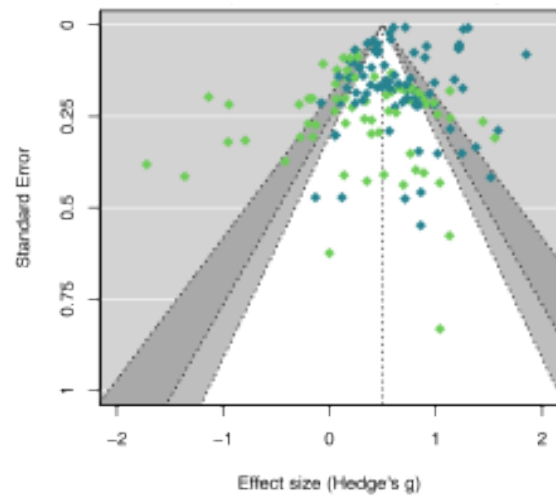
Publication status

◆ published ◆ unpublished

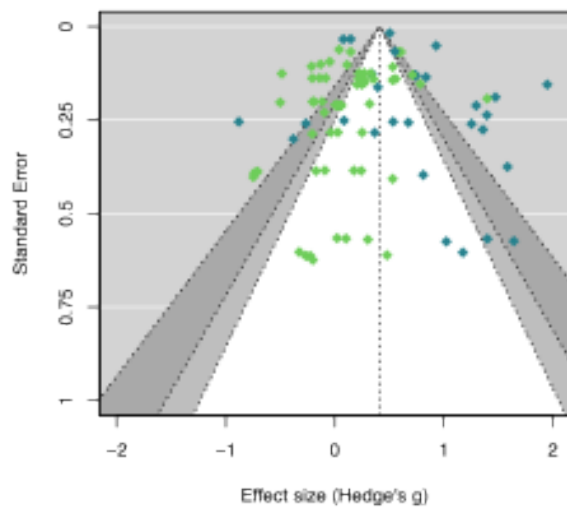
Use of inclusive teaching strategies



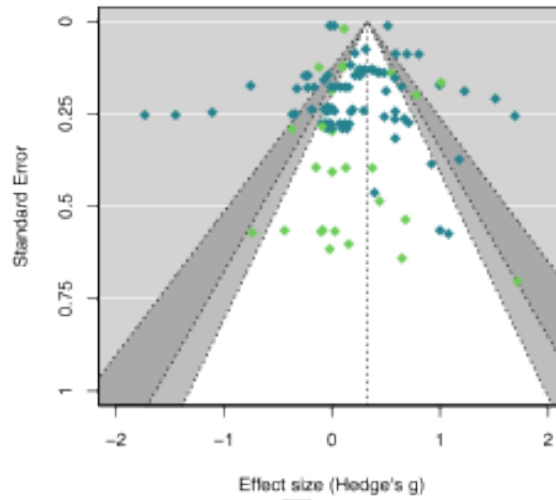
Self-efficacy for inclusive teaching



Student achievement



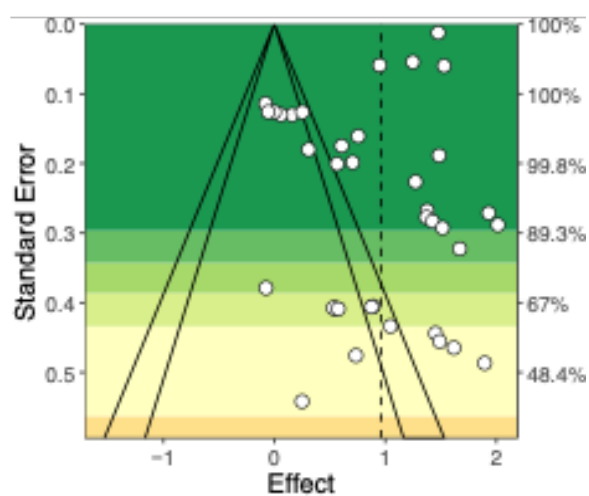
Other student behavior



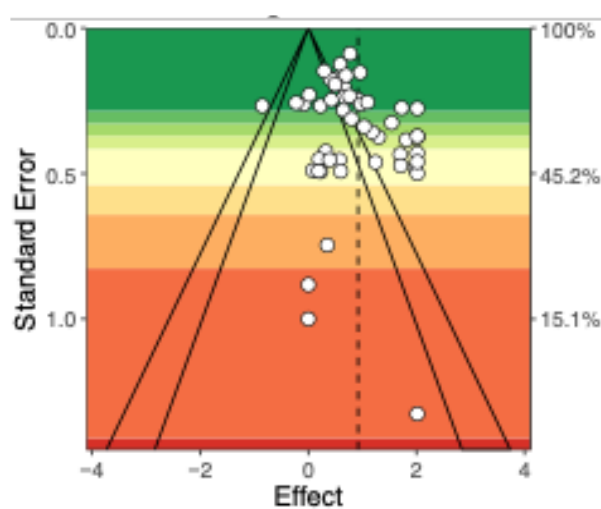
Publication status |♦| published |•| unpublished

Supplement J Power Enhanced Funnel Plots

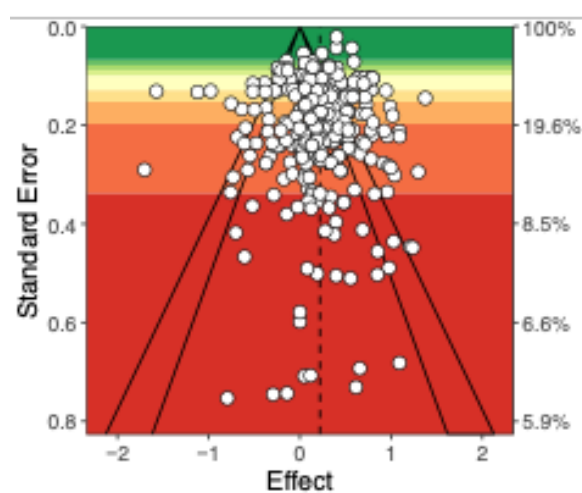
Self-rated knowledge



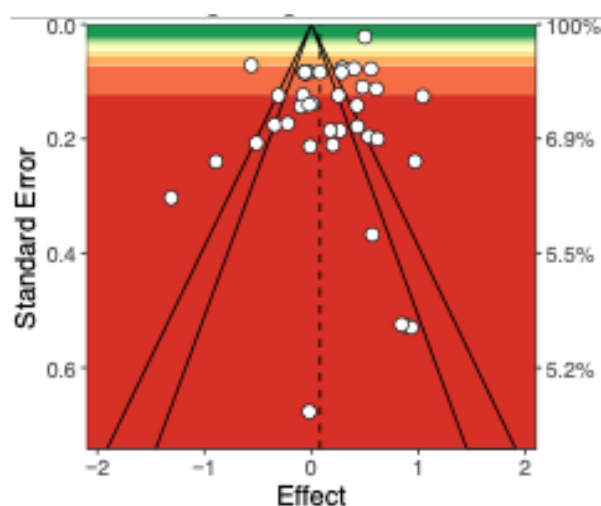
Tested knowledge



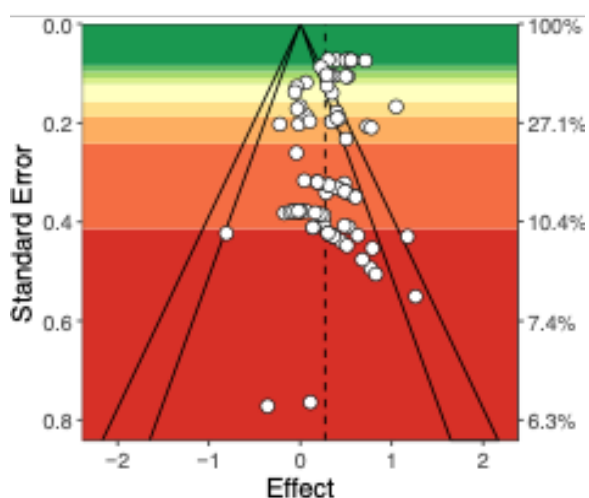
Attitude towards inclusive education



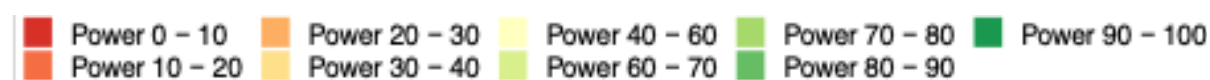
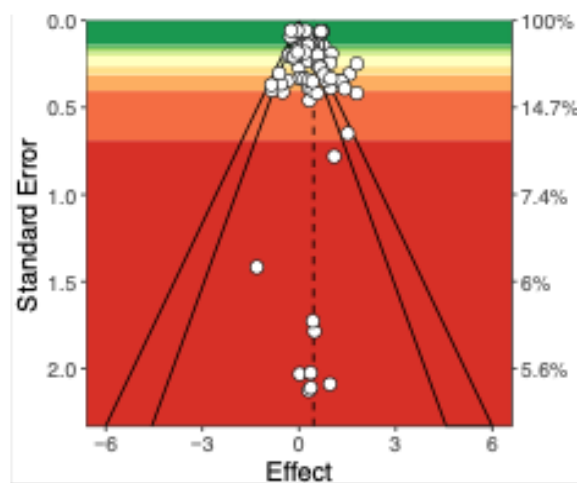
Concerns regarding inclusive education



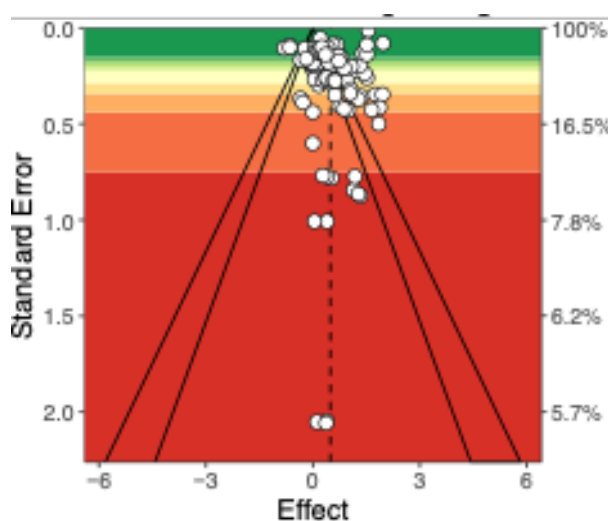
Perceptions on inclusive teaching strategies



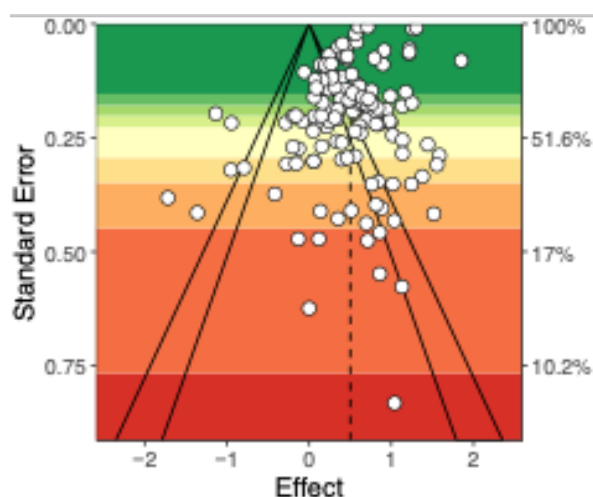
Quality of implementation



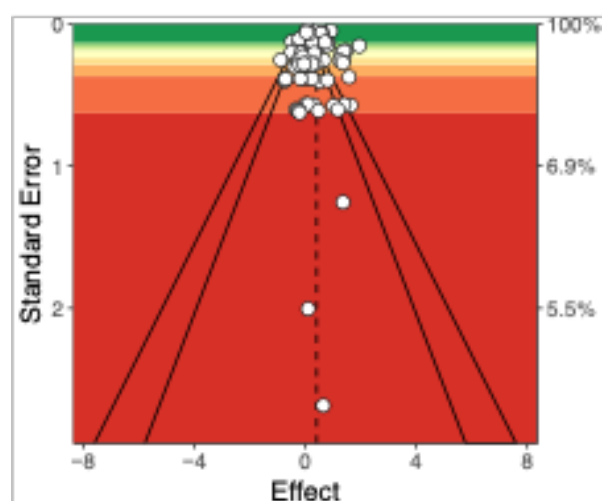
Use of inclusive teaching strategies



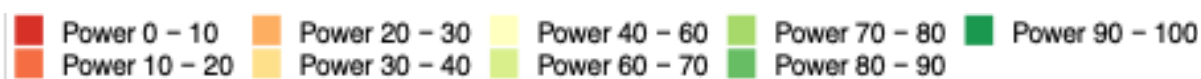
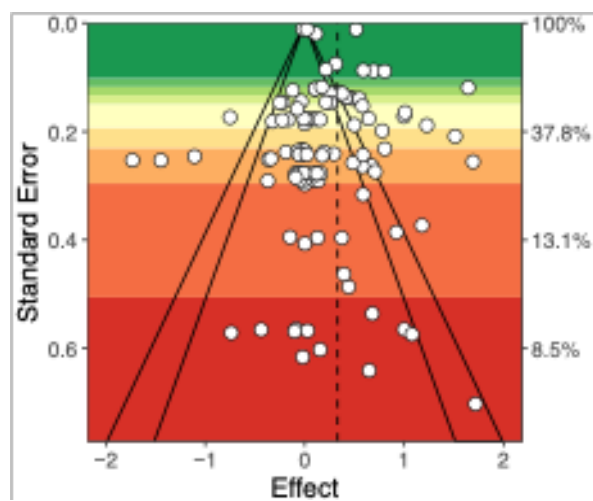
Self-efficacy for inclusive teaching



Student achievement



Other student behavior



Supplement K Moderation Analyses of Study Design, Participant Characteristics and Professional Development Design

Knowledge about inclusive education

	Knowledge	Self-rated knowledge	Tested knowledge
Effect size estimate	0.926 [0.756; 1.097]	0.957 [0.697; 1.217]	0.913 [0.677; 1.148]
Number of effect sizes	88	37	51
Components of outcome dimension	$F(1, 86)=0.497, p=0.483$		
Characteristics of the study			
Intervention study	$F(1, 86)=3.733, p=0.057$	$F(1, 35)=2.216, p=0.146$	$F(1, 49)=1.497, p=0.227$
Publication year	$F(1, 86)=1.060, p=0.306$	$F(1, 35)=0.466, p=0.500$	$F(1, 49)=0.703, p=0.406$
Years since legal introduction of IE	$F(1, 86)=0.218, p=0.642$	$F(1, 35)=0.031, p=0.861$	$F(1, 49)=0.566, p=0.456$
Continent	$F(6, 81)=0.669, p=0.675$	$F(1, 35)=0.457, p=0.702$	$F(5, 45)=0.495, p=0.778$
Characteristics of the data collection			
Time between end of PD and post-data collection	$F(1, 75)=0.380, p=0.540$	$F(1, 29)=0.127, p=0.724$	$F(1, 44)=0.938, p=0.338$
Type of measurement	$F(2, 85)=1.992, p=0.143$	$F(2, 34)=1.668, p=0.204$	$F(2, 48)=3.537, p=0.037$
Instrument focusses on specific diversity feature	$F(1, 86)=6.573, p=0.012$	$F(1, 35)=0.107, p=0.756$	$F(1, 49)=5.543, p=0.023$
Instrument focusses on specific method	$F(1, 86)=0.031, p=0.861$	$F(1, 35)=0.020, p=0.889$	$F(1, 49)=0.095, p=0.759$
Characteristics of the participants			
Mean age	$F(1, 34)=1.663, p=0.206$	$F(1, 9)=0.004, p=0.951$	$F(1, 23)=8.496, p=0.008$
Mean teaching experience	$F(1, 53)=1.403, p=0.241$	$F(1, 19)=0.079, p=0.782$	$F(1, 32)=2.769, p=0.106$
School type	$F(3, 84)=0.568, p=0.637$	$F(2, 34)=0.387, p=0.692$	$F(3, 47)=0.311, p=0.817$
participants with IE experience (%)	$F(1, 39)=3.885, p=0.056$	$F(1, 11)=2.152, p=0.170$	$F(1, 26)=1.880, p=0.182$
Characteristics of the professional development design			
Content focus	$F(1, 75)=0.007, p=0.936$	$F(1, 29)=0.024, p=0.879$	$F(1, 44)=0.025, p=0.876$
Specific topic	$F(1, 75)=1.199, p=0.277$	$F(1, 29)=2.465, p=0.127$	$F(1, 44)=0.014, p=0.906$
Specific subject	$F(1, 75)=1.285, p=0.261$	$F(1, 29)=2.157, p=0.153$	$F(1, 44)=0.090, p=0.765$
Specific method	$F(1, 75)=0.036, p=0.849$	$F(1, 29)=1.107, p=0.302$	$F(1, 44)=0.162, p=0.690$
Active learning	$F(1, 75)=0.001, p=0.978$	$F(1, 29)=0.302, p=0.587$	$F(1, 44)=0.159, p=0.693$
Practice opportunities are offered in sessions	$F(1, 75)=0.731, p=0.395$	$F(1, 29)=1.920, p=0.176$	$F(1, 44)=0.015, p=0.903$
Sandwich	$F(1, 75)=0.001, p=0.981$	$F(1, 29)=2.381, p=0.134$	$F(1, 44)=3.025, p=0.089$
Case studies are used in sessions	$F(1, 75)=0.732, p=0.395$	$F(1, 29)=0.016, p=0.902$	$F(1, 44)=0.635, p=0.430$
Coherence with other learning activities	$F(1, 75)=0.695, p=0.407$	$F(1, 29)=0.861, p=0.361$	$F(1, 44)=0.033, p=0.857$
Additional coaching	$F(1, 75)=4.661, p=0.034$	$F(1, 29)=0.653, p=0.426$	$F(1, 44)=4.502, p=0.040$
Implementation is planned in session	$F(1, 75)=0.202, p=0.654$	$F(1, 29)=1.264, p=0.270$	$F(1, 44)=0.095, p=0.760$
Prerequisites to participate in PD	$F(1, 75)=1.500, p=0.211$	$F(1, 29)=0.115, p=0.737$	$F(1, 44)=1.671, p=0.203$
Duration	$F(1, 75)=0.019, p=0.890$	$F(1, 29)=0.021, p=0.887$	$F(1, 44)=0.001, p=0.974$
Collective participation	$F(1, 75)=1.894, p=0.173$	$F(1, 29)=0.040, p=0.843$	$F(1, 44)=2.220, p=0.143$
Certification	$F(1, 75)=8.266, p=0.005$	$F(1, 29)=2.136, p=0.155$	$F(1, 44)=6.140, p=0.017$

Skills for inclusive education

	Skills	Implementation quality	Use of inclusive teaching strategies	Self-efficacy towards IE
Effect size estimate	0.485 [0.408; 0.562]	0.469 [0.212; 0.726]	0.525 [0.362; 0.687]	0.501 [0.400; 0.601]
Number of effect sizes	371	87	136	148
Components of outcome dimension	$F(2, 368)=0.153$, $p=0.859$			
Characteristics of the study				
Intervention study	$F(1, 369)=8.126$, $p=0.005$	$F(1, 85)=3.166$, $p=0.079$	$F(1, 135)=2.639$, $p=0.107$	$F(1, 146)=2.522$, $p=0.114$
Publication year	$F(1, 368)=3.220$, $p=0.074$	$F(1, 85)=3.072$, $p=0.083$	$F(1, 134)=3.304$, $p=0.071$	$F(1, 146)=2.286$, $p=0.133$
Years since legal introduction of inclusive education	$F(1, 368)=0.115$, $p=0.735$	$F(1, 85)=0.219$, $p=0.641$	$F(1, 134)=2.949$, $p=0.088$	$F(1, 146)=1.125$, $p=0.291$
Continent (Europe)	$F(1, 368)=0.006$, $p=0.938$	$F(1, 85)=11.862$, $p=0.001$	$F(1, 133)=1.979$, $p=0.162$	$F(1, 146)=4.174$, $p=0.043$
Characteristics of the data collection				
Time between end of PD and post-data collection	$F(1, 257)=1.633$, $p=0.202$	$F(1, 75)=1.785$, $p=0.186$	$F(1, 88)=0.232$, $p=0.631$	$F(1, 91)=2.749$, $p=0.101$
Type of measurement	$F(5, 365)=1.400$, $p=0.224$	$F(5, 81)=0.249$, $p=0.939$	$F(3, 133)=2.190$, $p=0.092$	$F(2, 145)=0.734$, $p=0.482$
Instrument focusses on specific diversity feature	$F(1, 369)=0.003$, $p=0.954$	$F(1, 85)=1.516$, $p=0.222$	$F(1, 135)=1.525$, $p=0.219$	$F(1, 146)=0.126$, $p=0.723$
Instrument focusses on specific method	$F(1, 369)=0.859$, $p=0.355$	$F(1, 85)=0.061$, $p=0.805$	$F(1, 135)=0.120$, $p=0.729$	$F(1, 146)=1.322$, $p=0.252$
Characteristics of the participants				
Mean age	$F(1, 89)=0.8434$, $p=0.361$	$F(1, 10)=0.540$, $p=0.479$	$F(1, 25)=0.698$, $p=0.411$	$F(1, 50)=0.114$, $p=0.737$
Mean teaching experience	$F(1, 197)=0.011$, $p=0.916$	$F(1, 33)=0.045$, $p=0.833$	$F(1, 72)=0.375$, $p=0.542$	$F(1, 88)=0.013$, $p=0.908$
School type	$F(3, 366)=1.567$, $p=0.197$	$F(3, 83)=1.614$, $p=0.192$	$F(3, 132)=0.658$, $p=0.579$	$F(3, 144)=0.582$, $p=0.628$
participants with IE experience (%)	$F(1, 214)=2.156$, $p=0.144$	$F(1, 51)=0.014$, $p=0.908$	$F(1, 88)=10.910$, $p=0.001$	$F(1, 71)=0.875$, $p=0.353$
Characteristics of the professional development design				
Content focus	$F(1, 257)=0.017$, $p=0.896$	$F(1, 75)=0.532$, $p=0.468$	$F(1, 87)=0.208$, $p=0.650$	$F(1, 91)=0.283$, $p=0.596$
Specific topic	$F(1, 257)=0.698$, $p=0.404$	$F(1, 75)=0.405$, $p=0.526$	$F(1, 88)=0.009$, $p=0.925$	$F(1, 91)=0.778$, $p=0.380$
Specific subject	$F(1, 257)=0.022$, $p=0.882$	$F(1, 75)=1.204$, $p=0.276$	$F(1, 88)=0.865$, $p=0.355$	$F(1, 91)=0.069$, $p=0.793$
Specific method	$F(1, 257)=0.355$, $p=0.552$	$F(1, 75)=0.087$, $p=0.768$	$F(1, 88)=1.385$, $p=0.242$	$F(1, 91)=0.016$, $p=0.899$
Active learning	$F(1, 368)=7.840$, $p=0.005$	$F(1, 85)=2.938$, $p=0.090$	$F(1, 133)=4.772$, $p=0.031$	$F(1, 146)=0.535$, $p=0.466$
Practice opportunities	$F(1, 257)=0.005$, $p=0.946$	$F(1, 75)=0.092$, $p=0.762$	$F(1, 88)=0.003$, $p=0.959$	$F(1, 91)=0.006$, $p=0.940$
Sandwich	$F(1, 257)=3.263$, $p=0.072$	$F(1, 75)=2.295$, $p=0.134$	$F(1, 88)=9.031$, $p=0.004$	$F(1, 91)=0.429$, $p=0.514$
Case studies are used in sessions	$F(1, 257)=0.939$, $p=0.334$	$F(1, 75)=0.217$, $p=0.643$	$F(1, 88)=1.415$, $p=0.237$	$F(1, 91)=0.721$, $p=0.398$
Coherence with other learning activities	$F(1, 368)=2.095$, $p=0.149$	$F(1, 85)=1.574$, $p=0.213$	$F(1, 133)=0.462$, $p=0.498$	$F(1, 146)=0.027$, $p=0.870$
Additional coaching	$F(1, 257)=0.301$, $p=0.584$	$F(1, 75)=0.057$, $p=0.812$	$F(1, 88)=0.003$, $p=0.954$	$F(1, 91)=0.120$, $p=0.730$

Implementation is planned in session	$F(1, 257)=0.762$, $p=0.383$	$F(1, 75)=1.665$, $p=0.201$	$F(1, 88)=0.841$, $p=0.362$	$F(1, 91)=0.729$, $p=0.395$
Prerequisites to participate in PD	$F(1, 257)=1.707$, $p=0.193$	$F(1, 75)=0.017$, $p=0.896$	$F(1, 88)=3.342$, $p=0.071$	$F(1, 91)=0.394$, $p=0.532$
Duration	$F(1, 245)=0.561$, $p=0.455$	$F(1, 70)=0.052$, $p=0.821$	$F(1, 83)=1.161$, $p=0.284$	$F(1, 88)=0.000$, $p=0.999$
Collective participation	$F(1, 257)=0.068$, $p=0.794$	$F(1, 75)=1.500$, $p=0.225$	$F(1, 87)=0.253$, $p=0.616$	$F(1, 91)=0.148$, $p=0.702$
Certification	$F(1, 257)=0.735$, $p=0.392$	$F(1, 75)=0.160$, $p=0.690$	$F(1, 88)=1.727$, $p=0.192$	$F(1, 91)=0.011$, $p=0.916$

Beliefs regarding inclusive education

	Beliefs	Attitude	Concerns	Perception of strategies
Effect size estimate	0.220 [0.18; 0.28]	0.227 [0.176; 0.278]	0.081 [-0.143; 0.304]	0.270 [0.155; 0.385]
Number of effect sizes	461	338	40	83
Components of outcome dimension	$F(2, 457)=2.339$, $p=0.098$			
Characteristics of the study				
Intervention study	$F(1, 458)=0.040$, $p=0.842$	$F(1, 336)=1.210$, $p=0.272$	$F(1, 38)=0.658$, $p=0.422$	$F(1, 81)=0.795$, $p=0.375$
Publication year	$F(1, 458)=0.084$, $p=0.772$	$F(1, 336)=0.314$, $p=0.575$	$F(1, 38)=0.018$, $p=0.893$	$F(1, 81)=0.454$, $p=0.503$
Years since legal introduction of IE	$F(1, 458)=0.909$, $p=0.341$	$F(1, 336)=1.684$, $p=0.195$	$F(1, 38)=0.049$, $p=0.827$	$F(1, 81)=0.548$, $p=0.461$
Continent (Europe)	$F(1, 458)=3.451$, $p=0.064$	$F(1, 336)=0.851$, $p=0.357$	$F(1, 38)=0.608$, $p=0.441$	$F(1, 81)=5.536$, $p=0.021$
Characteristics of the data collection				
Time between end of PD and post-data collection	$F(1, 210)=0.407$, $p=0.524$	$F(1, 136)=0.021$, $p=0.885$	$F(1, 11)=0.037$, $p=0.851$	$F(1, 60)=1.685$, $p=0.199$
Type of measurement	$F(3, 456)=1.574$, $p=0.195$	$F(3, 334)=1.775$, $p=0.152$	$F(2, 37)=0.118$, $p=0.889$	$F(2, 80)=2.385$, $p=0.100$
Instrument focusses on specific diversity feature	$F(1, 458)=6.212$, $p=0.013$	$F(1, 337)=4.174$, $p=0.042$	$F(1, 38)=0.016$, $p=0.899$	$F(1, 80)=3.939$, $p=0.051$
Instrument focusses on specific method	$F(1, 458)=6.343$, $p=0.012$	$F(1, 337)=0.155$, $p=0.694$	$F(1, 38)=2.223$, $p=0.144$	$F(1, 81)=2.075$, $p=0.154$
Characteristics of the participants				
Mean age	$F(1, 170)=0.027$, $p=0.870$	$F(1, 134)=1.559$, $p=0.214$	$F(1, 22)=0.172$, $p=0.683$	$F(1, 11)=0.244$, $p=0.631$
Mean teaching experience	$F(1, 316)=0.173$, $p=0.678$	$F(1, 219)=1.891$, $p=0.171$	$F(1, 24)=0.257$, $p=0.617$	$F(1, 67)=2.405$, $p=0.126$
School type	$F(3, 456)=2.655$, $p=0.048$	$F(3, 334)=3.292$, $p=0.021$	$F(3, 36)=1.276$, $p=0.297$	$F(3, 79)=0.140$, $p=0.936$
participants with IE experience (%)	$F(1, 281)=0.081$, $p=0.777$	$F(1, 202)=0.180$, $p=0.672$	$F(1, 19)=1.982$, $p=0.175$	$F(1, 57)=0.626$, $p=0.432$
Characteristics of the professional development design				
Content focus	$F(1, 210)=0.377$, $p=0.540$	$F(1, 136)=0.080$, $p=0.777$	$F(1, 11)=0.037$, $p=0.851$	$F(1, 60)=0.436$, $p=0.512$
Specific topic	$F(1, 210)=0.394$, $p=0.531$	$F(1, 136)=0.128$, $p=0.721$	$F(1, 11)=0.001$, $p=0.983$	$F(1, 60)=0.201$, $p=0.656$
Specific subject	$F(1, 210)=0.248$, $p=0.619$	$F(1, 136)=0.308$, $p=0.580$	$F(1, 11)=1.202$, $p=0.296$	$F(1, 60)=0.152$, $p=0.698$
Specific method	$F(1, 210)=0.629$, $p=0.429$	$F(1, 136)=0.180$, $p=0.672$	$F(1, 11)=1.327$, $p=0.274$	$F(1, 60)=1.096$, $p=0.299$
Active learning	$F(1, 210)=2.142$, $p=0.145$	$F(1, 136)=4.834$, $p=0.030$	$F(1, 11)=1.213$, $p=0.294$	$F(1, 60)=2.111$, $p=0.152$
Practice opportunities are offered in sessions	$F(1, 210)=1.709$, $p=0.193$	$F(1, 136)=1.494$, $p=0.224$	$F(1, 11)=1.529$, $p=0.242$	$F(1, 60)=0.074$, $p=0.786$

Sandwich	$F(1, 210)=1.262, p=0.263$	$F(1, 136)=3.998, p=0.048$	$F(1, 11)=2.086, p=0.177$	$F(1, 60)=2.734, p=0.104$
Case studies are used in sessions	$F(1, 210)=0.121, p=0.728$	$F(1, 136)=0.956, p=0.330$	$F(1, 11)=0.165, p=0.693$	$F(1, 60)=0.007, p=0.934$
Coherence with other learning activities	$F(1, 210)=0.914, p=0.340$	$F(1, 136)=0.229, p=0.633$	$F(1, 11)=0.138, p=0.718$	$F(1, 60)=4.801, p=0.032$
Additional coaching	$F(1, 210)=1.697, p=0.194$	$F(1, 136)=1.460, p=0.229$	$F(1, 11)=0.224, p=0.646$	$F(1, 60)=0.182, p=0.671$
Implementation is planned in session	$F(1, 210)=0.849, p=0.358$	$F(1, 136)=0.907, p=0.343$	$F(1, 11)=1.113, p=0.314$	$F(1, 60)=0.925, p=0.340$
Prerequisites to participate in PD	$F(1, 210)=4.080, p=0.045$	$F(1, 136)=2.022, p=0.157$	$F(1, 11)=1.882, p=0.197$	$F(1, 60)=16.269, p=0.000$
Duration	$F(1, 209)=1.050, p=0.307$	$F(1, 135)=0.009, p=0.923$	$F(1, 11)=0.000, p=0.990$	$F(1, 59)=2.468, p=0.122$
Collective participation	$F(1, 210)=0.850, p=0.358$	$F(1, 136)=0.058, p=0.809$	$F(1, 11)=0.302, p=0.593$	$F(1, 60)=1.376, p=0.245$
Certification	$F(1, 209)=0.927, p=0.337$	$F(1, 136)=3.809, p=0.053$	-	$F(1, 60)=0.491, p=0.486$

Student behavior

	Student behavior	Student achievement	Other student behavior
Effect size estimate	0.372 [0.231; 0.512]	0.409 [0.213; 0.606]	0.328 [0.144; 0.512]
Number of effect sizes	203	95	108
Components of outcome dimension	$F(1, 201)=0.001, p=0.978$		
Characteristics of the study			
Intervention study	$F(1, 201)=0.156, p=0.694$	$F(1, 93)=0.505, p=0.479$	$F(1, 106)=0.125, p=0.724$
Publication year	$F(1, 200)=2.558, p=0.111$	$F(1, 93)=3.596, p=0.061$	$F(1, 105)=1.100, p=0.297$
Years since legal introduction of inclusive education	$F(1, 200)=0.604, p=0.438$	$F(1, 93)=0.120, p=0.730$	$F(1, 105)=1.047, p=0.309$
Continent (Europe)	$F(1, 200)=4.170, p=0.042$	$F(1, 93)=0.128, p=0.722$	$F(1, 105)=4.083, p=0.046$
Characteristics of the data collection			
Time between end of PD and post-data collection	$F(1, 194)=2.717, p=0.101$	$F(1, 90)=2.591, p=0.111$	$F(1, 102)=0.824, p=0.366$
Type of measurement	$F(4, 198)=8.534, p<.0001$	$F(2, 92)=1.973, p=0.145$	$F(4, 130)=9.301, p<.0001$
Instrument focusses on specific diversity feature	$F(1, 201)=1.076, p=0.301$	-	$F(1, 106)=1.576, p=0.212$
Instrument focusses on specific method	$F(1, 201)=0.152, p=0.698$	$F(1, 93)=0.032, p=0.858$	$F(1, 106)=0.103, p=0.749$
Characteristics of the participants			
Mean age of students	$F(1, 41)=0.071, p=0.791$	$F(1, 10)=0.162, p=0.696$	$F(1, 29)=0.045, p=0.834$
School type	$F(3, 198)=2.575, p=0.055$	$F(3, 91)=1.578, p=0.200$	$F(3, 103)=0.947, p=0.421$
Characteristics of the professional development design			
Content focus	$F(1, 194)=2.550, p=0.112$	$F(1, 90)=5.655, p=0.020$	$F(1, 102)=0.192, p=0.662$
Specific topic	$F(1, 194)=2.319, p=0.129$	$F(1, 90)=0.511, p=0.477$	$F(1, 102)=2.391, p=0.125$
Specific subject	$F(1, 194)=0.895, p=0.345$	$F(1, 90)=3.274, p=0.074$	$F(1, 102)=0.453, p=0.502$
Specific method	$F(1, 194)=1.323, p=0.252$	$F(1, 90)=3.621, p=0.060$	$F(1, 102)=0.050, p=0.824$
Active learning	$F(1, 194)=0.015, p=0.901$	$F(1, 90)=0.004, p=0.949$	$F(1, 102)=0.006, p=0.941$
Practice opportunities are offered in sessions	$F(1, 194)=2.759, p=0.098$	$F(1, 90)=1.324, p=0.253$	$F(1, 102)=1.569, p=0.213$
Sandwich	$F(1, 194)=0.568, p=0.452$	$F(1, 90)=0.223, p=0.638$	$F(1, 102)=0.142, p=0.707$
Case studies are used in sessions	$F(1, 194)=1.096, p=0.297$	$F(1, 90)=0.412, p=0.523$	$F(1, 102)=0.463, p=0.498$
Coherence with other learning activities	$F(1, 194)=1.676, p=0.197$	$F(1, 90)=1.486, p=0.226$	$F(1, 102)=0.379, p=0.540$
Additional coaching	$F(1, 194)=0.562, p=0.454$	$F(1, 90)=0.570, p=0.452$	$F(1, 102)=0.281, p=0.596$
Implementation is planned in session	$F(1, 194)=2.930, p=0.089$	$F(1, 90)=1.238, p=0.269$	$F(1, 102)=2.793, p=0.098$

Prerequisites to participate in PD	$F(1, 194)=3.944, p=0.045$	$F(1, 90)=5.197, p=0.025$	$F(1, 102)=0.124, p=0.725$
Duration	$F(1, 188)=0.010, p=0.919$	$F(1, 89)=0.006, p=0.941$	$F(1, 97)=0.137, p=0.712$
Collective participation	$F(1, 194)=3.864, p=0.051$	$F(1, 90)=7.714, p=0.007$	$F(1, 102)=0.011, p=0.915$
Certification	$F(1, 194)=0.069, p=0.793$	$F(1, 90)=0.097, p=0.756$	$F(1, 102)=0.056, p=0.814$

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6.2 Supplement to Study 2

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Supplement A. Codebook

Coding of the publications that were identified in the screening process will be done on four different levels:

1. Publication and study
2. Participants
3. Teacher training
4. Outcomes

The excel file, that will be used for coding, is organized along these levels in the according sheets of the file.

All information that are available in the publications should be entered into the excel file into the according sheets and columns. If additional information is provided in the publications, it can be entered into the comment section in each sheet.

Missing values

If certain information is not provided in the publication, please indicate this with **NA** (not available).

If certain information is not relevant for the study at hand, please indicate this with **n.r.** (not relevant). This accounts for example when a variable does not fit a certain study design, as for example specific information about activities in the teacher training program in correlational studies. When a variable is per se not relevant for a certain study design, these variables are filled out automatically when selecting this study design.

More than one reported sample

If a study report results separately for different samples, e.g. for participants with different professions or different intervention groups, please indicate the number of samples in the level '*Publication and study characteristics*' in the column *nsamples*. Please assign a number to each sample (starting with 1 for each study) and indicate the specific characteristics of each sample in the column *sample_def*. If a sample is a subsample, please name it accordingly in the column *sample_def*.

Please code a line for each sample in the following sheets and indicate the assigned number for the sample in the column *sample*. The specific characteristics for each sample will be coded in the sheet *Participant characteristics*.

If some information is reported only for the whole sample, this information is assumed to represent all samples.

If the study only investigates one sample, please indicate this in the column *nsamples* by filling in "1" and in the column *sample_def* by filling in "n.r.". In the following sheets please indicate the sample with the number "1".

More than one outcome

If a study reports several outcomes, please fill out a line in the sheet *Outcomes* for each reported outcome measurement. This accounts as well when one outcome type is assessed with several methods, e.g. survey and observation.

If a study reports additional test statistics, please indicate these in the column *add_results*. This accounts for example when one outcome measure is investigated with several statistical tests.

Exclusion of studies

If it becomes apparent during the coding process that a selected publication does not fit the inclusion criteria for this study, it can be excluded retroactively.

Inclusion criteria are the following:

The impact of teacher training on in-service educators' knowledge, beliefs and/or skills is being assessed with quantitative measures (pre-post measures, comparison of intervention and control group, correlational studies).

Exclusion criteria are the following:

- Pre-service educators
- Coaching as teacher training (if coaching is provided additional to teacher training sessions studies can be included)
- Intervention with students only (if the intervention is conducted by the teacher and the teacher is being trained for this, the study is to be included; if the teacher is just following an implementation manual it is to be excluded)
- Qualitative measurements only

No relevant quantitative data reported

If it becomes apparent during the coding process that the publication does not provide any quantitative data that can be entered into the meta-analysis but fits all other inclusion criteria, the study is not eligible for the meta-analysis because data are not reported in a usable manner. Therefore, please fill out the column *eligible?* with 'no' and give a reason in the subsequent column *reason*.

Reporting of non-significant findings

If studies report non-significant results, these are to be included. If it is just reported that a finding was non-significant without test statistics or means and standard deviations, all available information should be coded (e.g., instrument, which type of test was applied). In this case the column *pguessed* should be filled out with >0,05.

Data imputation

If categorical data are reported, e.g. for the age of participants or years of teaching experience, means and standard deviations are to be imputed. The mean of each category is to be used for the imputation.

Coding scheme

Publication and study		
Name	Type	Description
coderID	categorical	Initials of coder
studyID	numeric	Study ID
studyname	string	Last name of first author, Last name of second author or 'et al.' if more than two authors, publication year in parenthesis
authors	string	Last names of authors
pubyear	numeric	Year of publication
title	string	Title of publication
doi	string	Doi of the publication
pubtype	categorical	Type of publication
country	string	Country where the study was conducted
continent	categorical	Continent of data collection
design	categorical	please indicate the design of the study <i>single-group design</i> : intervention study without control group, can also account for studies with several intervention groups <i>independent groups pretest-posttest design</i> : intervention study with control group and pre- and posttest assessment in both groups <i>independent groups posttest design</i> : intervention with control group and assessment in both groups after the intervention <i>correlative study</i> : assessment of at least two outcome measures that are related in analyses to former participation in teacher training (e.g. correlation analysis, anova, t-test, etc.) <i>retrospective</i> : assessment of at least two outcome measures that are related in analyses after teacher training and reporting of relations between the assessed variables
samplesize	numeric	number of participants included in the study in all samples, please indicate the number of valid data sets, hence the number of participants that were included in the analysis
sampling	categorical	Sampling strategy used in the study
allocation	categorical	Allocation of the participants to the different conditions, only relevant for intervention studies, coding: non-/random
responserate	numeric	If a survey was sent out to a certain number of people, please report the percentage of people responding to the survey
missings	dummy	Does the publication provide any information about dealing with incomplete data or excluding data? Coding: yes/no
Studycomment	string	Any additional comments on the publication or study characteristics

Participants		
Name	Type	Description
studyID	numeric	study ID
sampleID	string	Please indicate the number for each sample (studyID_x)
Nteachers	numeric	Number of adult participants in the study
Nstudents	numeric	Number of student participants in the study
profession	categorical	Profession of the participants in this sample
percgeneral	numeric	percentage general educators in this sample
percfemale	numeric	Percentage of female educators in this sample
teachexpM	numeric	Mean years of teaching experience
teachexpSD	numeric	Standard deviation of teaching experience in this sample
schooltype	categorical	School type where participants work at
expIE	numeric	Percentage of participants with experience implementing inclusive education (e.g., teaching SEN students)
currentIE	numeric	percentage of participants currently teaching an inclusive class
attrition	numeric	percentage of educators leaving the study
studDiv	numeric	percentage of students with diversity feature of interest
studfemale	numeric	Percentage of female students
studattrition	numeric	percentage of students leaving the study

Teacher training		
Name	Type	Description
studyID	numeric	study ID
sampleID	string	Please indicate the number for each sample (studyID_x)
percPD	numerical	Percentage of educators that participated in training
conceptIE	dummy	How is inclusive education understood in the publication? <u>Narrow</u> : focus on disability <u>Wide</u> : focus on other features of diversity or several diversity features
divfeature	categorical	please indicate the diversity feature that was focused on in the publication
divspecific	String	Indicate further information on diversity feature addressed in the study, e.g. specific SEN type
PDtype	categorical	name used in the publication for the type of teacher training
hours	numeric	Total number of hours spent in teacher training
weeks	string	Total number of weeks between first and last session
sandwich	dummy	Alternating input and practice phases, or input provided on consecutive days
practice	dummy	does the teacher training provide opportunity to practice inclusive strategies in the training session?
opportunity	dummy	does the teacher training program provide opportunities to practice inclusive strategies in own classroom?
classroom	dummy	Is implementation in own classroom content of the training sessions?
implanning	dummy	Do participants receive a certification after finishing the teacher training?
certification	dummy	Is it mentioned that joint participation in the teacher training program was required? With whom were educators asked to participate?
jointPD	dummy	Does the teacher training offer additional coaching?
coaching	dummy	Does the teacher training program address inclusive education in general or a specific topic related to it?
topic	dummy	Does the teacher training program address inclusive education in general or a specific topic related to it?
topicspecific	string	If topic is specific, please note specific topic or method that is being addressed in the teacher training program
topicsubject	string	if the teacher training program addresses educators teaching a certain school subject, please indicate this subject
topicmethod	string	if a specific inclusive teaching method is addressed in the teacher training program (e.g., UDL), please note this method
prereq	dummy	Do educators need to fulfill certain prerequisites in order to participate in this teacher training?
postdata	string	Number of weeks between pre- and posttest

Metasemdata		
Name	type	description
studyID	numeric	study ID
sampleID	String	Please indicate the number for each sample (studyID_x)
studydesign	categorical	please indicate the study design again for automatically filling out irrelevant variables
knowledge	dummy	How is knowledge assessed in the study?
skills	dummy	How are self-perceived skills (self-efficacy) assessed in the study?
practice	dummy	How are teaching practices assessed in the study?
beliefs	dummy	How are beliefs about IE assessed in the study?
students	dummy	How are student data assessed in the study?
willingness	dummy	How is willingness to change assessed in the study?
satisfaction	dummy	How is satisfaction with the teacher training assessed in the study?
Data	dummy	Are all data reported in the study?
availability		<u>PD effects</u> : only relations of outcome measures with training participation are reported <u>Partly</u> : not all relations between outcome measures and/or training participation are reported <u>Yes</u> : relations of all outcome measures with training participation and among them are reported
N	numeric	Total number of psrticipants in the study
PDKnow	numeric	Correlation of knowledge measure with training participation
PDSkill	numeric	Correlation of self-efficacy measure with training participation
PDPract	numeric	Correlation of measure of teaching practices with training participation
PDBel	numeric	Correlation of beleifs measure with training participation
PDStud	numeric	Correlation of measure of student data with training participation
PDWill	numeric	Correlation of willingness to change measure with training participation
PDSatis	numeric	Correlation of measure of satisfaction with training with training participation
KnowSkill	string	Correlation of (posttest) knowledge measure with (posttest) self-efficacy measure
KnowPract	numeric	Correlation of (posttest) knowledge measure with (posttest) teaching practice measure
KnowBel	numeric	Correlation of (posttest) knowledge measure with (posttest) beliefs measure
KnowStud	numeric	Correlation of (posttest) knowledge measure with (posttest) measure of student data
KnowWill	numeric	Correlation of (posttest) knowledge measure with (posttest) measure of willingness to change
KnowSatis	numeric	Correlation of (posttest) knowledge measure with (posttest) measure of satisfaction with the training
SkillPract	numeric	Correlation of (posttest) self-efficacy measure with (posttest) measure of teaching practices
SkillBel	numeric	Correlation of (posttest) self-efficacy measure with (posttest) measure of teaching beliefs
SkillStud	numeric	Correlation of (posttest) self-efficacy measure with (posttest) measure of student data
SkillWill	numeric	Correlation of (posttest) self-efficacy measure with (posttest) measure of willingness to change
SkillSatis	numeric	Correlation of (posttest) self-efficacy measure with (posttest) measure of satisfaction with the training
PractBel	numeric	Correlation of (posttest) teaching practice measure with (posttest) measure of teaching beliefs
PractStud	numeric	Correlation of (posttest) teaching practice measure with (posttest) measure of student data
PractWill	numeric	Correlation of (posttest) teaching practice measure with (posttest) measure of willingness to change
PractSatis	numeric	Correlation of (posttest) teaching practice measure with (posttest) measure of satisfaction with training
BelStud	numeric	Correlation of (posttest) beliefs measure with (posttest) measure of student data
BelWill	numeric	Correlation of (posttest) beliefs measure with (posttest) measure of willingness to change
BelSatis	numeric	Correlation of (posttest) beliefs measure with (posttest) measure of satisfaction with training

StudWill	numeric	Correlation of (posttest) student data measure with (posttest) measure of teachers' willingness to change
StudSatis	numeric	Correlation of (posttest) student data measure with (posttest) measure of teachers' satisfaction with program
WillSatis	numeric	Correlation of (posttest) satisfaction with training measure with (posttest) willingness to change measure
instKnow	string	Instrument used to measure teacher' knowledge
instSkill	string	Instrument used to measure self-perceived skills
instPract	string	Instrument used to measure teaching practices
instBel	string	Instrument used to measure teachers' beliefs
instStud	string	Instrument used to measure student data
instWill	string	Instrument used to measure willingness to change
instSatis	string	Instrument to measure satisfaction with training
relreported	dummy	Are reliability data reported?
validatedScale	dummy	Are validated scales used?

Effect sizes are converted, if necessary, using the R package 'esc' <https://CRAN.R-project.org/package=esc>

Supplement B. Risk of Study Bias Assessment

Domain	Item	score
(9) Study design	Cross-sectional design	1
	Single-group design	1.5
	Independent groups posttest design	2
	Independent groups pre-posttest design	3
(10) Response rate	Not reported or not applicable	0
	< 50%	0.5
	50% - 75%	1
	>75%	1.5
(11) Sampling procedure	Non-random	0
	random	1
(12) Allocation to conditions	Non-random or not applicable	0
	random	1
(13) Use of standardized instrument	Single-items or self-developed instrument	0
	Standardized instrument	1
(14) Internal structure of instrument	Reliability data not reported	0
	Reliability data reported	1
(15) Handling of missing data	Not reported	0
	reported	1

Supplement C. Literature Search Strategy

Search period	
1 st search	2 nd search
9.4.2021-13.4.2021	09.-10.07.2024

Search terms

(inclusion OR inclusive education OR inclusive classroom) AND (professional development OR teacher training OR workshop OR teacher education) AND (teacher OR pedagogical staff OR pedagogical personnel OR teaching assistant OR educators) AND (school OR K-12 OR kindergarten OR preschool OR vocational college) ("inclusion" OR "inclusive education" OR "inclusive classroom") AND ("professional development" OR "teacher training" OR "workshop" OR "teacher education") AND ("teacher" OR "pedagogical staff" OR "pedagogical personnel" OR "teaching assistant" OR "educators") AND ("school" OR "K-12" OR "kindergarten" OR "preschool" OR "vocational college")

Results per database

Database	1 st search April 2021	2 nd search July 2024
PsycInfo	2064	549
Web of Science	8583	2265
ERIC	1207	93
ProQuest	5092	699

Removing duplicates

Duplicates removed with revtools (<https://CRAN.R-project.org/package=revtools>)

Records screened: 14226

Inclusion criteria

Studies had to (1) assess data in the context of teacher training for inclusive education of (2) teachers and/or their students with (3) quantitative measures (4) reported as cross-sectional data, pre- versus post-comparisons of participant data, or comparisons with a control group. The studies had to (4) measure data on at least two variables of the following: teacher knowledge, self-efficacy for inclusive education, teaching practices, beliefs regarding inclusive education, willingness for change, satisfaction with the program and student achievement and learning behavior.

Studies were excluded when the teacher training was solely based on coaching, referring to one-on-one training of the teachers. Studies comparing special with general education teachers were excluded because the current study is interested in teacher training on inclusive education and not in comparisons between the two main professions involved in the implementation of inclusive education in schools.

Dependent variables

Variable	Names of variables in the primary studies	Type of assessments
Knowledge	Knowledge about inclusive education	Self-rating Knowledge test
Skills	Self-efficacy for inclusive education Confidence for inclusive teaching	Self-rating
Practice	General use of inclusive teaching methods Frequency inclusive teaching methods are applied Implementation quality of inclusive teaching methods	Self-rating Observation (time sampling or rating by authors, study assistants) Individual education plans (IEPs)
Beliefs	Attitude towards inclusive education Concerns towards inclusive education Perspectives/opinions on inclusive teaching methods	Self-rating
Willingness to change	Willingness to change Intentions to implement inclusive teaching methods Behavioral intentions Motivation to implement inclusive education Perceived responsibility for the implementation process	Self-rating
Satisfaction with training	Engagement in the implementation process Satisfaction with training Usefulness of training Perceived preparedness through training Perceived quality of training	Self-rating
Student behavior	Student achievement Student behavior Opinion of students towards inclusive education	Standardized tests Gradings from teachers School data Ratings by teachers Ratings by students Observation (time sampling ratings by authors, study assistants)

Transparency of coding

Three raters, disagreements resolved through discussion, Krippendorff's alpha (2011) $\alpha = 0.907$ indicates high level of agreement

Supplement D. List of Included Studies

Authors and date	Type	Country	Study design	N	Outcome type
Adams, Mohamed, Moosa & Shareefa (2023)	Journal article	Maldives	Cross-sectional	613	Knowledge – self-rated Self-efficacy Beliefs – attitude
Adhabi (2018)	Dissertation	Saudi Arabia	Cross-sectional	202	Beliefs – attitude Skills – self-efficacy
Aerni (2009)	Dissertation	USA	Single-group	96	Self-efficacy Practice – strategy use Beliefs – attitude
Agostino & Horton (2023)	Journal article	USA	Cross-sectional	33	Knowledge – self-rated Self-efficacy Practice – quality Beliefs – attitude Willingness – motivation
Alhamad (2006)	Dissertation	USA	Cross-sectional	205	Beliefs – attitude Skills – self-efficacy
Alhumaid (2022)	Journal article	Saudi Arabia	Cross-sectional	1303	Knowledge – self-rated Beliefs – attitude
Alkahtani (2014)	Journal article	Saudi Arabia	Control group	81	Knowledge – tested Self-efficacy
Alnemary (2017)	Dissertation	Saudi Arabia	Cross-sectional	135	Knowledge – tested Skills – self-efficacy
Alsarawi & Sukonthaman (2021)	Journal article	USA	Cross-sectional	108	Knowledge – self-rated Self-efficacy Beliefs – attitude
Antala, Pruzek & Popluharova (2022)	Journal article	Slovakia	Cross-sectional	150	Knowledge – self-rated Practice – quality Beliefs – strategy perception Satisfaction – usefulness
Antil (1997)	Dissertation	USA	Posttest	80	Self-efficacy Practice – strategy use Beliefs – strategy perception Willingness – motivation
Arcangeli, Baccherini, Gaggioli, Sannipoli & Balboni (2020)	Journal article	Italy	Cross-sectional	307	Beliefs – attitude Knowledge – self-rated
Arias-Pastor, Van Vaerenbergh, Fernández-Solana & González-Bernal	Journal article	Spain	Cross-sectional	436	Knowledge – self-rated Self-efficacy Practice – strategy use Beliefs – attitude Willingness – motivation Satisfaction – preparedness Students – behavior
Arias-Pastor, Van Vaerenbergh, González-Bernal & González-Santos	Journal article	Spain	Cross-sectional	305	Self-efficacy Practice – strategy use Beliefs – attitude Satisfaction – preparedness
Armstrong, Cusumano, Todd & Cohen (2008)	Journal article	USA	Single-group	95	Knowledge – tested Beliefs – perception of strategies Skills – self-efficacy
Azizi (2022)	Journal article	Kosovo	Cross-sectional	293	Skills – self-efficacy Beliefs – attitude
Baker-Henningham, Bowers, Francis, Vera-Hernández & Walker	Journal article	Jamaica	Control-group	1094	Self-efficacy Practice – strategy use Students – behavior
Ballantyne, Wilson, Teye & Gillespie-Smith (2024)	Journal article	UK	Cross-sectional	138	Knowledge – tested Practice – quality

Barrett (1996)	Dissertation	USA	Control-group	324	Knowledge – tested
Bartholomaeus, Riggs & Andrew (2017)	Journal article	Australia	Cross-sectional	75	Beliefs – concerns Self-efficacy Beliefs – attitude
Bas (2022)	Journal article	Turkey	Cross-sectional	292	Self-efficacy
Bender, Boon, Hinrichs & Lawson (2008)	Journal article	USA	Cross-sectional	91	Practice – strategy use
Bender, Strycker, Pennefather & Smith (2022)	Journal article	USA	Single-group	91	Practice – strategy use Beliefs – attitude Knowledge – tested Self-efficacy Beliefs – attitude Willingness – intentions Satisfaction – usefulness
Benoit (2014)	Conference proceeding	Germany, France	Cross-sectional	169	Self-efficacy Beliefs – attitude
Benyo (1997)	Dissertation	USA	Posttest	64	Practice – strategy use Beliefs – attitude Willingness – motivation
Bergren (1997)	Project report	USA	Cross-sectional	150	Knowledge – self-rated Practice – quality Beliefs – strategy perception Satisfaction – usefulness
Bertuccio, Runion, Culler, Moeller & Hall (2019)	Journal article	USA	Single-group	87	Knowledge – tested Self-efficacy
Bielik, Dulikova, Rotko & Voronska (2022)	Journal article	Czech Republic	Posttest	255	Self-efficacy Beliefs – attitude Willingness – motivation
Botfield, Ratu, Turagabeci, Chivers, McDonald, Wilson & Cheng (2021)	Journal article	Fiji	Single-group	35	Knowledge – tested Self-efficacy Practice – strategy use Beliefs – attitude
Brady, Wang, Griffiths, Yang, Markus & Fryberg (2024)	Journal article	USA	Single-group	1894	Practice – strategy use Beliefs – attitude Students – achievement Willingness – motivation
Brewer (1996)	Dissertation	USA	Posttest	32	Self-efficacy Practice – strategy use Beliefs – strategy perception Students – achievement
Brown, Welsh, Haegele Hill & Cipko (2008)	Journal article	USA	Posttest	208	Knowledge – tested Self-efficacy Beliefs – attitude Willingness – responsibility
Brown, Straub, Bohnacker & Plener (2018)	Journal article	Germany	Single-group	603	Knowledge – self-rated Self-efficacy Beliefs – attitude
Bruck, Robinson & Gallagher (2021)	Journal article	Australia	Single-group	15	Knowledge – self-rated Self-efficacy
Brusca-Vega, Alexander & Kamin (2014)	Journal article	USA	Single-group	58	Practice – strategy use Students – behavior
Bumble, Rooney-Kron, Gilson, Sanderson, & Regester (2023)	Journal article	USA	Cross-sectional	1086	Knowledge – tested Practice – quality Beliefs – attitude
Burnham (2020)	Dissertation	USA	Cross-sectional	123	Self-efficacy Beliefs – attitude
Butler (2019)	Dissertation	USA	Single-group	165	Beliefs – attitude Willingness – intentions Satisfaction Students – achievement

Carew, Deluca, Groce & Kett (2018)	Journal article	Kenya	Single-group	123	Self-efficacy Practice – Strategy use Beliefs – attitude Willingness – intentions
Celik & Kraska (2017)	Journal article	USA	Cross-sectional	84	Knowledge – self-rated Beliefs – attitude
Chambers, Main & Sarah (2016)	Journal article	Seychelles	Single-group	32	Knowledge – self-rated Self-efficacy Beliefs – attitude
Chanturia (2023)	Journal article	Georgia	Cross-sectional	811	Self-efficacy Beliefs – attitude Willingness – motivation
Chao, Forlin & Ho (2016), Chao, Wing Sze, Forlin & Ho (2017)	Journal article	Hong Kong	Single-group	417	Knowledge – self-rated Self-efficacy
Chow & Sharma (2024)	Journal article	Hong Kong	Single-group	1100	Knowledge – self-rated Self-efficacy Satisfaction – preparedness
Christiansen, Hirsch, Knig, Steinmayr & Roehrl (2015)	Journal article	Germany	Control-group	457	Self-efficacy Students – behavior
Chung (1998)	Dissertation	USA	Cross-sectional	386	Practice – Strategy use Beliefs – Strategy perception
Clench & Smyth King (2014)	Book chapter	UK, Australia	Single-group	13465	Knowledge – self-rated Self-efficacy Practice – Strategy use
Cohen (2015)	Journal article	Israel	Cross-sectional	96	Self-efficacy Beliefs – attitude Willingness – motivation
Cole (2012)	Dissertation	UK	Control-group	204	Self-efficacy Beliefs – attitude Students – behavior
Colling, Fishbaugh & Hermanson (2003)	Conference proceeding	USA	posttest	490	Self-efficacy Beliefs – attitude Satisfaction – preparedness
Cooper-Jones (2013)	Dissertation	UK	Single-group	24	Knowledge – tested Self-efficacy Practice – strategy use Willingness – intentions
Coutsocostas & Alborz (2010)	Journal article	Greece	Cross-sectional	138	Knowledge – tested Self-efficacy Beliefs – attitude
Cruz, Lamb, Giri, Vanderburg, Ferrarone, Bhattarai, Giardina, Hampanda, Gaynes & Matergia (2021)	Journal article	India	Single-group	15	Knowledge – tested Self-efficacy Practice – strategy use Beliefs – attitude Willingness – intentions
Dapudong (2014)	Journal article	Thailand	Cross-sectional	52	Practice – strategy use Beliefs – attitude
Darjan & Lustrea (2018)	Journal article	Romania	Cross-sectional	82	Knowledge – self-rated Beliefs – attitude Willingness – intentions
Derguy, Aubé, Rohmer & Loyal (2023)	Journal article	France	Cross-sectional	307	Knowledge – tested Beliefs – attitude
Detzer (2016)	Dissertation	USA	Single-group	26	Knowledge – self-rated Self-efficacy Beliefs – attitude
DeVault (2021)	Journal article	USA	Single group	41	Knowledge – self-rated Practice – strategy use Beliefs – attitude Willingness – intentions Satisfaction

Didaskalou, Stavroussi & Greif Green (2023)	Journal article	Greece	Cross-sectional	315	Knowledge – self-rated Self-efficacy Beliefs – attitude
Edwards, Carr & Siegel (2006)	Journal article	USA	Single-group	34	Self-efficacy Beliefs – strategy perception Satisfaction - preparedness
Evans (1997)	Journal article	USA	Control-group	345	Practice – strategy use Students – achievement
Ezsirkinti & Akay (2019)	Journal article	Turkey	Single-group	14	Self-efficacy Beliefs – attitude
Falla, Gómez & del Pino (2022)	Journal article	Spain	Cross-sectional	942	Beliefs – attitude Willingness – engagement Satisfaction
Fisher (1996)	Dissertation	USA	Control-group	19	Knowledge – tested Self-efficacy Beliefs – attitude
Fisher (2005)	Dissertation	USA	Cross-sectional	196	Self-efficacy Practice – Strategy use Beliefs – attitude Satisfaction
Fontana (2003)	Dissertation	USA	Posttest	63	Practice – strategy use Beliefs – strategy perception Students – achievement
Forlin & Sin (2010)	Journal article	Hong Kong	Single-group	567	Knowledge – self-rated Self-efficacy Beliefs – attitude
Forlin, Sharma & Loreman (2014)	Journal article	Hong Kong	Single-group	2361	Knowledge – self-rated Self-efficacy Beliefs – attitude
Foster Austin (2011)	Dissertation	USA	Single-group	382	Knowledge – self-rated Practice – strategy use
Gaastra, Groen, Tucha & Tucha (2020)	Journal article	Netherlands	Cross-sectional	140	Knowledge – self-rated Self-efficacy Practice – strategy use Beliefs - attitude
Gafoor & Asaraf (2009)	Conference proceeding	India	Posttest	91	Knowledge – tested Beliefs - attitude
Gao & Mager (2011)	Journal article	USA	Posttest	106	Self-efficacy Beliefs – attitude
Garret & Spano (2017)	Journal article	USA	Cross-sectional	300	Self-efficacy Beliefs – attitude
Gayle-Evans (1992)	Dissertation	USA	Cross-sectional	165	Practice – strategy use Beliefs – strategy perception
Gezer-Demirdaglı & Cavkaytar (2022)	Journal article	USA	Control-group	120	Knowledge – tested Self-efficacy Practice – strategy use Beliefs – attitude Students – behavior
Gigante & Gilmore (2020)	Journal article	Australia	Cross-sectional	163	Knowledge – self-rated Self-efficacy Beliefs – attitude
Goetz (2002)	Dissertation	USA	Single-group	25	Knowledge – self-rated Self-efficacy Practice – quality Beliefs – attitude
Gu (2009)	Dissertation	China	Cross-sectional	203	Self-efficacy Beliefs – attitude Satisfaction – preparedness

Harbour, Livers, McDaniel, Gleason & Barth (2022)	Journal article	USA	Single-group	19522	Knowledge – tested Self-efficacy Practice – strategy use Students – behavior
Harris, Lane, Graham, Driscoll, Sandmel, Brindle & Schatschneider (2012)	Journal article	USA	Control-group + single-group	282	Practice – quality Beliefs – strategy perception Students – achievement
Heller (2012)	Project report	USA	Control-group	5541	Knowledge – tested Self-efficacy Students – achievement
Hellman (2007)	Dissertation	USA	Posttest	1314	Practice – quality Students – achievement
Henninger (2010)	Dissertation	USA	Single-group	142	Practice – quality Beliefs – attitude Students – achievement Willingness – engagement
Hernandez González, Spencer Contreras, Lagos Luciano, Sanz-Carrera & Tárraga-Mínguez (2023)	Journal article	Cuba	Cross-sectional	139	Knowledge – tested Practice – strategy use
Hilsenbeck (2000)	Project report	USA	Single-group	30	Knowledge – tested Self-efficacy Practice – quality Beliefs – strategy perception
Hofman & Kilimo (2014)	Journal article	Tanzania	Cross-sectional	100	Self-efficacy Beliefs – attitude
Huai, Braden & White (2006)	Journal article	USA	Control-group	55	Knowledge – self-rated Self-efficacy Practice – strategy use Beliefs – attitude
Hutzler & Barak (2017)	Journal article	Israel	Cross-sectional	94	Self-efficacy Beliefs – attitude
Jäntschi, Jaeuthe, Bosse & Sporer (2017)	Project report	Germany	Single-group	493	Knowledge self-rated Practice – strategy use Beliefs – attitude Willingness – intentions Satisfaction Students – behavior
Johnson (2019)	Dissertation	USA	Control-group	17	Knowledge – tested Practice – strategy use Beliefs – attitude
Kamphausen (2015)	Dissertation	USA	Cross-sectional	92	Self-efficacy Beliefs – attitude
Karni-Vizer (2022)	Journal article	Israel	Cross-sectional	1158	Self-efficacy Practice – strategy use Beliefs – attitude Students – behavior Willingness – engagement Satisfaction – usefulness
Katz (2015)	Journal article	Canada	Control-group	58	Practice – strategy use Beliefs – strategy perception Students – behavior
Katz, Sokal & Wu (2019)	Journal article	Canada	Control-group	736	Self-efficacy Practice – strategy use Student – achievement
Kazan & ElDaou (2016)	Journal article	Lebanon	Posttest	97	Knowledge – tested Self-efficacy Beliefs – attitude Willingness - intentions Students – achievement

Kennedy, Rodgers, Romig, Mathews & Peeples (2018)	Journal article	USA	Control-group	279	Practice – Strategy use
Kimber (2023)	Dissertation	UK	Cross-sectional	62	Students – achievement
Kisbu-Sarakaya & Doeniyas (2021)	Journal article	Turkey	Posttest	763	Knowledge – self-rated
Koliqi & Zabeli (2022)	Journal article	Kosovo	Cross-sectional	499	Self-efficacy
Kormos & Nijakowska (2017)	Journal article	world	Single-group	752	Beliefs – attitude
Kumar (2019)	Dissertation	USA	Cross-sectional	198	Willingness – intentions
Kuok, Teixeira, Forlin, Monteiro & Correia (2022)	Journal article	China	Cross-sectional	508	Self-efficacy
Kurniawati, de Boer, Minnaert & Mangunsong (2017)	Journal article	Indonesia	Control-group	67	Beliefs – attitude
Kuyini, Desai & Sharma (2020)	Journal article	Ghana	Cross-sectional	134	Knowledge – self-rated
Kwon & Block (2017)	Journal article	Korea	Control-group	47	Self-efficacy
Kwon, Hong & Jeon (2017)	Journal article	USA	Cross-sectional	117	Practice – Strategy use
Landrum (2008)	Dissertation	USA	Single-group	400	Beliefs – attitude
Laranjeira, Teixeira, Roberto & Sharma (2022)	Journal article	Portugal	Cross-sectional	171	Students – behavior
Leckie (2018)	Dissertation	USA	Single-group	13	Practice – strategy use
Lee (2012)	Dissertation	USA	Cross-sectional	127	Students - achievement
Lewis (2000)	Dissertation	USA	Single-group	50	Self-efficacy
Lifshitz, Glaubmann & Issawi (2004)	Journal article	Israel, Palestine	Single-group	258	Beliefs – attitude
Lillestol (1997)	Dissertation	USA	Cross-sectional	328	Willingness – intentions
Linville (2020)	Journal article	USA	Single-group	511	Knowledge – self-rated
					Practice – strategy use
					Beliefs – strategy perception
					Willingness – engagement

Magyar, Krausz, Kapás & Habók (2020)	Journal article	Hungary	Single-group	121	Knowledge – self-rated Practice – strategy use Beliefs – strategy perception Willingness – engagement Satisfaction – quality
Man Li & Cheung (2021)	Journal article	Hong Kong	Cross-sectional	94	Self-efficacy Beliefs – attitude
Manzanares (2009)	Dissertation	USA	Cross-sectional	174	Practice – strategy use Willingness – intentions Satisfaction – usefulness
Marithmu (2018)	Dissertation	Malaysia	Cross-sectional	60	Knowledge – tested Self-efficacy Beliefs – attitude Willingness – resistance
Martynchuk, Skrypnyk, Maksymchuk, Babych & Biriukova (2021)	Conference proceeding	Ukraine	Cross-sectional	300	Knowledge – self-rated Self-efficacy Beliefs – attitude Willingness – engagement
Mejia-Cardenas, Rivard & Mestari (2024)	Journal article	Canada	Cross-sectional	181	Knowledge – tested Beliefs – attitude
Memisevic, Dizdarevic, Mujezinovic, & Djordjevic (2020)	Journal article	Bosnia & Herzegovina	Cross-sectional	105	Self-efficacy Beliefs – attitude
Mikami, Owens, Hudec, Kassab & Evans (2020)	Journal article	USA, Canada	Single-group	206	Practice – strategy use Students – behavior Willingness – intentions
Mikami, Owens, Evans, Hudec, Kassab, Smit, Na & Khalis (2021)	Journal article	USA, Canada	Cross-sectional	592	Practice – quality Students – behavior Willingness – intentions
Miller & Savage (1995)	Conference	USA	Single-group	135	Self-efficacy Practice – strategy use Beliefs – attitude Willingness – intentions Satisfaction – usefulness
Mitchell (2016)	Dissertation	USA	Cross-sectional	286	Practice – strategy use Beliefs – attitude Satisfaction
Mngo (2017)	Dissertation	Cameroon	Cross-sectional	344	Self-efficacy Beliefs – attitude
Montgomery (2013)	Dissertation	Canada	Cross-sectional	100	Self-efficacy Beliefs – attitude
Morgan (2019)	Dissertation	USA	Cross-sectional	93	Knowledge – self-rated Self-efficacy Practice – strategy use Beliefs – attitude
Morrissey (2008)	Dissertation	USA	Control-group	107	Practice – quality Beliefs – strategy perception Students – behavior
Morrow (2000)	Dissertation	USA	Single-group	7	Practice – strategy use Beliefs – strategy perception Students - behavior
Mucherah, Finch, Bota & Thomas (2024)	Journal article	Kenya	Cross-sectional	1050	Knowledge – self-rated Self-efficacy Practice – strategy use Beliefs – attitude
Mui Lee, Tracey, Barker, Fan & Yeung (2014)	Journal article	Hong Kong	Single-group	275	Knowledge – tested Self-efficacy Beliefs – attitude Willingness – resistance

Mullick, Sharma & Deppeler (2013)	Journal article	Bangladesh	Cross-sectional	5126	Beliefs – strategy perception Students – achievement Satisfaction
Murry & Murry (2000)	Conference proceeding	USA	Single-group	30	Self-efficacy Practice – strategy use Beliefs – strategy perception Willingness – intentions
Murthy, Rajaram, Mudiyanuru, Marimuthu, Govindappa & Dasgupta (2019)	Journal article	India	Single-group	139	Knowledge – self-rated Practice – strategy use Beliefs – attitude
Mutch-Jones, Puttick & Minner (2012)	Journal article	USA	Cross-sectional	391	Knowledge – self-rated Self-efficacy Practice – strategy use Students – behavior
Myhill, Hill, Link, Small & Bunch (2012)	Journal article	USA	Single-group	88	Knowledge – self-rated Self-efficacy Practice – strategy use
Narang (2022)	Dissertation	Canada	Control-group	60	Practice – strategy use Beliefs – strategy perception Students – behavior
Neeman (2016)	Dissertation	USA	Cross-sectional	66	Practice – strategy use Beliefs – attitude Satisfaction – quality
Nelis, Pedaste & Leijen (2024)	Journal article	Estonia	Single-group	56	Knowledge – self-rated Self-efficacy Practice – strategy use Beliefs – attitude Students – behavior Willingness – intentions
Ngcobo & Bornman (2024)	Journal article	South Africa	Control-group	52	Self-efficacy Beliefs – attitude Willingness – intentions
Nijakowska (2022)	Journal article	Greece, Poland, Slovenia	Single-group	69	Knowledge – self-rated Self-efficacy Beliefs – attitude
Nordike (2018)	Dissertation	USA	Single-group	22	Knowledge – tested Beliefs – attitude
Opoku, Cuskelly, Rayner, Pedersen (2020)	Journal article	Ghana	Cross-sectional	457	Self-efficacy Beliefs – attitude Willingness – intentions
Opoku, Nketesia, Odame & Agyei-Okyere (2021)	Journal article	Ghana	Cross-sectional	855	Knowledge – self-rated Self-efficacy Beliefs – attitude Willingness – intentions
Owens-Twaites (2013)	Dissertation	USA	Single-group	296	Self-efficacy Students – achievement
Parey (2019)	Journal article	Trinidad	Cross-sectional	322	Self-efficacy Beliefs – attitude
Park, Dimitrov & Park (2018)	Journal article	USA	Cross-sectional	679	Self-efficacy Beliefs – concerns Willingness – resistance
Pearl, Dieker & Kirkpatrick (2012)	Journal article	USA	Single-group	264	Self-efficacy Beliefs – strategy perception Students – achievement
Peda (2018)	Dissertation	USA	Single-group	32	Knowledge – self-rated Practice – strategy use Satisfaction – usefulness
Perez (1997)	Dissertation	USA	Cross-sectional	94	Knowledge – self-rated Self-efficacy Beliefs – attitude

Perold, Louw & Kleynhans (2010)	Journal article	South Africa	Cross-sectional	552	Knowledge – tested Self-efficacy Practice – strategy use
Poon, Ng, Wong & Kaur (2016)	Journal article	Singapoore	Cross-sectional	131	Knowledge – self-rated Self-efficacy Beliefs – attitude
Pryor (2003)	Dissertation	USA	Posttest + single-group	38	Knowledge – tested Self-efficacy Practice – strategy use Beliefs – attitude
Rabiola (2021)	Dissertation	USA	Cross-sectional	100	Self-efficacy Beliefs – attitude Willingness – intentions
Rajesh & Joseph (2023)	Journal article	India	Single-group	35	Knowledge – tested Practice – strategy use Beliefs – attitude
Ray, Torres & Cao (2023)	Journal article	USA	Single-group	294	Self-efficacy Practice – strategy use Students – achievement
Reese (2007)	Dissertation	USA	Single-group	18	Knowledge – tested Beliefs – attitude
Reyes, Hutchinson & Little (2017)	Journal article	USA	Single-group	47	Knowledge – self-rated Self-efficacy
Ritter, Wehner, Lohaus & Krämer (2020)	Journal article	Germany	Single-group	97	Self-efficacy Practice – quality Beliefs – attitude Willingness – engagement
Romer (2004)	Dissertation	Bahamas	Cross-sectional	122	Practice – strategy use Beliefs – attitude
Romero-Contreras, Garcia-Cedillo, Forlin & Lomeli-Henrández (2016)	Journal article	Mexico	Cross-sectional	813	Knowledge – self-rated Self-efficacy Beliefs – attitude
Royster, Reglin & Losike-Sedimo (2014)	Journal article	USA	Single-group	19	Knowledge - tested Beliefs – attitude
Saade, Bean, Gillespie-Lynch, Poirier & Harrison (2021)	Journal article	USA, Canada	Single-group	201	Knowledge – tested Self-efficacy Beliefs – attitude
Sabella (2016)	Dissertation	El Salvador	Cross-sectional	43	Self-efficacy Beliefs – attitude
Saffar (2020)	Dissertation	Saudi Arabia	Posttest	40	Knowledge – self-rated Practice – quality Beliefs – attitude Willingness – resistance Students – achievement
Sam, Odom, Tomaszewski, Perkins & Cox (2020)	Journal article	USA	Control-group	545	Self-efficacy Practice – quality Beliefs – strategy perception Students – behavior
Samms (2017)	Dissertation	Jamaica	Cross-sectional	191	Self-efficacy Beliefs – attitude
Sanclon, Pitsia, Maguire, Nikolaeva (2022)	Journal article	Bulgaria	Cross-sectional	922	Self-efficacy Beliefs – attitude
Sari (2007)	Journal article	Turkey	Control-group	122	Knowledge – tested Self-efficacy Beliefs – attitude Students - behavior
Savolainen, Malinen & Schwab (2020)	Journal article	Finland	Single-group	1326	Self-efficacy Beliefs – attitude
Scanlon & Barnes-Holmes (2013)	Journal article	Ireland	Single-group	45	Self-efficacy Beliefs – attitude Willingness – intentions

Scanlon, Radeva, Pitsia, Maguire, & Nikolaeva (2022)	Journal article	Bulgaria	Cross-sectional	922	Self-efficacy Beliefs – attitude Willingness – intentions
Schenck, Feighan, Coffey & Rui (2011)	Project report	USA	Single-group + Posttest	396	Practice – quality Students – achievement
Scherer & Bertram (2024)	Journal article	Germany	Single-group	92	Self-efficacy Beliefs – attitude
Schlandt, Ocasio-Stoutenburg, Nunez, Dowling, Shearer, Bailey, Garilli & Natale (2022)	Journal article	USA	Single-group	50	Knowledge – tested Practice – strategy use Beliefs – attitude Students – achievement
Schmidt (2020)	Dissertation	USA	Single-group	8	Knowledge – tested Self-efficacy Practice – strategy use Beliefs – attitude Student – behavior
Scienza (2019)	Dissertation	USA	Cross-sectional	228	Practice – quality Students – behavior
Seibert (2003)	Dissertation	USA	Single-group	48	Knowledge – tested Self-efficacy Beliefs – attitude Student – behavior
Seigler (2003)	Dissertation	USA	Cross-sectional	400	Knowledge – self-rated Practice – strategy use Beliefs – attitude Students – behavior
Sharma, Shaukat & Furlonger (2015)	Journal article	Pakistan	Cross-sectional	194	Knowledge – self-rated Self-efficacy Beliefs – attitude
Sharma, Grové, Laletas, Rangarajan & Finkelstein (2023)	Journal article	Australia	Single-group	67	Self-efficacy Practice – strategy use Beliefs – attitude
Smith (2009)	Dissertation	USA	Cross-sectional	173	Self-efficacy Beliefs – attitude Willingness – resistance
Smith Canter, King, Williams, Metcalf & Rhys Myrick Potts (2017)	Journal article	USA	Single-group	14	Self-efficacy Practice – strategy use Beliefs – strategy perception
Soares de Sousa (2020)	Dissertation	South Africa	Cross-sectional	100	Knowledge – tested Self-efficacy Practice – strategy use Beliefs – attitude Students – behavior
Sucuoglu, Bakkaloglu, Akalin, Demir & Iscen-Karasu (2015)	Journal article	Turkey	Single-group	30	Knowledge – tested Self-efficacy Practice – strategy use Beliefs – attitude Students – behavior
Sokal & Katz (2017)	Journal article	Canada	Control-group	111	Self-efficacy Practice – strategy use Beliefs – strategy perception
Song, Sharma & Choi (2019)	Journal article	South Korea	Single group	119	Self-efficacy Beliefs – attitude Willingness - intentions
Spektor-Levy & Yifrach (2019)	Journal article	USA	Cross-sectional	215	Self-efficacy Practice – strategy use Beliefs – attitude
Srivastava, de Boer & Pijl (2015)	Journal article	India	Control-group	79	Knowledge – tested Beliefs – attitude

Steinert & Jurkowski (2023)	Journal article	Germany	Single-group	122	Knowledge – tested Self-efficacy Practice – strategy use Beliefs – attitude Willingness – engagement
Stephens (1993)	Project report	USA	Single-group	65	Practice – quality Students – achievement
Strigel (2020)	Dissertation	Ethiopia	Single-group	109	Self-efficacy Practice – strategy use Beliefs – attitude
Stubbs (2009)	Dissertation	Bahamas	Cross-sectional	234	Self-efficacy Beliefs – attitude
Subban, Round & Sharma (2021)	Journal article	Australia	Cross-sectional	122	Self-efficacy Practice – strategy use
Sun (2017)	Dissertation	China	Cross-sectional	816	Self-efficacy Beliefs – attitude
Sunardi, Maryardi & Sugini (2014)	Journal article	Indonesia	Single-group	50	Knowledge – self-rated Self-efficacy
Swanson (1995)	Project report	USA	Posttest	671	Beliefs – strategy perception Students – achievement
Tarantino & Neville (2023)	Journal article	Ireland	Cross-sectional	260	Self-efficacy Practice – quality Beliefs – attitude
Thomas & Uthaman (2019)	Journal article	India	Cross-sectional	180	Knowledge – tested Beliefs – attitude
Toren & Schwartz (2024)	Journal article	Isreal	Single-group	59	Self-efficacy Beliefs – attitude
Ueda, Goto, Imamoto & Yamazaki (2021)	Journal article	Japan	Single-group	96	Self-efficacy Beliefs – attitude Students – behavior
VanHorn (2017)	Dissertation	USA	Single-group	114	Practice – strategy use Students – achievement
VanUitert, Kennedy, Peeples, Roming, Mathews & Rodgers (2022)	Journal article	USA	Posttest	993	Practice – strategy use Students – achievement
Varcoe & Boyle (2014)	Journal article	Australia	Posttest	342	Knowledge – tested Self-efficacy Beliefs – attitude
Vaughn Linscott (1995)	Dissertation	USA	Cross-sectional	714	Practice – strategy use Beliefs – attitude
Weaver Miller (1997)	Dissertation	USA	Cross-sectional	96	Self-efficacy Practice – strategy use Beliefs – attitude Students - achievement
Webb (1994)	Dissertation	USA	Posttest	113	Knowledge – self-rated Self-efficacy Practice – strategy use Beliefs – strategy perception
Weber, Rehder & Vereenoghe (2021)	Journal article	Germany	Single-group	245	Practice – quality Students – behavior
Weisel & Dror (2006)	Journal article	Israel	Cross-sectional	139	Self-efficacy Practice – strategy use Beliefs – attitude
Werner, Gumpel, Koller, Wiesenthal & Weintraub (2021)	Journal article	Israel	Cross-sectional	352	Knowledge – self-rated Self-efficacy Beliefs – attitude
Whipple (2012)	Dissertation	USA	Cross-sectional	81	Knowledge – tested Practice – quality
Wilkins & Nietfeld (2004)	Journal article	USA	Posttest	89	Self-efficacy Beliefs – attitude

Wilson, Woolfson, Durkin & Elliott (2016)	Preprint	UK	Cross-sectional	145	Self-efficacy Practice – strategy use Beliefs – attitude Willingness – intentions
Witherspoon (2005)	Dissertation	USA	Cross-sectional	131	Knowledge – self-rated Self-efficacy Practice – strategy use Beliefs – attitude
Wood (2007)	Dissertation	USA	Cross-sectional	272	Self-efficacy Practice – strategy use Beliefs – attitude
Woodcock, Gibbs, Hitches & Regan (2023)	Journal article	Australia	Cross-sectional	208	Self-efficacy Beliefs – attitude
Wright (2015)	Dissertation	USA	Single-group	6	Knowledge – tested Self-efficacy
Xue, Chai, Zhu, Yao, Lan & Wu (2022)	Journal article	China	Cross-sectional	286	Knowledge – self-rated Self-efficacy Practice – strategy use Beliefs – attitude
Yada, Tolvanen & Savolainen (2018)	Journal article	Finland,	Cross-sectional	1231	Self-efficacy Beliefs – attitude
Yoshikawa, Leyva, Snow, Trevino, Barata, Weiland, Gomez & Moreno (2015)	Journal article	Japan Chile	Control-group	1995	Practice – strategy use Students – achievement
You, Kim & Shin (2019)	Journal article	South Korea	Cross-sectional	190	Self-efficacy Beliefs – attitude
Young (2018)	Dissertation	USA	Cross-sectional	7	Beliefs – attitude Satisfaction – preparedness Students – achievement
Young, Mannix McNamara & Coughlan (2017)	Journal article	Ireland	Cross-sectional	126	Knowledge – self-rated Self-efficacy
Yu (2019)	Journal article	USA	Cross-sectional	41	Self-efficacy Beliefs – attitude
Zakai-Mashiach, Dromi & Al-Yagon (2021)	Journal article	Israel	Single-group	241	Self-efficacy Practice – strategy use Beliefs – attitude Satisfaction – preparedness Students – behavior
Ziegler (2002)	Dissertation	USA	Posttest	279	Practice – strategy use Students – achievement

Supplement E. Overview of Included Studies

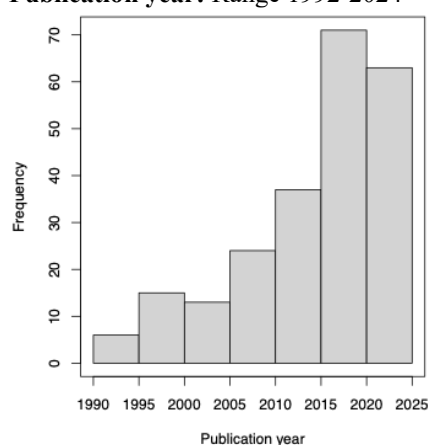
Data reported several times

Included study	Double report
Kuok et al., 2020	Monteiro et al., 2019
Xue et al., 2022	Xue et al., 2023
Opoku et al., 2021	Opoku et al., 2020
Wilson et al., 2016	Wilson, 2016
Yada et al., 2018	Savolainen et al., 2012; Yada, 2015
Chao et al., 2016	Chao et al., 2017
Sharma et al. (2015)	Shaukat (2012)

Continent

North America	Europe	Asia	Africa	South America	Australia	>1 continent
109	39	48	12	10	7	3

Publication year: Range 1992-2024



Study design

Cross-sectional	Single-group	Comparison with control group
k = 101	k = 71	Pre-posttest k = 27
Post intervention k = 10		Posttest k = 19

Allocation to conditions

Random + quasi-experimental	Non-random
53	175

Sampling method

Random	Stratified + clustered	Purposive	Convenience
23	66	55	84

Handling of missing data reported

Yes	No
88	140

Response rate

Reported	Not reported
76	152

Completeness of the data

All relations among assessed variables reported	Data partly reported
70	158

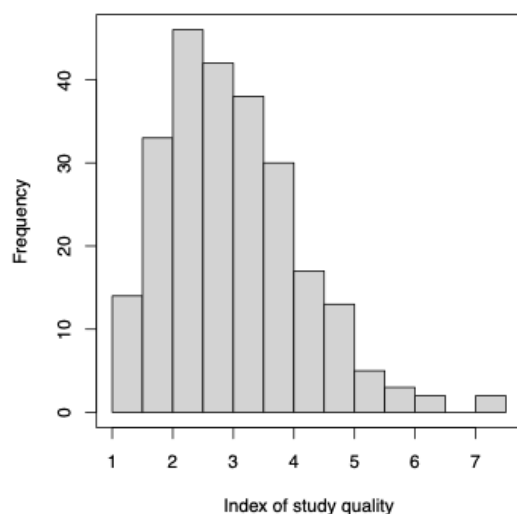
Authors contacted

Contacted	Responded	Provided data
76	18	14

Study quality

Possible maximum: 9.5

M = 3.24, SD = 1.15, Median = 3, Range = 1 - 7.5



Overview of participating teachers and students

Number of participants

Teachers	Students
61 766	55 843 (20.62% with diversity feature)

Profession of teachers

General educators	Special educators	Administrators	Teaching assistants	Pre-service educators
46 128	4 905	3 741	883	6 109
74.68%	7.94%	6.06%	1.43%	9.89%

School type

Kindergarden	Primary school	Secondary school	Kindergarden + primary school	Primary + secondary school	K-12
24	59	45	12	88	16

Teachers' experience

Teaching experience M = 12.72, SD = 8.45

Experience with inclusive education 76.89%

Currently teaching inclusive classroom 74.42%

Attrition of participants

58 studies out of 98 intervention studies with pre-post design (59.18%) provide data on attrition of teachers (M = 9.99%, 0- 56.67%)

14 out of 22 intervention studies with pre-post design assessing student data (63.63%) reported information on students' attrition (M = 6.83%, 0 – 44.9%)

Overview of training programs

Duration

Hours: 2– 5000, M = 153.21, SD = 718.37, Median = 24

Weeks: ½ day – 4 years, M = 28.76, SD = 43.39, Median = 12

Diversity feature addressed in the studies

Narrow	Wide
188 (82.53%)	40 (17.47%)

Specific diversity features

Special educational needs	189
Not defined	138
ADHD	7
ASD	18
EBD	8
Learning disability	8
Intellectual disability	5
Deafness	3
Speech impairment	2
At-risk students	6
Chronic illness	3
Multicultural background + second language learners	6
Gender + sexual orientation	5
Mental health	4
giftedness	2
combination	13

Content of teacher training

IE in general	Specific topic
24	93

Subject

206 studies did not define subject

Language	math	STEM	PE	Social studies
7	4	6	3	3

Training design

36 Studies investigated blocked training, 85 trainings were spread via several weeks with practice phases in the own classroom in between input sessions

48 of the trainings offered opportunities to plan the implementation in the classrooms

45 of the trainings offered certification to the participating teachers

35 offered additional coaching to the training teachers

32 of the trainings required prerequisites

In 65 studies teachers participated alone, in 31 studies with at least one colleague, 18 studies investigated trainings for class teams and 17 for the whole school staff

Overview of dependent variables

42.36% of assessments with self-developed instruments

57.64% with validated instruments or established tests

Knowledge

assessed in 113 samples

Validated instrument	Self-developed instrument
29	84

Type of assessment of knowledge

Knowledge test	Self-rated knowledge
52	61

Skills (Self-efficacy)

Assessed in 178 samples

Validated instrument	Self-developed instrument
118	60

Practice

Assessed in 120 samples

Validated instrument	Self-developed instrument
43	77

Type of assessment	
Use of strategies	Quality of implementation
60	60

Beliefs regarding IE

Assessed in 194 samples

Validated instrument	Self-developed instrument
134	60

Willingness to change

Assessed in 58 samples

Validated instrument	Self-developed instrument
38	20

Satisfaction with training

Assessed in 25 samples

Validated instrument	Self-developed instrument
10	15

Students' achievement and behavior

Assessed in 58 samples

State test	Validated instrument	Self-developed instrument
16	19	23

Supplement F. Model Results – Main Analysis

This report contains the output of your one-stage MASEM analysis using webMASEM.

The following function arguments were used in the analysis:

- Random effects type: Diag
- Interval type: z
- Transformation on between-study variances: expLog
- Start values of between-study variances: 0.05

Variable names used for analysis:

Training participation	PD
Change in knowledge about inclusive education	Know
Change in perceived skills for inclusive education	Skill
Change in inclusive teaching practices	Pract
Change in beliefs regarding inclusive education	Bel
Change in willingness to engage in change process towards inclusive education	Will
Satisfaction with training	Satis
Change in student behavior	Stud

Model comparison

Model	CFI	TLI	RMSEA	SRMR
Basic Model	0.749	0.248	0.015	0.166
Implicit Model	0.859	0.698	0.011	0.114
Evaluation Model	0.722	0.479	0.011	0.201
Change Model	0.812	0.647	0.012	0.197
Cognitive Change Model	0.918	0.808	0.008	0.099

Basic Model

Number of studies (upper triangle) and total sample size (lower triangle) per correlation coefficient

	PD	Know	Pract	Stud
PD	x	81	101	52
Know	58 379	x	26	6
Pract	64 298	14 484	x	17
Stud	52 531	9 141	14 708	x

Model Statistics

Chi2(2) = 55.68263, p = 8.103472e-13

CFI: 0.7494718

TLI: 0.2484155

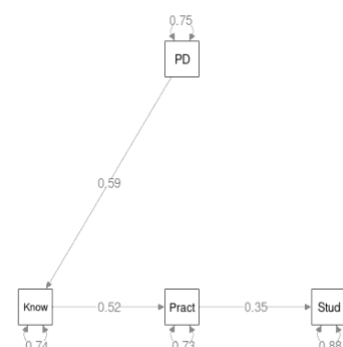
RMSEA (with 95% CI) = 0.01512816 [0.0111983, 0.01933069], Prob(RMSEA <= 0.05): 1

SRMR = 0.166

	df Penalty	Parameters Penalty	Sample-Size Adjusted
AIC	-433.3421	132.6579	132.6598
BIC	-3073.8900	229.3813	197.6009

	Parameters	Degrees of Freedom	Fit (-2lnL units)
Model	10	273	112.65791
Saturated	12	271	56.97528
Independence	6	277	277.25310

Number of observations/statistics: 117 282/283



Summary of one stage MASEM for basic model:

name	matrix	row	Col	Estimate	Std.Error	z value	Pr(> z)
KnowONPD	A0	Know	PD	0.58715	76.13281	0.007712	9.93847e-01
PractONKnow	A0	Pract	Know	0.52211	0.069816	7.478295	7.52731e-14
StudONPract	A0	Stud	Pract	0.35073	0.071238	4.923373	8.50650e-07
PDWITHPD	S0	PD	PD	0.74680	96.83393	0.007712	9.93847e-01
Tau1_1	vecTau1	1	1	-2.62005	0.182883	-14.3264	0.00000e+00
Tau1_2	vecTau1	2	1	-2.76173	0.168302	-16.4094	0.00000e+00
Tau1_3	vecTau1	3	1	-2.44314	0.227057	-10.7600	0.00000e+00
Tau1_4	vecTau1	4	1	-1.74178	0.393622	-4.42500	9.64407e-06
Tau1_5	vecTau1	5	1	-3.18777	0.639313	-4.98624	6.15657e-07
Tau1_6	vecTau1	6	1	-2.64709	0.426055	-6.21301	5.19798e-10

Residual variance

PD	Know	Pract	Stud
0.7468	0.7425	0.7274	0.8770

Between Studies Variances Of Correlation Coefficients

Know ~ PD	Pract ~ PD	Stud ~ PD	Know ~ Stud	Stud ~ Pract
0.073	0.063	0.087	0.041	0.071

Implicit Model

Number of studies (upper triangle) and total sample size (lower triangle) per correlation coefficient

	PD	Know	Skill	Pract	Bel	Stud
PD	x	81	158	101	174	52
Know	58 379	x	39	26	44	6
Skill	77 426	11 663	x	30	79	6
Pract	64 298	14 484	7 861	x	32	17
Bel	60 374	22 974	24 079	17 241	x	12
Stud	52 531	9 141	2 391	14 708	15 786	x

Model Statistics

Chi2(7) = 104.1433, $p = 1.50118e-19$

CFI: 0.8590218

TLI: 0.6979038

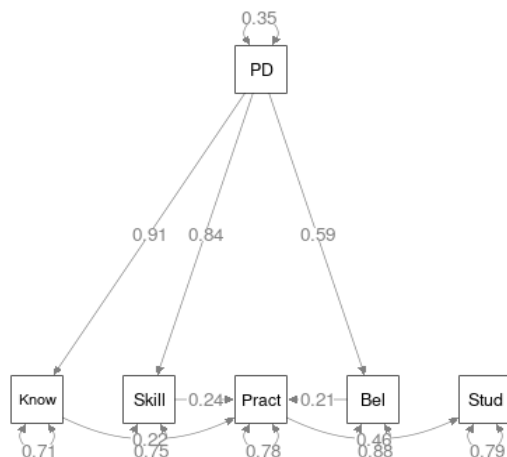
RMSEA: 0.01087782 [95% CI (0.008731703, 0.01312535)], Prob(RMSEA <= 0.05): 1

SRMR = 0.114.

	df Penalty	Parameters Penalty	Sample-Size Adjusted
AIC	-1730.199	-16.19904	-16.18963
BIC	-9796.928	206.26470	133.16985

	Parameters	Degrees of Freedom	Fit (-2lnL units)
Model	23	834	-62.19904
Saturated	30	827	-166.34238
Independence	15	842	537.72385

Number of observations/statistics: 117 282/857



Summary of one stage MASEM for implicit model:

name	matrix	row	col	Estimate	Std.Error	z value	Pr(> z)
KnowONPD	A0	Know	PD	0.913433	0.083847	10.8940	0.000000e+00
SkillONPD	A0	Skill	PD	0.841728	0.151119	5.569989	2.547555e-08
BelONPD	A0	Bel	PD	0.587936	0.105368	5.579824	2.407617e-08
PractONKnow	A0	Pract	Know	0.220085	0.089042	2.471695	1.344740e-02
PractONSkill	A0	Pract	Skill	0.240855	0.053200	4.527322	5.973585e-06
StudONPract	A0	Stud	Pract	0.457251	0.158058	2.892938	3.816561e-03
PDWITHPD	S0	PD	PD	0.212344	0.076232	2.785497	5.344568e-03
Tau1_1	vecTau1	1	1	0.348231	0.060412	5.764271	8.201175e-09
Tau1_2	vecTau1	2	1	-2.66646	0.194963	-13.6768	0.000000e+00
Tau1_3	vecTau1	3	1	-3.49349	0.145208	-24.0586	0.000000e+00
Tau1_4	vecTau1	4	1	-2.68343	0.178089	-15.0679	0.000000e+00
Tau1_5	vecTau1	5	1	-3.46886	0.136581	-25.3979	0.000000e+00
Tau1_6	vecTau1	6	1	-2.49529	0.254899	-9.78936	0.000000e+00
Tau1_7	vecTau1	7	1	-3.34659	0.274626	-12.1859	4.183229e-09
Tau1_8	vecTau1	8	1	-2.57623	0.438375	-5.87678	0.000000e+00

Tau1_9	vecTau1	9	1	-4.42701	0.337843	-13.1037	2.041598e-06
Tau1_10	vecTau1	10	1	-3.19345	0.672409	-4.74926	0.000000e+00
Tau1_11	vecTau1	11	1	-3.27710	0.328561	-9.97411	0.000000e+00
Tau1_12	vecTau1	12	1	-3.21049	0.255591	-12.5610	6.470570e-05
Tau1_13	vecTau1	13	1	-2.76877	0.693066	-3.99496	6.403766e-13
Tau1_14	vecTau1	14	1	-2.26780	0.315341	-7.19159	2.844102e-03
Tau1_15	vecTau1	15	1	-2.73572	0.554899	-4.93011	8.218285e-07

Residual variance

PD	Know	Skill	Pract	Bel	Stud
0.3482	0.7094	0.7533	0.7850	0.8796	0.7909

Between Studies Variances Of Correlation Coefficients

Know ~ PD	Skill ~ PD	Pract ~ PD	Bel ~ PD	Stud ~ PD
0.069	0.030	0.068	0.031	0.082
Skill ~ Know	Pract ~ Know	Bel ~ Know	Stud ~ Know	Pract ~ Skill
0.035	0.076	0.012	0.041	0.038
Bel ~ Skill	Stud ~ Skill	Bel ~ Pract	Stud ~ Pract	Stud ~ Bel
0.040	0.063	0.104	0.106	0.065

Evaluation model

	PD	Know	Pract	Bel	Stud	Satis
PD	x	81	101	174	52	16
Know	58 379	x	26	44	6	5
Pract	64 298	14 484	x	32	17	6
Bel	60 374	22 974	17 241	x	12	9
Stud	52 531	9 141	14 708	15 786	x	4
Satis	13 104	9 564	9 709	15 889	9 592	x

Model Statistics

Chi2(8) = 126.5796, p = 1.446061e-23

CFI: 0.7219064

TLI: 0.4785744

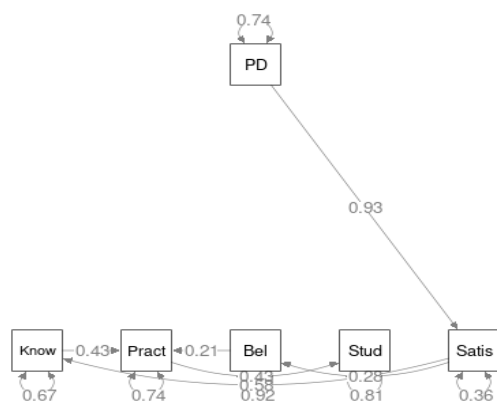
RMSEA: 0.01124202 [95% CI (0.009231715, 0.01333864)], Prob(RMSEA <= 0.05): 1

SRMR = 0.201.

	df Penalty	Parameters Penalty	Sample-Size Adjusted
AIC	-1079.688	90.31165	90.32028
BIC	-6525.214	303.10305	233.18625

	Parameters	Degrees of Freedom	Fit (-2lnL units)
Model	22	563	46.31165
Saturated	30	555	-80.26793
Independence	15	570	361.13369

Number of observations/statistics: 117 282/585



Summary of one stage MASEM for implicit model:

name	matrix	row	col	Estimate	Std.Error	z value	Pr(> z)
SatisONPD	A0	Satis	PD	0.9292477	NA	NA	NA
PractONKnow	A0	Pract	Know	0.4302194	0.0713874	6.026541	1.675055e-09
StudONPract	A0	Stud	Pract	0.4301961	0.1124958	3.824109	1.312461e-04
PractONBel	A0	Pract	Bel	0.2061488	0.0737459	2.795396	5.183622e-03
KnowONSatis	A0	Know	Satis	0.5774858	0.0453246	12.74111	0.000000e+00
BelONSatis	A0	Bel	Satis	0.2757249	0.0222275	12.40466	0.000000e+00
PDWITHPD	S0	PD	PD	0.7359741	NA	NA	NA
Tau1_1	vecTau1	1	1	-2.6721149	0.1783939	-14.97874	0.000000e+00
Tau1_2	vecTau1	2	1	-2.7340254	0.1714554	-15.94599	0.000000e+00
Tau1_3	vecTau1	3	1	-3.4611609	0.1360335	-25.44345	0.000000e+00
Tau1_4	vecTau1	4	1	-2.5022336	0.2384582	-10.49338	0.000000e+00
Tau1_5	vecTau1	5	1	-1.4347687	0.4214405	-3.404440	6.629992e-04
Tau1_6	vecTau1	6	1	-1.9766370	0.3957354	-4.994845	5.888302e-07
Tau1_7	vecTau1	7	1	-4.5651138	0.3319230	-13.75353	0.000000e+00
Tau1_8	vecTau1	8	1	-3.2464595	0.6366085	-5.099617	3.403410e-07
Tau1_9	vecTau1	9	1	-2.2488644	0.6940938	-3.240001	1.195294e-03
Tau1_10	vecTau1	10	1	-2.2969937	0.3018412	-7.609922	2.753353e-14
Tau1_11	vecTau1	11	1	-2.3598930	0.5840853	-4.040322	5.337777e-05
Tau1_12	vecTau1	12	1	-4.2876985	0.7267385	-5.899920	3.636788e-09
Tau1_13	vecTau1	13	1	-2.6167151	0.5041078	-5.190785	2.094095e-07
Tau1_14	vecTau1	14	1	-2.8477804	0.5143678	-5.536467	3.086334e-08
Tau1_15	vecTau1	15	1	-2.3515037	0.7599139	-3.094434	1.971886e-03

Residual variance

PD	Know	Pract	Bel	Satis	Stud
0.7360	0.6665	0.7442	0.9240	0.8149	0.3645

Between Studies Variances Of Correlation Coefficients

Know ~ PD	Pract ~ PD	Bel ~ PD	Stud ~ PD	Satis ~ PD
0.069	0.065	0.031	0.082	0.238
Pract ~ Know	Bel ~ Know	Stud ~ Know	Satis ~ Know	Bel ~ Pract
0.139	0.010	0.039	0.106	0.101
Stud ~ Pract	Satis ~ Pract	Stud ~ Bel	Satis ~ Bel	Satis ~ Stud
0.094	0.014	0.073	0.058	0.095

Change Model

Number of studies (upper triangle) and total sample size (lower triangle) per correlation coefficient

	PD	Know	Skill	Pract	Bel	Stud
PD	x	81	158	101	174	52
Know	58 379	x	39	26	44	6
Skill	77 426	11 663	x	30	79	6
Pract	64 298	14 484	7 861	x	32	17
Bel	60 374	22 974	24 079	17 241	x	12
Stud	52 531	9 141	2 391	14 708	15 786	x

Model Statistics

Chi2(7) = 137.7501, p = 6.966612e-26

CFI: 0.8117015

TLI: 0.6469403

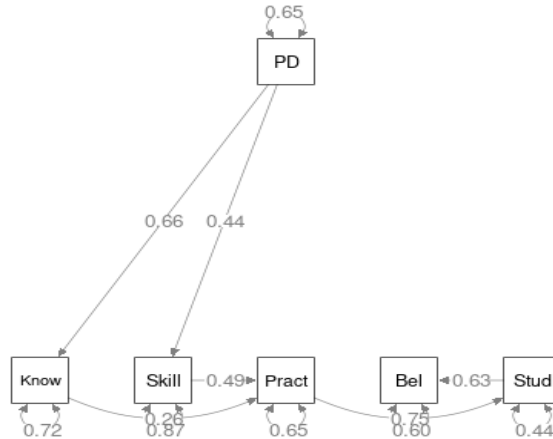
RMSEA0.01175962 [95% CI (0.009750374, 0.0138521)], Prob(RMSEA <= 0.05): 1

SRMR = 0.197

	df Penalty	Parameters Penalty	Sample-Size Adjusted
AIC	-1698.592	15.40776	15.41639
BIC	-9774.993	228.19916	158.28236

	Parameters	Degrees of Freedom	Fit (-2lnL units)
Model	22	835	-28.59224
Saturated	30	827	-166.34238
Independence	15	842	537.72385

Number of observations/statistics: 117 282/857



Summary of one stage MASEM for implicit model:

name	matrix	row	col	Estimate	Std.Error	z value	Pr(> z)
KnowONPD	A0	Know	PD	0.656975	0.1311680	5.00865	5.481291e-07
SkillONPD	A0	Skill	PD	0.440193	0.0915372	4.80891	1.517575e-06
BelONPD	A0	Bel	PD	0.258474	0.0391832	6.59656	4.208145e-11
PractONKnow	A0	Pract	Know	0.485319	0.0609373	7.96425	1.554312e-15
PractONSkill	A0	Pract	Skill	0.749388	0.1252633	5.98250	2.197357e-09
StudONPract	A0	Stud	Pract	0.629549	0.1012029	6.22066	4.950673e-10
PDWITHPD	S0	PD	PD	0.652880	0.1358956	4.80427	1.553147e-06
Tau1_1	vecTau1	1	1	-2.67689	0.1828151	-14.6427	0.000000e+00
Tau1_2	vecTau1	2	1	-3.49831	0.1447596	-24.1664	0.000000e+00
Tau1_3	vecTau1	3	1	-2.80767	0.1638647	-17.1341	0.000000e+00
Tau1_4	vecTau1	4	1	-3.33472	0.1370472	-24.3327	0.000000e+00
Tau1_5	vecTau1	5	1	-2.81394	0.2224098	-12.6521	0.000000e+00
Tau1_6	vecTau1	6	1	-3.25235	0.2922722	-11.1278	0.000000e+00
Tau1_7	vecTau1	7	1	-2.45896	0.3415466	-7.1995	6.044054e-13
Tau1_8	vecTau1	8	1	-4.52965	0.3330615	-13.6000	0.000000e+00
Tau1_9	vecTau1	9	1	-3.26572	0.6367692	-5.1286	2.919421e-07
Tau1_10	vecTau1	10	1	-2.31139	0.4054738	-5.7004	1.194910e-08
Tau1_11	vecTau1	11	1	-3.54728	0.1923341	-18.4433	0.000000e+00
Tau1_12	vecTau1	12	1	-2.83967	0.6550961	-4.3347	1.459299e-05
Tau1_13	vecTau1	13	1	-1.73183	0.3028789	-5.7179	1.078511e-08
Tau1_14	vecTau1	14	1	-1.13782	0.5374394	-2.1171	3.425006e-02
Tau1_15	vecTau1	15	1	-1.93108	0.6172191	-3.1287	1.755947e-03

Residual variance

PD	Know	Skill	Pract	Bel	Stud
0. 6529	0. 7182	0. 8735	0. 6503	0. 6037	0. 4384

Between Studies Variances Of Correlation Coefficients

Know ~ PD	Skill ~ PD	Pract ~ PD	Bel ~ PD	Stud ~ PD
0. 069	0. 030	0. 060	0.036	0.060
Skill ~ Know	Pract ~ Know	Bel ~ Know	Stud ~ Know	Pract ~ Skill
0.039	0.086	0.011	0.038	0.099
Bel ~ Skill	Stud ~ Skill	Bel ~ Pract	Stud ~ Pract	Stud ~ Bel
0.029	0.058	0.177	0.321	0.145

Cognitive Change Model

Number of studies (upper triangle) and total sample size (lower triangle) per correlation coefficient

	PD	Know	Skill	Pract	Bel	Will	Stud
PD	x	81	158	101	174	49	52
Know	58 379	x	39	26	44	14	6
Skill	77 426	11 663	x	30	79	24	6
Pract	64 298	14 484	7 861	x	32	14	17
Bel	60 374	22 974	24 079	17 241	x	25	12
Will	17 617	11 097	15 901	12 757	9 108	x	7
Stud	52 531	9 141	2 391	14 708	15 786	9 877	x

Model Statistics

Chi2(7) = 74.79894, $p = 1.731536e-12$

CFI: 0.9178387

TLI: 0.8082903

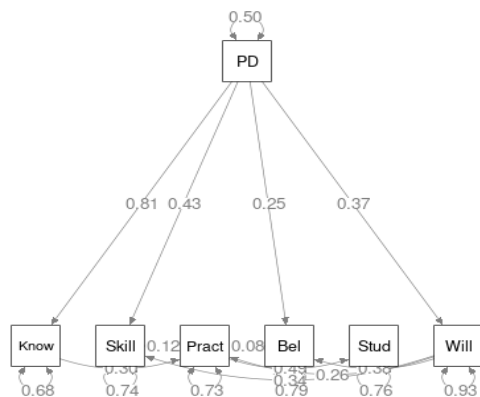
RMSEA: 0.00789537 [95% CI (0.005977743, 0.009910428)]

SRMR = 0.099

	df Penalty	Parameters Penalty	Sample-Size Adjusted
AIC	2040.308	-60.3081	-60.28896
BIC	-11296.734	258.8790	154.00379

	Parameters	Degrees of Freedom	Fit (-2lnL units)
Model	33	957	-126.3081
Saturated	43	948	-201.1070
Independence	21	969	620.7437

Number of observations/statistics: 117 282/990



Summary of one stage MASEM for implicit model:

name	matrix	row	col	Estimate	Std.Error	z value	Pr(> z)
KnowONPD	A0	Know	PD	0.8051119	0.08463333	9.512942	0.000000e+00
SkillONPD	A0	Skill	PD	0.4277073	0.07424146	5.761031	8.360172e-09
BelONPD	A0	Bel	PD	0.2479113	0.04979511	4.978627	6.403679e-07
WillONPD	A0	Will	PD	0.3700627	0.07073563	5.231629	1.680219e-07
PractONKnow	A0	Pract	Know	0.2951205	0.07509070	3.930187	8.487985e-05
PractONSkill	A0	Pract	Skill	0.1240973	0.06292383	1.972183	4.858870e-02
StudONPract	A0	Stud	Pract	0.4855292	0.11758635	4.129129	3.641406e-05
PractONBel	A0	Pract	Bel	0.0792071	0.08784809	0.901637	3.672495e-01
SkillONWill	A0	Skill	Will	0.3432792	0.05276241	6.506132	7.711076e-11
PractONWill	A0	Pract	Will	0.2553339	0.10188833	2.506017	1.220998e-02
BelONWill	A0	Bel	Will	0.3789394	0.04195605	9.031819	0.000000e+00
PDWITHPD	S0	PD	PD	0.4968378	0.06451523	7.701093	1.354472e-14
Tau1_1	vecTau1	1	1	-2.7145192	0.17894554	-15.16953	0.000000e+00
Tau1_2	vecTau1	2	1	-3.5461063	0.14325724	-24.75342	0.000000e+00
Tau1_3	vecTau1	3	1	-2.7650508	0.16961775	-16.30166	0.000000e+00
Tau1_4	vecTau1	4	1	-3.4937601	0.13600770	-25.68796	0.000000e+00
Tau1_5	vecTau1	5	1	-2.5782711	0.23961738	-10.75995	0.000000e+00
Tau1_6	vecTau1	6	1	-3.5004782	0.26667648	-13.12631	0.000000e+00

Tau1_7	vecTau1	7	1	-3.3397889	0.27418091	-12.18097	0.000000e+00
Tau1_8	vecTau1	8	1	-2.3672679	0.41158154	-5.751638	8.838298e-09
Tau1_9	vecTau1	9	1	-4.5898796	0.33234996	-13.81038	0.000000e+00
Tau1_10	vecTau1	10	1	-3.2940376	0.64499459	-5.107078	3.271789e-07
Tau1_11	vecTau1	11	1	-2.6747470	0.44328887	-6.033869	1.600796e-09
Tau1_12	vecTau1	12	1	-3.3672248	0.31407383	-10.72113	0.000000e+00
Tau1_13	vecTau1	13	1	-3.4938717	0.19818379	-17.62945	0.000000e+00
Tau1_14	vecTau1	14	1	-2.7833175	0.66920809	-4.159121	3.194744e-05
Tau1_15	vecTau1	15	1	-2.8976727	0.35484805	-8.165954	2.220446e-16
Tau1_16	vecTau1	16	1	-2.3489514	0.29389924	-7.992369	1.332268e-15
Tau1_17	vecTau1	17	1	-2.1275630	0.61284406	-3.471622	5.173239e-04
Tau1_18	vecTau1	18	1	-2.7599005	0.41265461	-6.688161	2.259926e-11
Tau1_19	vecTau1	19	1	-2.7052966	0.50759509	-5.329635	9.841029e-08
Tau1_20	vecTau1	20	1	-3.4168957	0.34197007	-9.991798	0.000000e+00
Tau1_21	vecTau1	21	1	-4.0815425	0.60053552	-6.796505	1.071876e-11

Residual variance

PD	Know	Skill	Pract	Bel	Will	Stud
0.4968	0.6779	0.7373	0.7318	0.7913	0.9320	0.7643

Between Studies Variances Of Correlation Coefficients

Know~PD	Skill~PD	Pract~PD	Bel~PD	Will~PD	Stud~PD	Will~Pract
0.066	0.029	0.063	0.030	0.030	0.076	0.063
Skill~Know	Pract~Know	Bel~Know	Stud~Know	Will~Know	Pract~Skill	Will~Bel
0.035	0.094	0.010	0.037	0.069	0.034	0.033
Bel~Skill	Stud~Skill	Bel~Pract	Stud~Pract	Will~Skill	Stud~Bel	Will~Stud
0.030	0.062	0.095	0.119	0.055	0.067	0.017

Supplement G. Model Results – Analysis Based on Same Number of Samples

This report contains the output of your one-stage MASEM analysis using webMASEM.

The following function arguments were used in the analysis:

- Random effects type: Diag
- Interval type: z
- Transformation on between-study variances: expLog
- Start values of between-study variances: 0.05

Variable names used for analysis:

Training participation	PD
Change in knowledge about inclusive education	Know
Change in perceived skills for inclusive education	Skill
Change in inclusive teaching practices	Pract
Change in beliefs regarding inclusive education	Bel
Change in willingness to engage in change process towards inclusive education	Will
Satisfaction with training	Satis
Change in student behavior	Stud

Data base: 163 samples with 84 661 participants

- 50 769 students,
- 25 609 general educators,
- 2 639 special educators,
- 3 511 administrators,
- 739 teaching assistants,
- 1 394 pre-service teachers

Model	CFI	TLI	RMSEA	SRMR
Basic Model	0.749	0.248	0.018	0.166
Implicit Model	0.866	0.712	0.011	0.121
Evaluation Model	0.683	0.406	0.013	0.204
Change Model	0.786	0.598	0.013	0.186
Cognitive Change Model	0.901	0.769	0.009	0.104

Basic Model

Number of studies (upper triangle) and total sample size (lower triangle) per correlation coefficient

	PD	Know	Pract	Stud
PD	x	81	101	52
Know	58 379	x	26	6
Pract	64 298	14 484	x	17
Stud	52 531	9 141	14 708	x

Model Statistics

Chi2(2) = 55.68263, p = 8.103472e-13

CFI: 0.7494718

TLI: 0.2484155

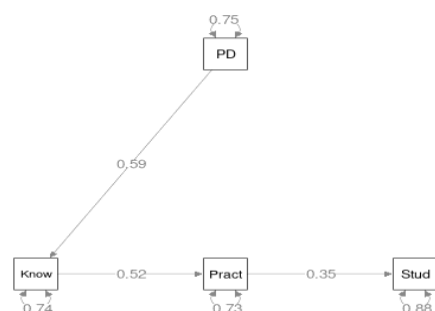
RMSEA (with 95% CI) = 0.01512816 [0.0111983, 0.01933069], Prob(RMSEA <= 0.05): 1

SRMR = 0.166

	df Penalty	Parameters Penalty	Sample-Size Adjusted
AIC	-433.3421	132.6579	132.6598
BIC	-3073.8900	229.3813	197.6009

	Parameters	Degrees of Freedom	Fit (-2lnL units)
Model	10	273	112.65791
Saturated	12	271	56.97528
Independence	6	277	277.25310

Number of observations/statistics: 84 526 / 283



Summary of one stage MASEM for basic model:

name	matrix	row	Col	Estimate	Std.Error	z value	Pr(> z)
KnowONPD	A0	Know	PD	0.58715	76.13281	0.007712	9.93847e-01
PractONKnow	A0	Pract	Know	0.52211	0.069816	7.478295	7.52731e-14
StudONPract	A0	Stud	Pract	0.35073	0.071238	4.923373	8.50650e-07
PDWITHPD	S0	PD	PD	0.74680	96.83393	0.007712	9.93847e-01
Tau1_1	vecTau1	1	1	-2.62005	0.182883	-14.3264	0.00000e+00
Tau1_2	vecTau1	2	1	-2.76173	0.168302	-16.4094	0.00000e+00
Tau1_3	vecTau1	3	1	-2.44314	0.227057	-10.7600	0.00000e+00
Tau1_4	vecTau1	4	1	-1.74178	0.393622	-4.42500	9.64407e-06
Tau1_5	vecTau1	5	1	-3.18777	0.639313	-4.98624	6.15657e-07
Tau1_6	vecTau1	6	1	-2.64709	0.426055	-6.21301	5.19798e-10

Residual variance

PD	Know	Pract	Stud
0.7468	0.7425	0.7274	0.8770

Between Studies Variances Of Correlation Coefficients

Know ~ PD	Pract ~ PD	Stud ~ PD	Know ~ Stud	Stud ~ Pract
0.073	0.063	0.087	0.041	0.071

Implicit Model

Number of studies (upper triangle) and total sample size (lower triangle) per correlation coefficient

	PD	Know	Skill	Pract	Bel	Stud
PD	x	81	93	101	105	52
Know	58 379	x	25	26	27	6
Skill	57 155	5 094	x	24	29	5
Pract	64 298	14 484	6 102	x	31	17
Bel	31 414	14 292	6 057	17 148	x	11
Stud	52 531	9 141	1 955	14 708	10 660	x

Model Statistics

Chi2(7) = 73.90941, p = 2.387446e-13

CFI: 0.8655472

TLI: 0.7118869

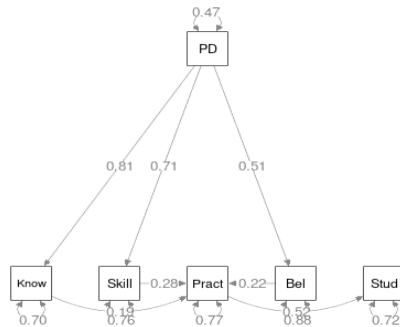
RMSEA: 0.01063407 [95% CI (0.008096577, 0.01330844)]

SRMR = 0.121

	df Penalty	Parameters Penalty	Sample-Size Adjusted
AIC	-1148.355	117.6446	117.6577
BIC	-6848.692	332.5753	259.4806

	Parameters	Degrees of Freedom	Fit (-2lnL units)
Model	23	610	71.644595
Saturated	30	603	-2.264813
Independence	15	618	510.377662

Number of observations/statistics: 84 526 / 633



Summary of one stage MASEM for implicit model:

name	matrix	row	col	Estimate	Std.Error	z value	Pr(> z)
KnowONPD	A0	Know	PD	0.805565	0.098952	8.14100	4.4409e-16
SkillONPD	A0	Skill	PD	0.711736	0.112024	6.35341	2.1059e-10
BelONPD	A0	Bel	PD	0.512729	0.079468	6.45199	1.1039e-10
PractONKnow	A0	Pract	Know	0.193446	0.077223	2.50504	1.2244e-02
PractONSkill	A0	Pract	Skill	0.280049	0.064332	4.35316	1.3419e-05
StudONPract	A0	Stud	Pract	0.524881	0.266720	1.96791	4.9079e-02
PractONBel	A0	Pract	Bel	0.217482	0.085435	2.54558	1.0909e-02
PDWITHPD	S0	PD	PD	0.468087	0.070528	6.63692	3.2029e-11
Tau1_1	vecTau1	1	1	-2.72220	0.177862	-15.305	0.0000e+00
Tau1_2	vecTau1	2	1	-3.36515	0.191088	-17.611	0.0000e+00
Tau1_3	vecTau1	3	1	-2.75557	0.168535	-16.350	0.0000e+00
Tau1_4	vecTau1	4	1	-3.18199	0.174944	-18.189	0.0000e+00
Tau1_5	vecTau1	5	1	-2.60803	0.314295	-8.2980	0.0000e+00
Tau1_6	vecTau1	6	1	-3.10958	0.329361	-9.4413	0.0000e+00
Tau1_7	vecTau1	7	1	-2.63604	0.393599	-6.6973	2.1235e-11
Tau1_8	vecTau1	8	1	-4.13856	0.389349	-10.629	0.0000e+00
Tau1_9	vecTau1	9	1	-3.23107	0.678215	-4.7641	1.8972e-06
Tau1_10	vecTau1	10	1	-3.05481	0.376039	-8.1236	4.4409e-16
Tau1_11	vecTau1	11	1	-2.99856	0.347642	-8.6254	0.0000e+00

Tau1_12	vecTau1	12	1	-2.72599	0.829808	-3.2851	1.0195e-03
Tau1_13	vecTau1	13	1	-2.22936	0.329401	-6.7679	1.3064e-11
Tau1_14	vecTau1	14	1	-1.96804	1.164869	-1.6895	9.1124e-02
Tau1_15	vecTau1	15	1	-2.74988	0.739120	-3.7205	1.9885e-04

Residual variance

PD	Know	Skill	Pract	Bel	Stud
0.4681	0.6962	0.7629	0.7707	0.8769	0.7245

Between Studies Variances Of Correlation Coefficients

Know ~ PD	Skill ~ PD	Pract ~ PD	Bel ~ PD	Stud ~ PD
0.066	0.035	0.064	0.042	0.074
Skill ~ Know	Pract ~ Know	Bel ~ Know	Stud ~ Know	Pract ~ Skill
0.045	0.072	0.016	0.040	0.047
Bel ~ Skill	Stud ~ Skill	Bel ~ Pract	Stud ~ Pract	Stud ~ Bel
0.050	0.065	0.108	0.140	0.064

Evaluation model

	PD	Know	Pract	Bel	Satis	Stud
PD	x	81	101	105	52	10
Know	58 379	x	26	27	6	4
Pract	64 298	14 484	x	31	17	6
Bel	31 414	14 292	17 148	x	11	7
Satis	52 531	9 141	14 708	10 660	x	4
Stud	10 241	8 464	9 709	9 821	9 592	x

Model Statistics

Chi2(8) = 122.8564, p = 8.519223e-23

CFI: 0.6833742

TLI: 0.4063266

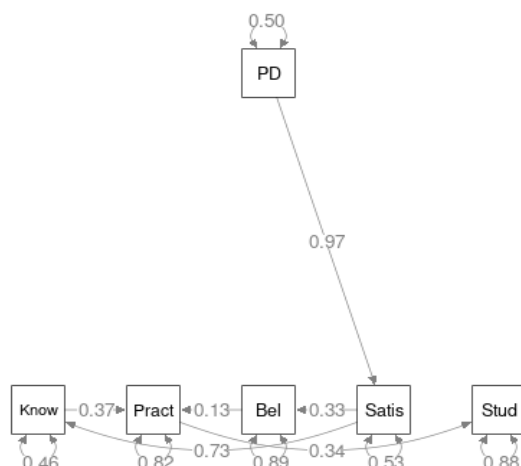
RMSEA: 0.01303279 [95% CI (0.01066428, 0.01550428)]

SRMR = 0.204

	df Penalty	Parameters Penalty	Sample-Size Adjusted
AIC	-803.0143	172.9857	172.9977
BIC	-5157.6978	378.5716	308.6550

	Parameters	Degrees of Freedom	Fit (-2lnL units)
Model	22	466	128.985726
Saturated	30	458	6.129323
Independence	15	473	383.880581

Number of observations/statistics: 84 526 / 488



Summary of one stage MASEM for implicit model:

name	matrix	row	col	Estimate	Std.Error	z value	Pr(> z)
SatisONPD	A0	Satis	PD	0.96890	240.6149	0.0040268	9.9679e-01
PractONKnow	A0	Pract	Know	0.37421	0.080406	4.6539470	3.2564e-06
StudONPract	A0	Stud	Pract	0.34038	0.084473	4.0294571	5.5906e-05
PractONBel	A0	Pract	Bel	0.13423	0.071199	1.8853173	5.9387e-02
KnowONSatis	A0	Know	Satis	0.73440	0.077630	9.4602578	0.0000e+00
BelONSatis	A0	Bel	Satis	0.33161	0.035175	9.4274879	0.0000e+00
PDWITHPD	S0	PD	PD	0.50467	125.3283	0.0040268	9.9679e-01
Tau1_1	vecTau1	1	1	-2.6663	0.179080	-14.88899	0.0000e+00
Tau1_2	vecTau1	2	1	-2.5785	0.185459	-13.90328	0.0000e+00
Tau1_3	vecTau1	3	1	-3.0719	0.179239	-17.13843	0.0000e+00
Tau1_4	vecTau1	4	1	-2.1565	0.271747	-7.935778	1.9984e-15
Tau1_5	vecTau1	5	1	-3.5437	0.584776	-6.059925	1.3618e-09
Tau1_6	vecTau1	6	1	-2.2149	0.428219	-5.172239	2.3131e-07
Tau1_7	vecTau1	7	1	-3.8552	0.408034	-9.448300	0.0000e+00
Tau1_8	vecTau1	8	1	-1.2235	0.642279	-1.904862	5.6798e-02
Tau1_9	vecTau1	9	1	-3.8155	0.958497	-3.980666	6.8722e-05
Tau1_10	vecTau1	10	1	-2.3667	0.285557	-8.288149	2.2204e-16
Tau1_11	vecTau1	11	1	-2.7696	0.385308	-7.188016	6.5747e-13
Tau1_12	vecTau1	12	1	-4.0356	0.964033	-4.186129	2.8375e-05
Tau1_13	vecTau1	13	1	-3.3419	0.491819	-6.795150	1.0820e-11
Tau1_14	vecTau1	14	1	-1.9094	0.573853	-3.327273	8.7700e-04
Tau1_15	vecTau1	15	1	-2.2115	0.747779	-2.957358	3.1029e-03

Residual variance

PD	Know	Pract	Bel	Satis	Stud
0.5047	0.4607	0.8175	0.8900	0.5262	0.8841

Between Studies Variances Of Correlation Coefficients

Know ~ PD	Pract ~ PD	Bel ~ PD	Stud ~ PD	Satis ~ PD
0.070	0.076	0.046	0.029	0.116
Pract ~ Know	Bel ~ Know	Stud ~ Know	Satis ~ Know	Bel ~ Pract
0.109	0.021	0.022	0.294	0.094
Stud ~ Pract	Satis ~ Pract	Stud ~ Bel	Satis ~ Bel	Satis ~ Stud
0.018	0.063	0.035	0.035	0.110

Change Model

Number of studies (upper triangle) and total sample size (lower triangle) per correlation coefficient

	PD	Know	Skill	Pract	Bel	Stud
PD	x	81	93	101	105	52
Know	58 379	x	25	26	27	6
Skill	57 155	5 094	x	24	29	5
Pract	64 298	14 484	6 102	x	31	17
Bel	31 414	14 292	6 057	17 148	x	11
Stud	52 531	9 141	1 955	14 708	10 660	x

Model Statistics

Chi2(7) = 114.666, p = 4.174107e-21

CFI: 0.7856573

TLI: 0.5981074

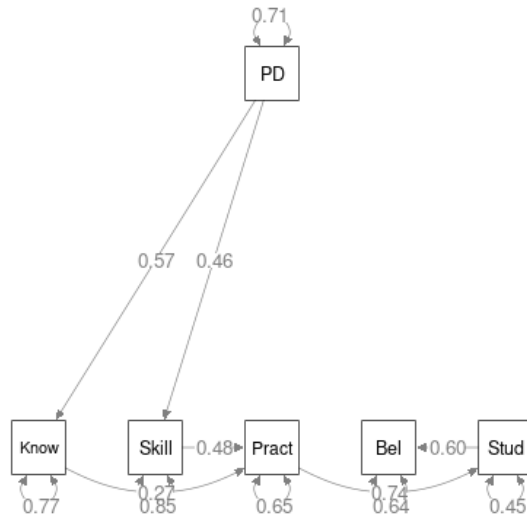
RMSEA: 0.01255952 [95% CI (0.01018969, 0.01503534)]

SRMR = 0.186

	df Penalty	Parameters Penalty	Sample-Size Adjusted
AIC	-1109.599	156.4012	156.4132
BIC	-6819.280	361.9872	292.0705

	Parameters	Degrees of Freedom	Fit (-2lnL units)
Model	22	611	112.401234
Saturated	30	603	-2.264813
Independence	15	618	510.377662

Number of observations/statistics: 84 526 / 633



Summary of one stage MASEM for implicit model:

name	matrix	row	col	Estimate	Std.Error	z value	Pr(> z)
KnowONPD	A0	Know	PD	0.57254	0.155765	3.67567	2.3723e-04
SkillONPD	A0	Skill	PD	0.464723	0.130482	3.56159	3.6861e-04
BelONPD	A0	Bel	PD	0.265601	0.060376	4.39913	1.0868e-05
PractONKnow	A0	Pract	Know	0.484025	0.084349	5.73839	9.5579e-09
PractONSkill	A0	Pract	Skill	0.742024	0.114153	6.50025	8.0187e-11
StudONPract	A0	Stud	Pract	0.596228	0.106726	5.58655	2.3163e-08
PDWITHPD	S0	PD	PD	0.712901	0.198297	3.59511	3.2425e-04
Tau1_1	vecTau1	1	1	-2.70667	0.179345	-15.092	0.0000e+00
Tau1_2	vecTau1	2	1	-3.35616	0.191264	-17.547	0.0000e+00
Tau1_3	vecTau1	3	1	-2.80924	0.162831	-17.252	0.0000e+00
Tau1_4	vecTau1	4	1	-2.99268	0.178280	-16.786	0.0000e+00
Tau1_5	vecTau1	5	1	-2.83136	0.220149	-12.861	0.0000e+00
Tau1_6	vecTau1	6	1	-3.00766	0.350631	-8.5779	0.0000e+00
Tau1_7	vecTau1	7	1	-2.43535	0.366181	-6.6507	2.9176e-11
Tau1_8	vecTau1	8	1	-4.11063	0.387855	-10.598	0.0000e+00
Tau1_9	vecTau1	9	1	-3.25577	0.638493	-5.0991	3.4119e-07
Tau1_10	vecTau1	10	1	-2.30326	0.481588	-4.7826	1.7301e-06
Tau1_11	vecTau1	11	1	-3.39437	0.387921	-8.7502	0.0000e+00
Tau1_12	vecTau1	12	1	-2.90214	0.695595	-4.1722	3.0172e-05
Tau1_13	vecTau1	13	1	-1.81727	0.327431	-5.5501	2.8555e-08
Tau1_14	vecTau1	14	1	-1.16657	0.514058	-2.2693	2.3248e-02
Tau1_15	vecTau1	15	1	-2.24716	0.696680	-3.2255	1.2574e-03

Residual variance

PD	Know	Skill	Pract	Bel	Stud
0.7120	0.7663	0.8460	0.6464	0.6445	0.4494

Between Studies Variances Of Correlation Coefficients

Know ~ PD	Skill ~ PD	Pract ~ PD	Bel ~ PD	Stud ~ PD
0.067	0.035	0.060	0.050	0.059
Skill ~ Know	Pract ~ Know	Bel ~ Know	Stud ~ Know	Pract ~ Skill
0.049	0.088	0.016	0.039	0.100
Bel ~ Skill	Stud ~ Skill	Bel ~ Pract	Stud ~ Pract	Stud ~ Bel
0.034	0.055	0.162	0.311	0.106

Cognitive Change Model

Number of studies (upper triangle) and total sample size (lower triangle) per correlation coefficient

	PD	Know	Skill	Pract	Bel	Will	Stud
PD	x	81	93	101	105	52	32
Know	58 379	x	25	26	27	6	9
Skill	57 155	5 094	x	24	29	5	14
Pract	64 298	14 484	6 102	x	31	17	13
Bel	31 414	14 292	6 057	17 148	x	11	14
Will	52 531	9 141	1 955	14 708	10 660	x	7
Stud	12 722	9 495	11 173	12 482	3 382	9 877	x

Model Statistics

Chi2(9) = 65.82903 p = 9.949719e-11

CFI: 0.9010529

TLI: 0.7691233

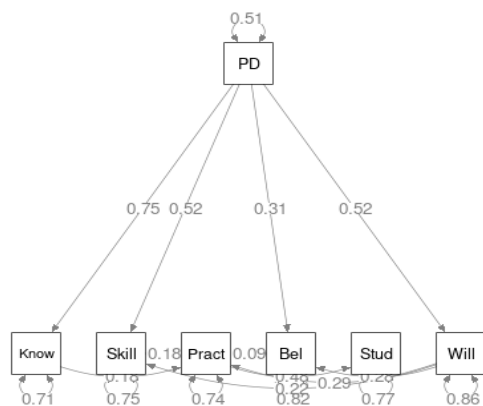
RMSEA: 0.008643084 [95% CI (0.006375102, 0.01102977)]

SRMR = 0.104

	df Penalty	Parameters Penalty	Sample-Size Adjusted
AIC	-1328.367	115.6329	115.6595
BIC	-7766.944	424.0118	319.1368

	Parameters	Degrees of Freedom	Fit (-2lnL units)
Model	33	689	49.63294
Saturated	43	680	-16.19609
Independence	21	701	579.14116

Number of observations/statistics: 117 282/990



Summary of one stage MASEM for implicit model:

name	matrix	row	col	Estimate	Std.Error	z value	Pr(> z)
KnowONPD	A0	Know	PD	0.753595	0.098823	7.62572	2.420286e-14
SkillONPD	A0	Skill	PD	0.518182	0.117955	4.39305	1.117709e-05
BelONPD	A0	Bel	PD	0.310559	0.076239	4.07349	4.631232e-05
WillONPD	A0	Will	PD	0.520212	0.116952	4.44809	8.663717e-06
PractONKnow	A0	Pract	Know	0.182643	0.076685	2.38173	1.723133e-02
PractONSkill	A0	Pract	Skill	0.178788	0.070315	2.54267	1.100082e-02
StudONPract	A0	Stud	Pract	0.475619	0.120539	3.94578	7.954081e-05
PractONBel	A0	Pract	Bel	0.091380	0.088060	1.03769	2.994101e-01
SkillONWill	A0	Skill	Will	0.217367	0.090754	2.39513	1.661457e-02
PractONWill	A0	Pract	Will	0.289379	0.112002	2.58369	9.774763e-03
BelONWill	A0	Bel	Will	0.284461	0.056702	5.01675	5.255415e-07
PDWITHPD	S0	PD	PD	0.512761	0.081344	6.30365	2.907117e-10
Tau1_1	vecTau1	1	1	-2.72383	0.177882	-15.313	0.000000e+00
Tau1_2	vecTau1	2	1	-3.40006	0.189924	-17.902	0.000000e+00
Tau1_3	vecTau1	3	1	-2.77471	0.166548	-16.660	0.000000e+00
Tau1_4	vecTau1	4	1	-3.19870	0.174635	-18.316	0.000000e+00

Tau1_5	vecTau1	5	1	-2.58579	0.242116	-10.679	0.000000e+00
Tau1_6	vecTau1	6	1	-3.21199	0.314042	-10.228	0.000000e+00
Tau1_7	vecTau1	7	1	-3.10795	0.328661	-9.4564	0.000000e+00
Tau1_8	vecTau1	8	1	-2.66998	0.387502	-6.8902	5.569767e-12
Tau1_9	vecTau1	9	1	-4.15444	0.390129	-10.649	0.000000e+00
Tau1_10	vecTau1	10	1	-3.17475	0.657894	-4.8256	1.395649e-06
Tau1_11	vecTau1	11	1	-2.09347	0.530428	-3.9468	7.921475e-05
Tau1_12	vecTau1	12	1	-3.16288	0.357163	-8.8556	0.000000e+00
Tau1_13	vecTau1	13	1	-3.22429	0.346259	-9.3118	0.000000e+00
Tau1_14	vecTau1	14	1	-2.60270	0.723919	-3.5953	3.240278e-04
Tau1_15	vecTau1	15	1	-2.98151	0.441266	-6.7567	1.411515e-11
Tau1_16	vecTau1	16	1	-2.31863	0.300399	-7.7185	1.176836e-14
Tau1_17	vecTau1	17	1	-2.17641	0.623265	-3.4919	4.795080e-04
Tau1_18	vecTau1	18	1	-2.61905	0.445102	-5.8842	4.000527e-09
Tau1_19	vecTau1	19	1	-2.58089	0.532989	-4.8423	1.283514e-06
Tau1_20	vecTau1	20	1	-4.02431	0.528666	-7.6122	2.686740e-14
Tau1_21	vecTau1	21	1	-4.09393	0.601880	-6.8019	1.032463e-11

Residual variance

PD	Know	Skill	Pract	Bel	Will	Stud
0.5128	0.7088	0.7550	0.7367	0.8225	0.8612	0.7738

Between Studies Variances Of Correlation Coefficients

Know~PD	Skill~PD	Pract~PD	Bel~PD	Will~PD	Stud~PD	Will~Pract
0.066	0.033	0.062	0.041	0.040	0.075	0.073
Skill~Know	Pract~Know	Bel~Know	Stud~Know	Will~Know	Pract~Skill	Will~Bel
0.045	0.069	0.016	0.042	0.123	0.042	0.018
Bel~Skill	Stud~Skill	Bel~Pract	Stud~Pract	Will~Skill	Stud~Bel	Will~Stud
0.040	0.074	0.098	0.113	0.051	0.076	0.017

Supplement H. Model Results – Analysis Based on RCT and nRCT Studies

This report contains the output of your one-stage MASEM analysis using webMASEM.

The following function arguments were used in the analysis:

- Random effects type: Diag
- Interval type: z
- Transformation on between-study variances: expLog
- Start values of between-study variances: 0.05

Variable names used for analysis:

Training participation	PD
Change in knowledge about inclusive education	Know
Change in perceived skills for inclusive education	Skill
Change in inclusive teaching practices	Pract
Change in beliefs regarding inclusive education	Bel
Change in willingness to engage in change process towards inclusive education	Will
Satisfaction with training	Satis
Change in student behavior	Stud

Included samples: randomized and quasi-experimental allocation to conditions, using just studies with randomized allocation to conditions would lead to too many missing data

Data base: 58 samples with 22 503 participants

- 14 772 students,
- 3 965 general educators,
- 1 103 special educators,
- 11 administrators,
- 143 teaching assistants,
- 2 509 pre-service teachers

Model	CFI	TLI	RMSEA	SRMR
Basic Model	0.857	0.571	0.014	0.194
Implicit Model	0.919	0.827	0.009	0.114
Evaluation Model	0.647	0.338	0.014	0.284
Change Model	0.863	0.743	0.011	0.225
Cognitive Change Model	0.933	0.843	0.008	0.106

In general very few data available, in especially for data regarding student outcomes, satisfaction, willingness, practice

Evaluation model: no data available for satisfaction with training program and student outcomes

Basic Model

Number of studies (upper triangle) and total sample size (lower triangle) per correlation coefficient

	PD	Know	Pract	Stud
PD	x	20	28	23
Know	7 462	x	6	2
Pract	8 445	912	x	6
Stud	14 471	262	3 947	x

Model Statistics

Chi2(2) = 11.30686, p = 0.003505472

CFI: 0.856897

TLI: 0.570691

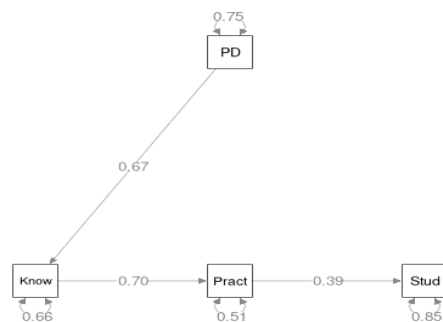
RMSEA = 0.01446893 [95% CI (0.005452701, 0.02467541)]

SRMR = 0.194

	df Penalty	Parameters Penalty	Sample-Size Adjusted
AIC	-103.1352	66.86484	66.87475
BIC	-703.8183	146.95592	115.17628

	Parameters	Degrees of Freedom	Fit (-2lnL units)
Model	10	75	46.86484
Saturated	12	73	35.55798
Independence	6	79	106.59407

Number of observations/statistics: 22 228 / 85



Summary of one stage MASEM for basic model:

name	matrix	row	Col	Estimate	Std.Error	z value	Pr(> z)
KnowONPD	A0	Know	PD	0.670177	553.86943	0.00120999	9.990346e-01
PractONKnow	A0	Pract	Know	0.700069	0.1269772	5.51334787	3.520714e-08
StudONPract	A0	Stud	Pract	0.392465	0.1311666	2.99210695	2.770592e-03
PDWITHPD	S0	PD	PD	0.753401	622.65049	0.00120999	9.990346e-01
Tau1_1	vecTau1	1	1	-2.55436	0.3652846	-6.99279429	2.694733e-12
Tau1_2	vecTau1	2	1	-2.53453	0.3000556	-8.44685761	0.000000e+00
Tau1_3	vecTau1	3	1	-2.43099	0.3498088	-6.94950737	3.665734e-12
Tau1_4	vecTau1	4	1	-1.10274	0.6651775	-1.65780783	9.735626e-02
Tau1_5	vecTau1	5	1	-3.21205	1.2294924	-2.61250178	8.988223e-03
Tau1_6	vecTau1	6	1	-2.14219	0.7137272	-3.00142379	2.687203e-03

Residual variance

PD	Know	Pract	Stud
0.7534	0.7534	0.5099	0.8460

Between Studies Variances Of Correlation Coefficients

Know ~ PD	Pract ~ PD	Stud ~ PD	Pract ~ Know	Know ~ Stud	Stud ~ Pract
0.078	0.079	0.088	0.332	0.040	0.117

Implicit Model

Number of studies (upper triangle) and total sample size (lower triangle) per correlation coefficient

	PD	Know	Skill	Pract	Bel	Stud
PD	x	20	35	28	39	23
Know	7 462	x	10	6	11	2
Skill	11 610	2 385	x	4	14	1
Pract	8 445	912	696	x	6	6
Bel	8 375	2 262	2 645	2 424	x	2
Stud	14 471	262	363	3 947	262	x

Model Statistics

Chi2(7) = 19.55067, p = 0.006626556

CFI: 0.9194066

TLI: 0.8272998

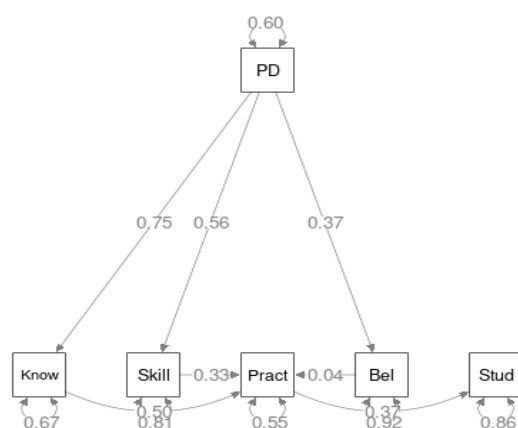
RMSEA: 0.008981197 [95% CI (0.003275664, 0.01466794)]

SRMR = 0.114

	df Penalty	Parameters Penalty	Sample-Size Adjusted
AIC	-340.447	73.55298	73.6027
BIC	-1814.123	257.76246	184.6693

	Parameters	Degrees of Freedom	Fit (-2lnL units)
Model			
Saturated			
Independence			

Number of observations/statistics: 22 228 / 207



Summary of one stage MASEM for implicit model:

name	matrix	row	col	Estimate	Std.Error	z value	Pr(> z)
KnowONPD	A0	Know	PD	0.74909904	0.1413105	5.30108	1.151170e-07
SkillONPD	A0	Skill	PD	0.55859446	0.1249996	4.46877	7.867092e-06
BelONPD	A0	Bel	PD	0.36850532	0.0912306	4.03927	5.361668e-05
PractONKnow	A0	Pract	Know	0.49761773	0.1809508	2.75002	5.959229e-03
PractONSkill	A0	Pract	Skill	0.33086319	0.1175509	2.81464	4.883240e-03
StudONPract	A0	Stud	Pract	0.37232449	0.1405922	2.64826	8.090759e-03
PractONBel	A0	Pract	Bel	0.03980443	0.1847245	0.21548	8.293931e-01
PDWITHPD	S0	PD	PD	0.59685707	0.1370285	4.35572	1.326326e-05

Tau1_1	vecTau1	1	1	-2.6707117	0.3598894	-7.42092	1.163514e-13
Tau1_2	vecTau1	2	1	-3.2725581	0.2862936	-11.4308	0.000000e+00
Tau1_3	vecTau1	3	1	-2.5556216	0.3022293	-8.45590	0.000000e+00
Tau1_4	vecTau1	4	1	-2.5556216	0.2858696	-10.5036	0.000000e+00
Tau1_5	vecTau1	5	1	-2.4105336	0.3549643	-6.79092	1.114220e-11
Tau1_6	vecTau1	6	1	-3.9813051	0.6996017	-5.69082	1.264332e-08
Tau1_7	vecTau1	7	1	-1.3954769	0.6941153	-2.01044	4.438467e-02
Tau1_8	vecTau1	8	1	-4.1114363	0.6514347	-6.31136	2.766016e-10
Tau1_9	vecTau1	9	1	-3.3860879	1.2186532	-2.77855	5.460224e-03
Tau1_10	vecTau1	10	1	-4.1003426	1.3242393	-3.09638	1.959019e-03
Tau1_11	vecTau1	11	1	-2.9709535	0.4878098	-6.09039	1.126337e-09
Tau1_12	vecTau1	12	1	-4.0718059	2.0659484	-1.97091	4.873376e-02
Tau1_13	vecTau1	13	1	-1.7873586	0.6647141	-2.68891	7.168507e-03
Tau1_14	vecTau1	14	1	-2.1881851	0.7126238	-3.07060	2.136267e-03
Tau1_15	vecTau1	15	1	-4.4307571	1.7232949	-2.57109	1.013772e-02

Residual variance

PD	Know	Skill	Pract	Bel	Stud
0.5969	0.6651	0.8138	0.5493	0.9189	0.8614

Between Studies Variances Of Correlation Coefficients

Know ~ PD	Skill ~ PD	Pract ~ PD	Bel ~ PD	Stud ~ PD
0.069	0.038	0.078	0.050	0.090
Skill ~ Know	Pract ~ Know	Bel ~ Know	Stud ~ Know	Pract ~ Skill
0.019	0.248	0.016	0.034	0.017
Bel ~ Skill	Stud ~ Skill	Bel ~ Pract	Stud ~ Pract	Stud ~ Bel
0.051	0.017	0.167	0.112	0.012

Evaluation model

	PD	Know	Pract	Bel	Satis	Stud
PD	x	20	28	39	23	2
Know	7 462	x	6	11	2	1
Pract	8 445	912	x	6	6	1
Bel	8 375	2 262	2 424	x	2	1
Satis	14 471	262	3 947	262	x	0
Stud	584	121	121	121	0	x

Model Statistics

Chi2(8) = 41.1757, p = 1.932681e-06

CFI: 0.6471359

TLI: 0.3383797

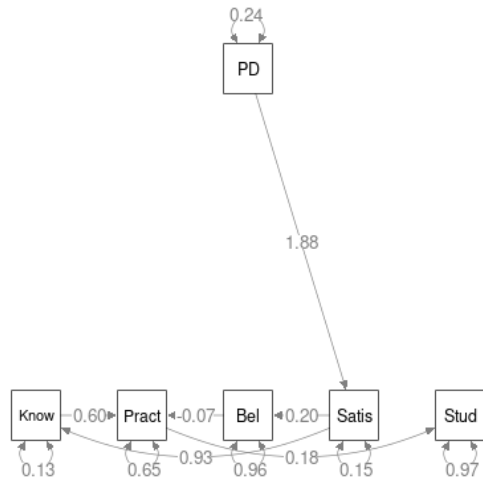
RMSEA: 0.01365887 [95% CI (0.008892448, 0.01869551)]

SRMR = 0.284

	df Penalty	Parameters Penalty	Sample-Size Adjusted
AIC	-195.2011	100.7989	100.8444
BIC	-1204.3488	276.9992	207.0840

	Parameters	Degrees of Freedom	Fit (-2lnL units)
Model	22	126	56.79886
Saturated	30	118	15.62316
Independence	15	133	124.64149

Number of observations/statistics: 22 228 / 148



Summary of one stage MASEM for implicit model:

name	matrix	row	col	Estimate	Std.Error	z value	Pr(> z)
SatisONPD	A0	Satis	PD	1.8778878	1.0634e+01	1.7660e-01	8.5982e-01
PractONKnow	A0	Pract	Know	0.5968073	2.0711e+01	2.8816e-02	9.7701e-01
StudONPract	A0	Stud	Pract	0.1751011	2.6714e+01	6.5547e-03	9.9477e-01
PractONBel	A0	Pract	Bel	-0.068712	1.3120e+01	-5.2372e-03	9.9582e-01
KnowONSatis	A0	Know	Satis	0.9334496	1.9591e+01	4.7647e-02	9.6199e-01
BelONSatis	A0	Bel	Satis	0.1987485	4.7199e+01	4.2108e-03	9.9664e-01
PDWITHPD	S0	PD	PD	0.2400618	8.3181e+01	2.8860e-03	9.9769e-01
Tau1_1	vecTau1	1	1	-2.587572	5.5897e+00	-4.6292e-01	6.4342e-01
Tau1_2	vecTau1	2	1	-2.374968	6.7373e+00	-3.5251e-01	7.2446e-01
Tau1_3	vecTau1	3	1	-2.716535	7.5253e+00	-3.6098e-01	7.1811e-01
Tau1_4	vecTau1	4	1	-2.230504	6.5217e+00	-3.4201e-01	7.3234e-01
Tau1_5	vecTau1	5	1	-36.90172	NA	NA	NA
Tau1_6	vecTau1	6	1	-1.397395	3.3494e+00	-4.1721e-01	6.7653e-01
Tau1_7	vecTau1	7	1	-3.855972	3.4435e+00	-1.119e+00	2.6281e-01
Tau1_8	vecTau1	8	1	-0.553641	1.9767e+00	-2.8008e-01	7.7942e-01
Tau1_9	vecTau1	9	1	-0.553641	1.1797e-04	-2.709e+05	0.0000e+00
Tau1_10	vecTau1	10	1	-1.918462	3.2903e+00	-5.8307e-01	5.5985e-01
Tau1_11	vecTau1	11	1	-1.673602	3.3866e+00	-4.9419e-01	6.2117e-01
Tau1_12	vecTau1	12	1	-31.08790	1.2126e-04	-2.564e+05	0.0000e+00
Tau1_13	vecTau1	13	1	-4.576410	1.1351e+00	-4.032e+00	5.5370e-05
Tau1_14	vecTau1	14	1	-0.965927	1.4033e+00	-6.8833e-01	4.9125e-01
Tau1_15	vecTau1	15	1	-2.995732	NA	NA	NA

Residual variance

PD	Know	Pract	Bel	Satis	Stud
0.2401	0.1287	0.6543	0.9605	0.1534	0.9693

Between Studies Variances Of Correlation Coefficients

Know ~ PD	Pract ~ PD	Bel ~ PD	Stud ~ PD	Satis ~ PD
0.075	0.093	0.066	0.000	0.107
Pract ~ Know	Bel ~ Know	Stud ~ Know	Satis ~ Know	Bel ~ Pract
0.247	0.021	0.000	0.575	0.147
Stud ~ Pract	Satis ~ Pract	Stud ~ Bel	Satis ~ Bel	Satis ~ Stud
0.000	0.188	0.381	0.010	0.050

Change Model

Number of studies (upper triangle) and total sample size (lower triangle) per correlation coefficient

	PD	Know	Skill	Pract	Bel	Stud
PD	x	20	35	28	39	23
Know	7 462	x	10	6	11	2
Skill	11 610	2 385	x	4	14	1
Pract	8 445	912	696	x	6	6
Bel	8 375	2 262	2 645	2 424	x	2
Stud	14 471	262	363	3 947	262	x

Model Statistics

Chi2(7) = 29.36456 p = 0.0002736098

CFI: 0.8628087

TLI: 0.7427662

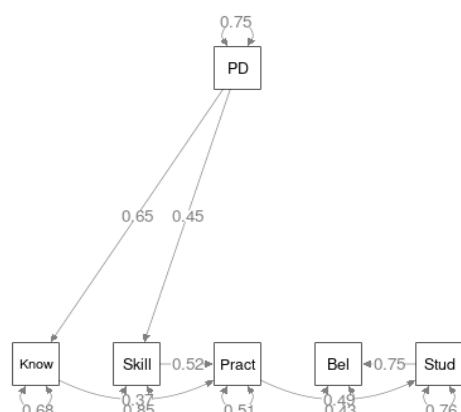
RMSEA: 0.01096104 [95% CI (0.006013213, 0.01612698)]

SRMR = 0.225

	df Penalty	Parameters Penalty	Sample-Size Adjusted
AIC	-332.6331	81.36687	81.41244
BIC	-1814.3181	257.56724	187.65204

	Parameters	Degrees of Freedom	Fit (-2lnL units)
Model	22	185	37.36687
Saturated	30	177	8.00231
Independence	15	192	178.73048

Number of observations/statistics: 117 282/857



Summary of one stage MASEM for implicit model:

name	matrix	row	col	Estimate	Std.Error	z value	Pr(> z)
KnowONPD	A0	Know	PD	0.652516	0.162919	4.00514	6.19791e-05
SkillONPD	A0	Skill	PD	0.450223	0.115641	3.89327	9.89025e-05
BelONPD	A0	Bel	PD	0.371409	0.114432	3.24568	1.17172e-03
PractONKnow	A0	Pract	Know	0.520039	0.148367	3.50507	4.56483e-04
PractONSkill	A0	Pract	Skill	0.493019	0.153886	3.20380	1.35626e-03
StudONPract	A0	Stud	Pract	0.752493	0.269599	2.79116	5.25199e-03
PDWITHPD	S0	PD	PD	0.749613	0.202784	3.69662	2.18492e-04
Tau1_1	vecTau1	1	1	-2.63446	0.367259	-7.1733	7.32081e-13
Tau1_2	vecTau1	2	1	-3.25484	0.287272	-11.330	0.00000e+00
Tau1_3	vecTau1	3	1	-2.56609	0.300800	-8.5309	0.00000e+00
Tau1_4	vecTau1	4	1	-2.87895	0.284032	-10.136	0.00000e+00
Tau1_5	vecTau1	5	1	-2.54382	0.343162	-7.4129	1.23679e-13
Tau1_6	vecTau1	6	1	-3.98962	0.725252	-5.5010	3.77612e-08
Tau1_7	vecTau1	7	1	-1.60702	0.634590	-2.5324	1.13291e-02
Tau1_8	vecTau1	8	1	-4.05181	0.660781	-6.1319	8.68647e-10
Tau1_9	vecTau1	9	1	-3.40623	1.2298601	-2.7696	5.61234e-03

Tau1_10	vecTau1	10	1	-3.14975	1.154028	-2.7293	6.34596e-03
Tau1_11	vecTau1	11	1	-3.33452	0.473952	-7.0356	1.98441e-12
Tau1_12	vecTau1	12	1	-2.68789	1.720879	-1.5619	1.18305e-01
Tau1_13	vecTau1	13	1	-1.31242	0.624623	-2.1011	3.56280e-02
Tau1_14	vecTau1	14	1	-1.80353	0.787547	-2.2901	2.20181e-02
Tau1_15	vecTau1	15	1	-0.89028	1.314866	-0.67701	4.98352e-01

Residual variance

PD	Know	Skill	Pract	Bel	Stud
0.7496	0.6808	0.8481	0.5065	0.4338	0.7569

Between Studies Variances Of Correlation Coefficients

Know ~ PD	Skill ~ PD	Pract ~ PD	Bel ~ PD	Stud ~ PD
0.072	0.039	0.077	0.056	0.079
Skill ~ Know	Pract ~ Know	Bel ~ Know	Stud ~ Know	Pract ~ Skill
0.019	0.200	0.017	0.033	0.043
Bel ~ Skill	Stud ~ Skill	Bel ~ Pract	Stud ~ Pract	Stud ~ Bel
0.036	0.068	0.269	0.165	0.411

Cognitive Change Model

Number of studies (upper triangle) and total sample size (lower triangle) per correlation coefficient

	PD	Know	Skill	Pract	Bel	Will	Stud
PD	x	20	35	28	39	23	12
Know	7 462	x	10	6	11	2	4
Skill	11 610	2 385	x	4	14	1	7
Pract	8 445	912	696	x	6	6	4
Bel	8 375	2 262	2 645	2 424	x	2	6
Will	14 471	262	363	3 947	262	x	2
Stud	2 216	425	1 772	2 279	1 180	264	x

Model Statistics

Chi2(7) = 21.22641, p = 0.01168219

CFI: 0.9327584

TLI: 0.843103

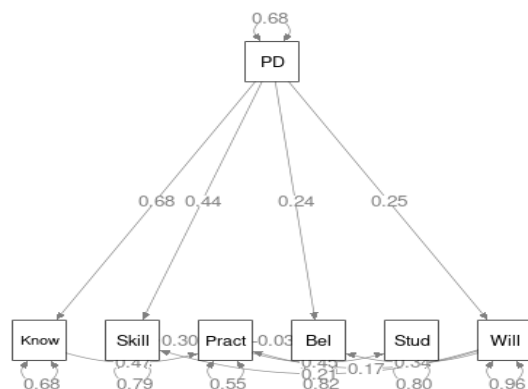
RMSEA: 0.007817683 [95% CI (0.00232826, 0.01294301)]

SRMR = 0.106

	df Penalty	Parameters Penalty	Sample-Size Adjusted
AIC	-409.2118	74.78815	74.88926
BIC	-2083.1154	339.08872	234.21591

	Parameters	Degrees of Freedom	Fit (-2lnL units)
Model	33	209	8.788152
Saturated	43	200	-12.438260
Independence	21	221	190.389930

Number of observations/statistics: 22 228 / 242



Summary of one stage MASEM for implicit model:

name	matrix	row	col	Estimate	Std.Error	z value	Pr(> z)
KnowONPD	A0	Know	PD	0.683631	0.134746	5.07348	3.90612e-07
SkillONPD	A0	Skill	PD	0.440003	0.111994	3.92880	8.53693e-05
BelONPD	A0	Bel	PD	0.236409	0.079654	2.96795	2.99796e-03
WillONPD	A0	Will	PD	0.246119	0.113971	2.15949	3.08123e-02
PractONKnow	A0	Pract	Know	0.47179	0.152860	3.08639	2.02598e-03
PractONSkill	A0	Pract	Skill	0.304366	0.112048	2.71637	6.60014e-03
StudONPract	A0	Stud	Pract	0.448936	0.129411	3.46909	5.22235e-04
PractONBel	A0	Pract	Bel	-0.03050	0.177032	-0.1723	8.63194e-01
SkillONWill	A0	Skill	Will	0.207806	0.091720	2.26565	2.34726e-02
PractONWill	A0	Pract	Will	0.173304	0.111447	1.55504	1.19938e-01
BelONWill	A0	Bel	Will	0.339386	0.073773	4.60039	4.21695e-06
PDWITHPD	S0	PD	PD	0.679482	0.157324	4.31900	1.56737e-05
Tau1_1	vecTau1	1	1	-2.65843	0.361148	-7.36101	1.82521e-13
Tau1_2	vecTau1	2	1	-3.27322	0.286144	-11.4391	0.00000e+00
Tau1_3	vecTau1	3	1	-2.55391	0.301574	-8.46861	0.00000e+00
Tau1_4	vecTau1	4	1	-3.00212	0.285644	-10.5100	0.00000e+00
Tau1_5	vecTau1	5	1	-2.48735	0.342643	-7.25931	3.89022e-13
Tau1_6	vecTau1	6	1	-3.05236	0.482345	-6.32818	2.48078e-10
Tau1_7	vecTau1	7	1	-4.02939	0.724306	-5.56309	2.65027e-08
Tau1_8	vecTau1	8	1	-1.47298	0.670275	-2.19757	2.79798e-02
Tau1_9	vecTau1	9	1	-4.29569	0.685293	-6.26841	3.64764e-10
Tau1_10	vecTau1	10	1	-3.45148	1.253304	-2.75391	5.88887e-03
Tau1_11	vecTau1	11	1	-3.35186	0.941315	-3.56083	3.69682e-04
Tau1_12	vecTau1	12	1	-4.51564	1.734165	-2.60393	9.21622e-03
Tau1_13	vecTau1	13	1	-3.26779	0.496498	-6.58167	4.65199e-11
Tau1_14	vecTau1	14	1	-3.59462	1.804545	-1.99198	4.63734e-02
Tau1_15	vecTau1	15	1	-3.15555	0.647779	-4.87134	1.10847e-06
Tau1_16	vecTau1	16	1	-1.81397	0.647779	-2.83521	4.57960e-03
Tau1_17	vecTau1	17	1	-1.93991	0.727326	-2.66719	7.64895e-03
Tau1_18	vecTau1	18	1	-3.96116	0.843191	-4.69782	2.62952e-06
Tau1_19	vecTau1	19	1	-4.91628	2.005137	-2.45184	1.42127e-02
Tau1_20	vecTau1	20	1	-3.78892	0.806744	-4.69656	2.64577e-06
Tau1_21	vecTau1	21	1	-33.0549	NA	NA	NA

Residual variance

PD	Know	Skill	Pract	Bel	Will	Stud
0.6795	0.6824	0.7947	0.5514	0.8200	0.7985	0.9588

Between Studies Variances Of Correlation Coefficients

Know~PD	Skill~PD	Pract~PD	Bel~PD	Will~PD	Stud~PD	Will~Pract
0.070	0.038	0.078	0.050	0.047	0.083	0.019
Skill~Know	Pract~Know	Bel~Know	Stud~Know	Will~Know	Pract~Skill	Will~Bel
0.018	0.229	0.014	0.032	0.035	0.011	0.023
Bel~Skill	Stud~Skill	Bel~Pract	Stud~Pract	Will~Skill	Stud~Bel	Will~Stud
0.038	0.027	0.163	0.144	0.043	0.007	0.000

Supplement I. Analyses Regarding Additional Moderators

Publication status as moderator for specific fields of the correlation matrix

correlation	F	p	published	unpublished
Training ~ Knowledge	0.4984	0.4823		
Training ~ Skills	0.5478	0.4603		
Training ~ Practice	0.0640	0.8008		
Training ~ Beliefs	3.5214	0.0623		
Training ~ Willingness	3.0010	0.0898		
Training ~ Satisfaction	0.0584	0.8126		
Training ~ Students	2.8164	0.0995		
Knowledge ~ Skills	0.0224	0.8818		
Knowledge ~ Practice	7.6381	0.0108	.07 [-.04; .19]	.40 [.12; .67]
Knowledge ~ Beliefs	0.1010	0.7522		
Knowledge ~ Willingness	4.2036	0.0628		
Knowledge ~ Satisfaction	0.2615	0.6443		
Knowledge ~ Students	0.2746	0.6279		
Skills ~ Practice	0.7049	0.4083		
Skills ~ Beliefs	0.0410	0.8401		
Skills ~ Willingness	0.0265	0.8721		
Skills ~ Satisfaction	0.0000	0.9951		
Skills ~ Students	0.8061	0.4200		
Practice ~ Beliefs	1.0296	0.3184		
Practice ~ Willingness	0.8792	0.3669		
Practice ~ Satisfaction	0.2534	0.6412		
Practice ~ Students	2.9229	0.1079		
Beliefs ~ Willingness	0.4276	0.5196		
Beliefs ~ Satisfaction	0.0912	0.7714		
Beliefs ~ Students	0.8826	0.3696		
Willingness ~ Satisfaction	0.0330	0.8674		
Willingness ~ Students	0.0026	0.9614		
Satisfaction ~ Students	0.0242	0.8908		

Study design

$F(4, 1038) = 5.9887, p < .0001$

Study design (number of studies)	Estimate [95% CI]
Correlative design (k = 105)	0.2388 [0.21; 0.27]
Posttest control group design (k = 22)	0.3282 [0.22; 0.44]
Control group design (k = 27)	0.3635 [0.28; 0.45]
Single group design (k = 80)	0.3525 [0.30; 0.41]
Restrospective (k = 10)	0.2621 [0.19; 0.33]

Cross-sectional	Intervention
0.242 [0.21; 0.27]	0.3475 [0.31; 0.39]

→ Intervention studies report larger effect sizes ($F(1, 1041) = 22.3642, p < .0001$) with no difference of study design among intervention studies ($F(2, 510) = 0.4098, p = 0.6640$)

School type $F(9, 1033) = 1.1322, p = 0.3366$

Publication year $F(1, 1041) = 0.0163, p = 0.8983$

Sampling strategy $F(1, 1041) = 3.3862, p = 0.0660$

Continent $F(9, 1033) = 1.6111, p = 0.1073$

Professional background of participating adults

Percent of **general educators** among adult participants non-influential

$F(df1 = 1, df2 = 1041) = 0.2370, p\text{-val} = 0.6265$

Percent of **special educators** among adult participants non-influential

$F(df1 = 1, df2 = 1041) = 0.0556, p\text{-val} = 0.8137$

Percent of **pre-service teachers** among adult participants non-influential
 $F(df1 = 1, df2 = 1041) = 0.5948, p\text{-val} = 0.4408$
 Percent of **administrators** among adult participants non-influential
 $F(df1 = 1, df2 = 1041) = 0.2862, p\text{-val} = 0.5928$
 Percent of **teaching assistants** among adult participants with significant influence
 $F(df1 = 1, df2 = 1041) = 7.0451, p\text{-val} = 0.0081$; Intercept = .2886, beta = .2229

Only teachers	With teaching assistants
0.2904 [.26; .32]	0.3912 [.21; .57]

Percentage of **students with diversity** feature of interest among students
 $F(df1 = 1, df2 = 269) = 0.3000, p\text{-val} = 0.5844$
 Percentage of teachers **currently teaching an inclusive classroom**
 $F(df1 = 20, df2 = 1022) = 1.0817, p\text{-val} = 0.3628$
 Percentage of teachers with **inclusive teaching experience**
 $F(df1 = 56, df2 = 986) = 0.8012, p\text{-val} = 0.8520$

Supplement J. References of Included Studies

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