

Insights on inclusive education in preservice teachers' education: A systematic literature review on true experimental research.

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Abstract

In The Salamanca Statement (1994) and the intended implementation of the Sustainable development Goals (2015), governments worldwide express their intention to implement inclusive education (Ainscow, 2020; Kuroda & Nakasato, 2022; UNESCO, 1994). Teacher educating programs play an important role in preparing preservice teachers to realize inclusive education. However, it is still not entirely clear what the characteristics are of effective preservice teacher education programs focused on inclusive education. Although a great amount interventional research has been conducted, and several interventions are described, there is a lack of insights on research of true experiments (Dignath et al., 2022; Lautenbach & Heyder, 2019). The aim of this systematic review is firstly to provide an overview of interventions in experimental and quasi-experimental research, including an experimental and control group or comparison group preservice teachers. Secondly to describe recommendations for preservice teacher programs to prepare preservice teachers. To the author's best knowledge, no systematic review has been published on research of true experiments concerning the effectiveness of the preservice teachers' educational programs. A systematic review was conducted. Eventually, 11 studies were meeting the inclusion criteria of the literature search. The studies were divided into three main themes 'Practical experiences or fieldwork', 'New teacher education program' and 'Subjective norm'. Implications for preservice teacher education are described. Based on this research, for example it is suggested that teacher education institutes should consider that preservice teachers' development and reflection concerning inclusive education in theory and practice in inclusive education should be a part of all education programs (Sharma et al., 2023). More true experiments in preservice teacher training in inclusive education could be carried out, to better prepare preservice teachers to realize inclusive education. Applicable international agreements on a balance of theory and practice in the curriculum of teacher education institutes are needed.

Keywords: Inclusive education; Preservice teachers' education programs; Interventions; True experiments; SDG 4 Quality education.

Points of Interest

- Governments aim to provide inclusive education worldwide, in line with the purpose of Sustainable Development Goal 4 to achieve Quality education in 2030.
- Preservice teacher education can be expected to provide effective programs on preparing preservice teachers to realize inclusive education. However, it is still not entirely clear what the characteristics of effective teacher education programs into inclusive education are. There seems to be a lack of insights on research with intervention and control groups of preservice teachers.

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- The aim of this systematic review is firstly, to provide an global overview of interventions into teacher education programs, to prepare preservice teachers to inclusive education, in research including an experimental and control group or comparison group preservice teachers. Secondly, recommendations for preservice teachers education.
- Three main themes are described: 1. Practical experience or fieldwork; 2. Developing new educational programs; 3. Subjective norm in preservice teacher programs.

1. Introduction

Since the Salamanca Statement in 1994, there has been an international consensus concerning future directions of special education. Arrangements were introduced to make attempts in developing and implementing inclusive education. The purpose of inclusive education is to enable educational environments to serve all students, also those with special educational needs, in mainstream schools (Ainscow, 2020; UNESCO, 1994). During the last decades, developments have emerged, focusing on implementation and practice of inclusive education, policy measures and internationally collaborative research (Ainscow et al., 2019; Hernandez et al., 2020). Besides, inclusive education has been more broadly defined in recent years as a principle, expecting to support the potential and the diversity of all students in mainstream education. According to Ainscow (2020), education provides the foundation of a more just society. Therefore, education should provide a prevention of social exclusion (Ainscow, 2020). This development is in line with the international agreement on the 17 Sustainable Development Goals (Kuroda & Nakasato, 2022). Sustainable Development Goal 4 - Quality education, reflects the global intended realization of inclusive education by 2030 (Hunt, 2019; Kuroda & Nakasato, 2022; Nketsia et al., 2020). The purpose of SDG 4 is to strengthen equality and to reduce disparities in education for all learners. SDG4 applies both access to education and the quality of education. Even though the goal is in progress, there are still obstacles formulated, for instance in teacher training, preservice teacher education programs and policy (Fairbrother et al., 2025; Onyishi & Sefotho, 2020; Sorooshian, 2024). Although, the principle of inclusive education is interpreted more broadly, international scientific studies show that the implementation of inclusive education with a focus on students with specific support needs, also still needs improvement. Currently, this is still a global theme (Hayes & Bulat, 2017; Kuroda & Nakasato, 2022; Nilholm, 2021). There is still a need to identify what advantages and obstacles are when implementing inclusive education (Nilholm 2021; Savolainen, 2022; Van Mieghem et al, 2021).

1.1. Does preservice teacher education prepare them for inclusive education?

Teacher education courses are expected to prepare teachers for inclusive education. However, initial preservice teacher education does not always sufficiently prepare them to realize inclusive education (Fairbrother et al., 2025; Onyishi & Sefotho, 2020; Tumkaya, 2020; Willcox, 2021). The last decades, various studies concerning in service teachers have shown, that a considerable number of teachers still seem to feel insufficiently competent (Lindner et al., 2023; Mukhopadhyay, 2014). In service teachers state that they are not equipped to promote inclusive education (Cochran-Smith, 2016; Ramos, 2022; Smeets et al.,

2019; Van Mieghem et al., 2020; Zagona et al., 2017). They indicate that they did not learn in teacher education how to realize it in practice (Chow et al., 2023; Chu et al., 2020; Clausen et al., 2023).

To make inclusive education successful, preservice teachers could be expected to develop new beliefs as well as new behavior and specific skills (Tangen & Beutel, 2017). Having regard to the experienced training of several in service teachers, an improvement of programs for preservice teachers is required (Florian, 2021; Metsala et al., 2020; Weber et al., 2019). In line with Florian and Cammeda (2020), Cretu and Morandau (2020) state the importance of preservice teachers as professionals in playing an important role in realizing inclusive education (Cretu and Morandau, 2020). Although teacher education should make a difference in preparing them to provide inclusive education, there is a lack of insights in educational programs of teachers that yield sufficient results (Lautenbach & Heyder, 2019; Tristani & Bassett-Gunter, 2020; Watkins & Donnelly, 2014). The programs should equip preservice teachers with content knowledge, skills and inclusive values to be able to realize inclusive education (Florian, 2021).

Dignath et al. (2022), state that teacher educators are role models to preservice teachers in realizing inclusive education. Their attitude towards students with specific support needs can influence the attitude of preservice teachers. At the same time, teacher educators could provide insights in the possibilities for preservice teachers in realizing successful teaching in educational environments (Dignath et al., 2022; Emmers et al., 2020). A related suggestion is to develop teacher education which involves exchanges between preservice teachers, following the initial teacher education, and preservice teachers following a special education training (Dignath et al., 2022).

1.2. Reviews and experimental design

Three reviews published in 2019- 2022, provide an overview of preservice teachers' education, interventions and inclusive education (Dignath et al., 2022; Lautenbach & Heyder, 2019; Tristani & Bassett-Gunter, 2020).

According to Tristani and Bassett-Gunter (2020), adequate preservice teacher training is essential for creating an inclusive environment. They provided a review of 27 North American and Australian studies, to identify interventions as best practices on preservice teacher education and teacher training or professional developments into inclusive education for students with disabilities (SWD). Overall, results of the interventions indicate positive changes in attitude, knowledge and skills. The research does not provide a clear answer to the question of what the effective characteristics of the interventions are. Nevertheless, a workshop method is recommended as an effective method (Tristani & Bassett-Gunter, 2020).

Lautenbach and Heyder (2019) also conducted research on interventions in teacher education programs. They provided a review of 23 interventional studies into educational programs concerning inclusive education of preservice teachers in Physical Education (PE). The purpose was to focus on interventions of programs effecting a more positive attitude change towards inclusive education. According to Lautenbach and Heyder (2019), a cognitive information-based intervention and practical experience combined with theory about students with specific support needs, could have positive effects on the attitude of preservice teachers PE.

In addition, Dignath et al. (2022), conducted a meta-analysis of 102 studies. This study also investigated effective interventions. The focus is on the variation in teachers' and preservice teachers' beliefs regarding inclusive education. Dignath et al. (2022), discuss the variation in teachers' beliefs and preservice teachers' beliefs into inclusive education. The study examined factors contributing to differences in teachers' belief systems, for example cognitive appraisal and self-efficacy beliefs about inclusive education, concerning

students with specific support needs. The examined factors are: the moment of developing as a teacher, a comparison between preservice teachers and in service teachers, the training in special education and mainstream schools, and finally, the effectiveness of additional educational programs and interventions. According to Dignath et al. (2022), preservice teachers show a higher score on self-efficacy compared to in service teachers. A possible explanation mentioned is that there could be an unrealistic confidence in their own competences. Furthermore, teachers in special education showed a more positive belief in inclusive education than teachers in mainstream schools. An important effective component of an educational program, mentioned in the meta-analysis, is becoming familiar with the inclusive work environment by experiencing the practice of inclusive classrooms. For example, by observing teachers effectively solving complex situations (Dignath et al., 2022).

The reviews all provide an overview of several important insights about educational programs and the effect of interventions. Despite that, the reviews do not provide studies including an experimental and a control group with a sample of preservice teachers in the period between 2013 and 2023. Dignath et al. (2022) and Lautenbach and Heyder (2019) mention a lack of articles with intervention groups and control groups in the interventional studies. This lack of studies is a limitation of the reviews due to the inability to establish causal conditions (Dignath et al., 2022; Lautenbach & Heyder, 2019). Lautenbach & Heyder (2019), state the lack of studies with a control group also, as an important methodological limitation of the review. In their review only one study included a control group (Gursel, 2007; Lautenbach & Heyder, 2019).

A true experimental design describes the measurement of an intervention and includes a control group to compare the respondents, a random assignment of the respondents and an independent variable influencing the other variables (Gribbons & Herman, 2019; Mazurek, 2012). The advantage of the implementation of a control group in the interventional studies could provide insights into causal relationships regarding the effects of the interventions into preservice teachers' developments concerning inclusive education. According to Unluol Unal et al. (2022) the lack of an experimental and control group is a threat to internal validity of a study. Additionally, Laron Scott et al. (2022), who conducted an experimental study concerning preservice teachers competencies, stated their study was not a true experiment, because of the lack of a control group to compare the participants. Besides, Williams (2007) confirms that conducting true experimental designs establish a causal relationship within a study.

1.3 The current study

As mentioned, implementing inclusive education is a global topic and has not yet been realized (Ainscow et al., 2019; Hernandez et al., 2020). Still, the implementation of inclusive education and teacher education programs into inclusive education needs improvement (Hayes and Bulat, 2017; Nilhom, 2021). Although there is a great amount of interventional research, there still is a lack of insights into true experimental research on interventions in preservice teacher education. An overview of true experimental research can provide new insights to better equip preservice teachers to realize inclusive education. As far as we can tell, no overview of true experimental research on this topic has been conducted.

The current study aims to bridge this gap by providing insights of true experimental and quasi experimental studies with intervention groups and control groups or comparison groups. To achieve this, a systematic review is conducted. The purpose of this systematic review is to examine international experimental and quasi experimental research on preservice teacher education into inclusive education. There are two primary aims: 1. To provide an overview of interventions into teacher education programs in experimental and quasi-experimental research, including an experimental and control group or comparison group preservice

teachers, to prepare preservice teachers into inclusive education 2. To describe suggestions for implementation of the findings in preservice teacher programs.

The research questions of the study are:

- What insights can be gained from interventional or experimental and quasi experimental studies, including an experimental group and a control group or a comparison group of preservice teachers, for teacher education programs that prepare them to realize inclusive education?
- What implications can be formulated for teacher education programs to prepare preservice teachers to realize inclusive education?

2. Methods

2.1 Systematic search

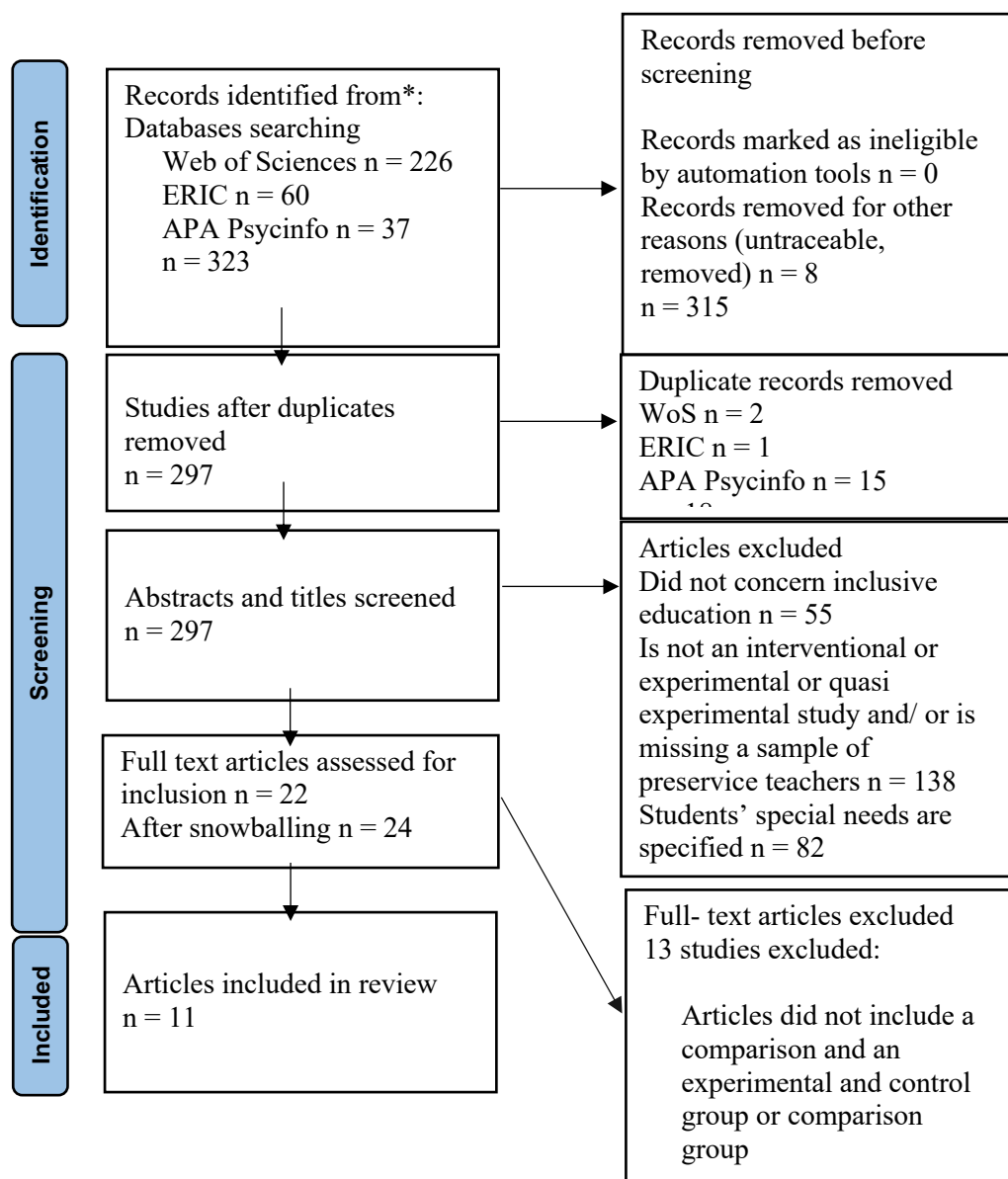
To answer the research questions, a systematic search was carried out in 2024. The aim was to provide an international methodological and comprehensive search of articles. The PRISMA guidelines were followed to select studies with a focus on three major topics: Interventional or experimental and quasi experimental research, Preservice teachers, Inclusive education (figure 1) (Moher, 2020). The following electronic databases ESCBO were used: Education Resources Information Center (ERIC), Web of Science (WoS) and APA PsycInfo.

First, the title and abstract of the studies were screened. Inserted descriptors to search titles and abstracts were: 'Intervention' OR 'Experiment' combined with 'Pre-service teacher' OR 'Preservice teacher' OR 'Student teacher' combined with 'Teacher training' OR 'Teacher education' combined with 'Inclusive education' OR 'Inclusive classrooms' OR 'Inclusion in education'. The search was limited to 'Peer reviewed journals' published in the period 2013- 2023. In the initial search 323 studies were yielded. After screening duplicate studies, 297 studies remained.

2.1.1. Inclusion criteria

Studies were included if the study met three inclusion criteria: 1. The study concerned interventional or experimental or quasi experimental research on student teachers or preservice teachers in primary or secondary education, 2. The study concerned inclusive education or inclusion or inclusive classrooms, 3. The intervention or experiment or quasi experiment included a comparison with an experimental and control group. Studies were excluded for multiple reasons: 1. The study did not concern inclusive education in the educational field, 2. The study did not concern interventional or experimental or quasi experimental research with a sample of student teachers or preservice teachers, 3. Students' special needs were specified, 4. Other reasons. Finally, 11 studies were selected. Figure 1 provides an overview of the selection process.

Figure 1. Flow diagram of the process of the review on preservice teacher education and inclusive education (based on Page et al., PRISMA 2020).



3. Results

The 11 included studies have been examined critically. Subsequently research question, intervention, independent variables, dependent variables and results were highlighted. Finally, three main themes were identified through descriptive analysis of characteristics in the studies. Findings from the study are summarized in Table 1.

Table 1. *Overview of selected studies of the review*

Author	Country	Intervention	Independent variables	Sample preservice teachers	Implication for practice
Alhumaid et al. (2021)	Saudi Arabia	Additional 6 weeks APA program working with students with disabilities in inclusive environments and para athletes	APA program PE and experience with students with disabilities	EG: 35 CG: 35	Facilitation of better interaction between preservice teachers and students with disabilities and para-athletes. Conditions of a successful training are mentioned.
Demchenko et al. (2021)	Ukraine	Development of a new additional educational program to prepare preservice teachers to work in inclusive education	Additional program PE	EG: 222 CG: 222	The new program and professional activities are effective to the development of preservice teachers' readiness to work in inclusive education
Emmers et al. (2021)	Belgium	Respondents followed an online guest lecture with a positive or a negative condition towards students with disabilities	Guest lectures	EG: 14 CG: 18	Institutes should pay attention to inclusive program and inclusive condition and the subjective norm of teacher educators towards inclusive education
Grimminger and Seida (2022)	Spain	APA Program inclusive education combining theory, practical experience with peer preservice teachers	APA program PE inclusive education	EG: 49 CG: 17	APA program including theory, practice and peers improves the positive attitude of preservice teachers into inclusive education. Practical experiences should be theoretically reflected
Hopkins et al. (2023)	Australia and Canada	Intervention group followed Keep on learning program Kol, fieldwork with students with disabilities	Fieldwork program	EG: 18 CG: 21	Kol has a positive effect on the decrease in discomfort in interacting with student with disabilities. Kol tutors were less motivated to support the vision of inclusive education.

Järvis et al. (2022)	Estonia and Ukraine	Comparison of psychological readiness between an experimental group majored Special education and control group majoring Educational Pedagogical Science	Program Special education	EG: 41 CG: 49	Additional theory concerning inclusive education improves respondents psychological readiness in working in inclusive education
Jiménez et al. (2023)	Spain	Intervention group followed extra program Fieldwork, 28 lessons of two hours about theory, methods of adapted physical activities, inclusion in physical education and parasports	Extra educational program PE	EG: 109 CG: 49	Self-efficacy of intervention group improves after following the fieldwork program including theory, adapted physical activities, inclusion in physical education and parasports
Merrtoglu (2020)	Turkey	Intervention group followed extra program Science laboratory education and differentiated teaching	Program differentiation in Science laboratory education	EG: 50 CG: 53	Preservice teachers should follow the extra program Differentiation contributing to their perception on realizing inclusive education
Ovcharenko et al. (2021)	Ukraine	Experimental group preservice teachers Music Arts followed an additional training including creative projects and tests with students.	Additional program Music Arts	EG: 16 CG: 15	Readiness of preservice teachers into inclusive Music Arts education can be improved by using the additional program
Sharma et al. (2023)	Australia	Experimental group was taught and mentored by school teachers and academic lecturers. Control group was taught and mentored by academic lecturers	New program designed by school teachers and academic lecturers	EG: 26 CG: 41	Co- teaching and co-creating a program between school teachers and academic lecturers contribute in bridging the gap between theory and practice and improve preservice teachers attitude towards inclusive education
Sobchenko et al. (2021)	Ukraine	Experimental group followed a new educational course to contribute to validation of the program. Control group followed the traditional program.		EG: 152 CG: 54	A program on theory, practical experience, new pedagogical insights, knowledge of special and mainstream education contributes to the development of preservice teachers. In addition, it appears that most of the respondents remain hesitant towards students with specific support needs in regular settings.

3.1 Design, sample and respondents

Seven studies were identified as an experiment (Hopkins et al., 2023) or experimental research (Alhumaid et al., 2021; Demchenko et al., 2021; Emmers et al., 2021; Jarvis et al., 2022; Ovcharenko et al., 2021; Sobchenko et al., 2021). Four of the studies were identified as a quasi-experimental intervention (Grimminger-Seidensticker & Seyda, 2022; Jiménez et al., 2023; Mertoglu, 2020; Sharma et al., 2023). Respondents of all 11 studies are preservice teachers. Ten of the studies contain an experimental and control group. One of the studies contains two groups which are compared, named as group 1 and group 2 (Emmers et al., 2021). The number of respondents varied from 444 preservice teachers in an intervention group ($n = 222$) combined with a control group ($n = 222$) (Demchenko et al., 2021) to 34 preservice teachers in an intervention group ($n = 16$) and control group ($n = 18$) (Emmers et al., 2020).

3.2 Main themes

Three main themes were identified from the 11 selected studies: 1. Practical experience or fieldwork in inclusive education settings, 2. New educational programs about inclusive education, 3 Subjective norm in preservice teacher programs concerning inclusive education.

3.2.1 Practical experience or fieldwork in inclusive educational settings

The first main theme concerns preservice teacher practical experiences or fieldwork in inclusive educational settings. Four of the included studies describe practical experience or fieldwork (Alhumaid et al., 2021; Grimminger-Seidensticker & Seyda 2022; Hopkins et al., 2023; Jiménez et al., 2023).

The first study, carried out by Alhumaid et al. (2021), conducted an experimental group of 35 preservice teachers that were following a 6 weeks Adapted Physical Activity (APA) intervention program. The focus of this new program, which contained 18 hours face to face instruction, was including students with physical disabilities in regular PE education. A control group of 35 preservice teachers did not follow this APA intervention program. The independent variables were preservice teachers' experience in working with students with disabilities and following an APA intervention program. Dependent variable was self-efficacy. Alhumaid et al. (2021) concluded that compared to the control group, the self-efficacy of the experimental group improved significantly in teaching students with disabilities in inclusive environments. Alhumaid et al. (2021) recommend the implementation of an 18-hour APA intervention during 6 weeks in preservice teacher education (Alhumaid et al., 2021).

The second study, done by Grimminger and Seyda (2022), initiated a quasi- experimental intervention in preservice teachers' training PE. Different learning situations and methods had been explored to improve competencies of preservice teachers to inclusive education. A first experimental group of 49 preservice teachers received a lecture on inclusive education with an information-based focus. The second experimental group of 17 preservice teachers followed a course on inclusive education with information-based theory combined with practical lessons. Those lessons were prepared and implemented by peer preservice teachers. The third group, a control group of 20 preservice teachers, did not receive any additional information about teaching inclusive education in PE nor any extra practical experience. The independent variable was an information-based course or an information-based course with practical lessons and peer preservice teachers or regular program. Dependent variables were attitudes, focusing on stress participation and self-efficacy. Grimminger and Seyda (2022) report significant results for subscales

concerning attitudes into inclusive education. They did not identify significant results for stress perception or self-efficacy. An approach of combining theory and practical experiences with peer preservice PE teachers, has more impact on the development of positive attitudes toward inclusion than only theory in courses. In addition, Grimminger and Seyda (2022) state that practical experiences should be theoretically reflected afterwards (Grimminger-Seidensticker & Seyda, 2022). The third study, carried out by Jiménez et al. (2023), also focused on preservice PE teachers. Jiménez et al. (2023) conducted a quasi-experimental design with a topic of working methods in inclusive education in PE to strengthen communication in inclusive settings (Jiménez, 2023). An intervention group of 109 preservice teachers Sports Sciences attended an extra program of 28 two- hours' lessons in three blocks for four months. The lessons of this program focused on inclusion of students with disabilities. Preservice teachers learned theory on methods of modified physical activity, inclusion in gymnastics, and parasports for their target group. The program contained simulation of various disabilities, adapted physical activity and disability awareness. The control group of 49 preservice teachers followed the usual program. In this study the independent variable was the extra educational program and the dependent variable was self-efficacy (Jiménez et al., 2023). According to Jiménez et al. (2023), the self-efficacy of the intervention group improved. Important components of the program indicated by Jiménez et al. (2023) are theory about inclusion, simulation by the preservice teachers themselves and different ways of dealing with students with disabilities.

Finally, the fourth study of this theme, carried out by Hopkins et al. (2023), conducted a research concerning a comparison between an experimental group participating in fieldwork interacting with students with intellectual disabilities and a control group. The first group of 18 preservice teachers was educated as tutor in the Keep on Learning Program (KoL). The control group of 21 preservice teachers did not participate in the KoL-program. In the experiment the independent variable was the field work program. The dependent variable was the impact of the KoL program concerning preservice teachers' attitude towards students with intellectual disabilities. According to Hopkins et al. (2023), additional fieldwork experiences in a KoL, can first lead to a better understanding of working in an inclusive environment. but not all participating preservice teachers gained more motivation to implement inclusive teaching for students with disabilities. Although the preservice teachers did have a positive attitude towards students with disabilities, participation of preservice teachers in the KoL project seemed to have led to a decrease in discomfort when interacting with students with disabilities. Lastly, it was concluded that preservice teachers, participating in KoL, were less motivated to support inclusive education after the experiment (Hopkins et al, 2021).

3.2.2 New educational programs about inclusive education

The second theme, The development of new educational programs about inclusive education, focuses on totally new educational programs or changes in existing preservice teacher education programs, for example in the curriculum. Six included studies discuss the development of new or additional programs into inclusive education (Demchenko et al., 2021; Mertoglu, 2020; Ovcharenko et al., 2021; Sharma et al., 2023; Sobchenko et al., 2021).

The first study in the second theme, was conducted by Sharma et al. (2023). They point out the results of a quasi-experimental design to give insights in the effects of an inclusive educational program, designed by academic lecturers and school educators. The study contained a comparison between two groups of preservice teachers. An experimental group of 26 preservice teachers was educated by university lecturers and schoolteachers using a co-creation and co-teaching program. A control group of 41 preservice teachers was educated by university lecturers. The characteristics of the program of the experimental group were

co-teaching in teams of university teachers and school teachers and internship guided by the school teachers, theory on inclusion and understanding of students' needs, support of the team during the internship and assessing readiness to work in inclusive education during the internship. The independent variables were the co-creation and co-teaching program. The dependent variable was attitudes of preservice teachers to teach in inclusive classrooms. According to Sharma et al. (2023), the attitudes of the intervention group improved significantly and did not change significantly in the control group.

The second study was carried out by Sobchenko's et al. (2021). The experimental study was a contribution to the development of a new valid program teacher education concerning inclusive education of students with specific support needs. An experimental group of 152 preservice teachers followed a new educational course with a varied content. The focus of the new educational course is on theory to work with students with specific support needs and practical experience and new pedagogical insights and, knowledge of special and mainstream education. A control group of 54 preservice teachers followed the traditional educational program. In the study the independent variable was the new program. The dependent variable consisted of a positive attitude towards developing skills to realize inclusive education, realizing the impact of inclusive education on the social inclusion of the students (Sobchenko et al., 2021). According to Sobchenko et al. (2021), results indicate the effect was improvement of development of respondents in the experimental group. Furthermore, the results indicate 60% of the respondents in the experimental group even after the experiment, and 67% of the control group respondents, were hesitant about placing students with specific support needs in inclusive educational settings.

The third study was conducted by Jarvis et al. (2022). They compared two preservice teachers' educational programs about inclusive education. An experimental group included 41 preservice teachers majoring in Special Education. The control group included 49 preservice teachers majoring in Educational Pedagogical Science. The independent variable of this study was the program Special Education and the dependent variable was psychological pedagogical readiness to work in inclusive education (Jarvis et al., 2022). They state that educational programs with additional theory concerning inclusive education have a positive effect on preservice teachers' value psychological readiness to work in inclusive education. Without the preparation preservice teachers are not motivationally ready and respondents did not seem to develop value orientations to work in inclusive settings (Jarvis et al., 2022). One of the reasons mentioned is the personal experience with students, gained in pedagogical practice. Jarvis et al. (2022) state that educational programs with additional theory concerning inclusive education have a positive effect on preservice teachers' value psychological readiness to work in inclusive education. Without the preparation preservice teachers are not motivationally ready and respondents did not seem to develop value orientations to work in inclusive settings (Jarvis et al., 2022).

The fourth study was carried out by Demchenko et al. (2021). They conducted a research, to develop and verify a new educational program to prepare preservice teachers PE for inclusive education. This new program is extensive and contains professional pedagogical activities. In addition, pedagogical characteristics of the program have been identified and justified. An experimental group of 222 preservice teachers followed the additional program, focusing on "Motivation and values, Theory and practice, Simulation and reflection" (Demchenko et al., 2021). A control group of 222 preservice teachers did not follow the additional program. The effects of the new developed educational program that were measured, concerned psychological, theoretical and practical readiness to act in inclusive education were measured. The independent variable of the experiment was the new program. According to Demchenko (2021), findings are that the new program and the training of the professional pedagogical activities were effective to the development of readiness of preservice teachers PE.

The fifth study was a quasi-experimental study with preservice science teachers (Mertoglu, 2020). The experimental group of 50 preservice teachers followed an educational program science laboratory lessons and differentiated teaching for one term. The lecturer showed methods of differentiation by introducing information about students with special needs and give preservice teachers the possibility to differentiate in practice with simulation. Those simulations were not taken into account and the experiences of the preservice teachers were discussed afterwards. The control group of 53 preservice teachers did not follow that program. Aim of the study was to conduct insights on preservice teachers' views on science education in an inclusive education environment with students with different support needs. The independent variable in this study was the program science laboratory with differentiated teaching and the dependent variable was the development of preservice teachers' views in terms of their perception on attitudes towards science laboratory education and differentiated education to realize inclusive education. Mertoglu (2020) states that the additional program improved preservice teachers opinions about inclusion and students with special needs (Mertoglu, 2020).

The sixth study in this theme was carried out by Ovcharenko et al. (2021). They published a study concerning a pedagogical experiment to give an overview of a preservice teachers Music art education program to improve their readiness into inclusive education. An experimental group of 16 preservice teachers Music art was selected to follow an additional educational program part of 'Fundamentals of Inclusive Musical Education'. The focus of the program was on educational activities into inclusive education in music arts for secondary school, such as execute creative projects, use instruments in 'group music playing', tests with students and providing an open safe and friendly working environment in the class. The control group of 15 preservice teachers did not follow the additional training. In this study the independent variable was the additional program and the dependent variable was readiness of preservice teachers music arts to inclusive education. Ovcharenko et al. (2021) concluded the additional program improved preservice teachers' readiness into inclusive music art education (Ovcharenko et al., 2021).

3.2.3 Subjective norm in preservice teacher programs concerning inclusive education

The third theme focuses on the subjective norm of teacher educators and the attitude of preservice teachers. Only one study of Emmers et.al (2020) discusses the subjective norm.

A subjective norm involves opinions with values and norms and can be established by one person, as a role model in a specific environment. In preservice teacher education a teacher educator is often seen as a role model. Teacher educators can therefore exert a lot of influence on the opinion and behavior of preservice teachers. The subjective norm in preservice teacher education, focuses on the subjective norm of teacher educators and preservice teachers' attitude towards students with disabilities. In the experimental study two conditions and measurement moments were included to investigate the influence of a subjective norm of guest lecturers to respondents' attitude toward students with disabilities. Group 1 followed a course of a guest lecturer, who adopted a positive attitude towards students with disabilities, group 2 followed a lecture influenced by the same guest lecturer, who adopted a negative attitude towards students with disabilities in terms of shared text. The independent variable was the text of the guest lecture manipulated with positive or negative variables. The dependent variable was respondents' attitudes toward students with disabilities. According to Emmers et al., (2020), respondents' attitudes changed in both groups. Results of group 1 show an improvement concerning attitudes towards students with disabilities. Results of group 2 show a decrease in attitudes towards students with disabilities (Emmers et al., 2020).

4. Discussion

The current study has focused on the trend of further implementation of globally inclusive education for students with specific support needs. A systematic literature review was conducted. Our first research question sought to examine what insights could be gained from interventional or experimental and quasi experimental studies, including an experimental group and a control group or a comparison group of preservice teachers, for teacher education programs to prepare preservice teachers to realize inclusive education. The second question sought to determine what implication can be formulated for preservice teachers' education programs to them to realize inclusive education.

In the systematic review 11 articles were found. Seven studies were identified as an experiment (Hopkins et al., 2023) or experimental research (Alhumaid et al., 2021; Demchenko et al., 2021; Emmers et al., 2021; Jarvis et al., 2022; Ovcharenko et al., 2021; Sobchenko et al., 2021). Four of the studies were identified as a quasi-experimental intervention (Grimminger-Seidensticker & Seyda, 2022; Jiménez et al., 2023; Mertoglu, 2020; Sharma et al., 2023). In five studies the self-efficacy of preservice teachers was measured (Alhumaid et al., 2021; Demchenko et al., 2021; Grimminger-Seidensticker & Seyda, 2022; Jiménez et al., 2023; Sharma et al., 2023). In four studies attitudes of preservice-teachers were measured (Alhumaid et al., 2021; Demchenko et al., 2021; Emmers et al., 2020; Grimminger-Seidensticker & Seyda, 2022).

5. Conclusions

5.1. Theme 1: Practical experience or fieldwork in inclusive settings

In theme 1, various interventions for preservice teachers are mentioned. Firstly, according to Grimminger-Seidensticker and Seyda (2022), Alhumaid et al., (2021) and Jiménez et al. (2023) both theory and practice are important characteristics of education programs. For instance, the combination of theory and practice could improve preservice teachers' development of positive attitudes towards inclusive education more than programs consisting of only theory. Besides, the focus on knowledge and attitudes about students with disabilities is important. In the practical context working in inclusive settings with students with specific support needs is mentioned, as well as simulation with peer preservice teachers. Both methods seem to be effective. Secondly, it is worth considering to implement these intervention programs widely in preservice teacher training programs. Furthermore, a similar study could be conducted at more different educational levels (Alhumaid et al., 2021). Alhumaid et al. (2021) conclude an effective program should at least consists of 6 hours over 18 weeks (Alhumaid et al., 2021). Finally, more reflection of preservice teachers at concrete practical experiences does seem necessary, for instance to improve their reflective attitude towards students with specific support needs (Hopkins et al., 2021).

5.2. Theme 2: New educational programs about inclusive education

Firstly, theme 2 also addresses the importance of theory and practice. For instance, Sharma et al. (2023) note an important connection between theory and practice through the collaboration between university teachers and schoolteachers. This collaboration has a positive influence on the relationship between the preservice teacher and the school teacher. Secondly, In line with Jarvis et al. (2022), Sobchenko et al. (2023) mention programs with attention to preservice teachers motivational attitude to inclusion. Authors also

mention the importance of characteristics as for instance knowledge, skills for working in inclusive settings, as well as creative activities, the importance of a personal reflective attitude and differentiation in the classroom (Demchenko et al., 2021; Sobchenko et al.; 2021; Ovcharenko et al., 2021; Mertoglu, 2020). Finally, although studies mention various fundamental characteristics of programs to prepare preservice teachers to realize inclusive education, the studies do not yet provide clarity regarding these characteristics. Therefore, there is a need for further research regarding these characteristics.

5.3. Theme 3: Subjective norm in preservice teacher programs concerning inclusive education

Theme 3 focuses on the relatively positive attitude of preservice teachers toward students with disabilities. This attitude plays an essential role for the successful implementation of inclusive education. Besides, the study mentions the importance of the influence of teacher educators' subjective norm and attitude toward students with disabilities. It is essential for teacher education institutes to be aware of this attitude and to address it (Emmers et al., 2020).

6. Implications

6.1. Theme 1: Practical experience or fieldwork in inclusive settings

A first recommendation for initial preservice teacher education programs, is to be aware of the influence of fieldwork in inclusive settings. Fieldwork has implications for a positive vision of inclusion, as preservice teachers experiencing the teaching of students with special needs could lead to a more positive attitude towards inclusive education (Alhumaid et al., 2021; Demchenko et al., 2021; Grimminger-Seidensticker & Seyda, 2022). Teacher education programs should contain more practical training that includes both students with specific support needs and preservice teachers. These programs would strengthen preservice teachers' confidence in including students with disabilities in regular classrooms. However, reflection is needed from preservice educators on fieldwork experiences, as too much preparation to realize inclusive education can also be counterproductive. Thus, programs should guarantee the balance between theory and fieldwork. It could be considered to evaluate practical experiences separately of the rest of the teacher education program (Hopkins et al., 2021).

Additionally, based on the results of various interventions, it can be recommended to explore collaboration with different programs and stakeholders. For example, teachers of mainstream and special education (Jarvis et al., 2022; Dignath et al., 2022).

Finally, teacher education programs should be challenging for preservice teachers. Besides preservice teachers need to be supported by an inclusive learning environment at their internships.

6.2. Theme 2: New educational programs about inclusive education

Another implication is to combine theory or course content with practice and working with students with special needs (Grimminger-Seidensticker & Seyda, 2022; Lautenbach & Heyder, 2019).

Additionally, a recommendation practice with collaboration between peer preservice tutors, for instance by the use of simulation. The specific support needs could be included in the preservice teacher programs, to better understand their students (Jarvis et al., 2022; Jiménez et al., 2023; Mertoglu, 2020). Another

implication is to implement differentiated instruction with an impact on preservice teachers' vision to implement inclusive teaching science (Mertoglu, 2020).

Additionally, attention to actual content of internships remains necessary. Teacher education institutes could implement more collaboration between school teachers and teacher training institutes to bridge the gap between theory and practice concerning the realization of inclusive education (Sharma et al., 2023). Additionally, the educational process of the programs needs to be well organized and teacher education institutes should take into account the problems preservice teachers encounter.

6.3. Theme 3: Subjective norm in preservice teacher programs concerning inclusive education

Teacher education institutes should pay attention to their communication with preservice teachers about their attitude toward students in inclusive education. The subjective norms of teacher educators and the influence of teacher educators on preservice teachers should be a central theme.

7. Limitations

Even though the current study offers valuable insights, there are some limitations that are important to take into account. First, the literature was limited to three databases. The use of more databases could have led to more results and could have strengthened the insights. Second, the current study focused on true experimental research. This focus limited the number of selected studies. As a result, the findings of the current study cannot be generalized. Furthermore, the aim of the study was to provide an overview of generic preservice teachers' education with regard to inclusive education. Therefore, studies with a focus on concrete specific support needs of students were excluded. Finally, this review did not focus on their personal perceptions and self-efficacy beliefs nor on their opinions about the education programs to prepare them for inclusive education settings.

8. Recommendations for future research

8.1. Theme 1: Practical experience or fieldwork in inclusive settings

According to Alhumaid et al. (2021) first, future research should take into account the different gender of the respondents of the study. Besides the use of randomized respondents groups, voluntary participation of the respondents and the focus of students with disabilities should be considered (Alhumaid et al., 2021). Future research could be established in another context, for instance into another national or international teacher training institute, to compare insights and provide new insights about the initial teacher training programs and the characteristics of inclusive education settings (Jiménez et al., 2023, Demchenko et al., 2021). Future research should consist items about operationalization of preservice teachers' behavior, attitudes and self-efficacy, besides include contextual variables (Grimminger-Seidensticker & Seyda). Future research should investigate the educational environment of preservice teachers in authentic settings with students with specific support needs.

8.2. Theme 2: New educational programs about inclusive education

Future research should investigate other collaborations to formulate other contents and methods. Besides the duration of the course and characteristics of the program, for instance teaching methods (Sharma et al., 2023). Future research could investigate different items of psychological readiness of preservice teachers (Jarvis). Future research should continue the conducted study about the good practice of the differentiated science practical lessons (Mertoglu, 2020).

8.3. Theme 3: Subjective norm in preservice teacher programs concerning inclusive education

According to Emmers et al., (2020), future research should be conducted with a larger sample of teacher educators and into other teacher training programs. There could be more focus on influence of teacher educators as role models and the influence of teacher educator. Besides, future research should examine the attitudes of teacher educators within different teacher education institutes.

The selected studies in this review focus on a broad understanding of inclusive education and students' supports needs. In future research, it is necessary to also include a more specified description of the support need. Since it is expected that more content knowledge and more specified descriptions of students' needs can improve the implementation of inclusive education.

Finally, in terms of directions for further research, future work could be carried out into true experiments in specific school subjects. As previously stated, PE programs concerning inclusive education, offer more impact on developing positive attitudes of preservice teachers towards inclusive education with a combination of theory and practical experiences with fellow preservice teachers, than only theoretically based programs. Given this insight, follow-up research could focus on whether this also applies to other school subjects.

Additionally, follow-up research could provide insights concerning fieldwork of preservice teachers in inclusive education and the recommendation of co-creating and co-teaching between preservice teacher education institutes and schools. A limitation of research concerning preservice teachers' programs is the lack of control groups in the interventional studies. Finally, preservice teachers are expected to develop new beliefs as well as new behavior and specific skills to make inclusive education a success. Therefore, future research should pay attention to the content of their education programs and the development of their beliefs, behavior and specific skills. Future research could investigate the development of their perceptions, for example their self-efficacy beliefs and their opinions on their own teacher education programs to prepare them for inclusive education settings.

In order to contribute to the body of knowledge about the effective preparation of preservice teachers to realize inclusive education, it is advisable to conduct more true experimental research.

9. Recommendations for policy

We identified the following recommendations for policy. Firstly, in order to achieve inclusive education for all students worldwide, governments should constantly facilitate and remind institutes, schools and preservice teachers to implement SDG4. Generally applicable agreements on a combination of theory and practice in the curriculum of teacher education institutes seem necessary.

In addition, the curriculum of international teacher education institutes should facilitate all preservice teachers to delve into inclusive education and to conduct possibilities to meet practical educational settings with students with specific support needs. Lastly, governments and institutes should encourage collaboration between preservice teachers following the initial teacher education and preservice teachers following a special education training.

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