Article

A Systematic Review on Inclusive Education of Students with Visual Impairment

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Abstract: This was a systematic review on the inclusive education of students with visual impairment. This study focused on two of the most addressed topics: the perceptions of general education teachers and challenges faced by students with visual impairment in accessing academic subjects. It synthesized the findings of 18 peer-reviewed articles published in English from 1980 to 2020. General education teachers' attitudes toward the inclusion of students with visual impairment were both positive and negative and were influenced by teacher-, student-, and environment-related factors. Feeling unprepared, one of the main teacher-related factors, seemed to have a great effect. In terms of access to academic subjects, the most discussed subjects were Mathematics, Science, and Physical Education. Although students with visual impairment seemed to be studying at or above their grade level, their exclusion from participation in classroom activities was apparent. Unfortunately, these challenges lead to short- and long-term consequences. Key elements in increasing accessibility to subjects were: general education teachers possessing a generic set of effective pedagogical strategies, effective teaching-learning tools, and external support. The importance of teacher training and a holistic support system were emphasized.

Keywords: inclusion; students with visual impairment; perceptions of teachers; academic subjects

1. Introduction

The number of students with visual impairment who are educated in general education classrooms continues to rise worldwide. With the increase in the number of students in general education classrooms, discussions in research on education and special education have also increased. For instance, based on the narrative meta-analysis conducted by Miyauchi and Paul [1], the number of articles involving "inclusion" and "visual impairment" published from 1980 to 2018 was 472, including ones written in English in peer-reviewed journals alone.

As stated in the United Nations Convention on the Rights of Persons with Disabilities, inclusive education is every student's right, not a privilege [2]. The benefits of inclusion for students with and without disabilities, such as greater access to the general curriculum and increased social interactions and friendships, are widely acknowledged [3]. However, there is ample research revealing how physically placing students with and without disabilities together in a classroom does not lead to quality inclusive education. For example, Jessup et al. [4] found that, although many students with visual impairment had positive experiences, one-third felt lonely or isolated and dissatisfied with their social relationships. Unfortunately, some students were teased or bullied because of their disabilities [5,6]. Challenges exist both socially and academically. Physical Education is one of the academic subjects where students with visual impairment experience isolation and exclusion [7,8].

Visual impairment is commonly known as a "low-incidence" and "high-needs" disability, and, therefore, triggers unique challenges pertaining to inclusion [9,10]. "Low incidence" implies a disability that occurs rarely or in low numbers. The specific definition can vary country to country; however,

in the United States, according to the Individuals with Disabilities Education Act (IDEA) of 2004, visual impairment is a severely disabling condition with an expected incidence rate that is less than 1% of the total statewide enrollment. "High needs" is a condition wherein a teacher with specialized skills for that specific disability is required to regularly support the student in accessing the general education curriculum [11,12]. For instance, students with severe visual impairment will need to learn braille, Orientation and Mobility, as well as to use assistive technologies that involve support from qualified teachers for the visually impaired. In earlier era, when children with disabilities were predominantly educated separately from those without disabilities, it was normal for students with such a "low-incidence, high-needs" disability to be catered to in a residential school for the blind. Students were convened in a specialized environment that met their needs, with continuous support from qualified teachers for the visually impaired [13]. With inclusive education, although students are educated in their local communities, they are often placed in a learning environment that relies heavily on vision, with a limited presence of teachers qualified to support the visually impaired [14,15].

This study synthesized the findings of articles pertaining to "perceptions of general education teachers" and "challenges faced by students with visual impairment in accessing academic subjects". These were the two most discussed topics related to inclusive education and students with visual impairment. This study built on the earlier work by Miyauchi and Paul [1] on students with visual impairment and inclusive education. They found a total of 472 articles on inclusion and visual impairment based on a systematic database search and identified 64 articles that fit the inclusion criteria after reviewing the full texts. The 64 articles were categorized into five broad research themes: "Perspective" (attitude, feeling, opinion), "Mental Health", "Self-Esteem and Social Support", "Content of Topic" (including academic subjects such as Mathematics, Physical Education, etc.), and "Other" (miscellaneous due to the range of diverse topics). Whereas Miyauchi and Paul [1] focused on "perceptions of students with visual impairment" within the broad research theme of "Perspective", this study focused on the other two topics under the broad research themes of "Perspective" and "Content of Topic".

Focusing on "perceptions of general education teachers" and "challenges faced by students with visual impairment in accessing academic subjects" is relevant in order to uncover issues that will contribute to high-quality inclusive education in the following ways.

First, despite the recognized importance of leaders and school administrators, classroom teachers are largely responsible for implementing inclusive principles and breaking down barriers to inclusion. This is especially true of high-needs and low-incidence disabilities, such as visual impairment, for the reason mentioned above. Teachers' perceptions, especially attitude, which can be defined as an individual's viewpoint or disposition toward a particular object, are known to facilitate or limit successful inclusion [16]. Teachers' attitudes are associated with their willingness to provide an inclusive environment to students and young people with special needs and/or disabilities [17]. A positive teacher attitude is a prerequisite for successful inclusion. Although studies proclaim that general education teachers are more positive toward students with visual impairment than to those with other impairments [18], researchers such as Wall [19] argue differently. According to Wall [19], the attitude toward students with visual impairment depends on the level of vision, and, therefore, there are differences in the attitudes toward students with low vision and those with blindness. Hence, it is worthwhile to further discuss this topic with particular focus on visual impairment.

Second, although students with visual impairment are capable of studying all academic subjects like their peers, they are known to be excluded from participating in all subject-related activities, particularly in Mathematics, Science, and Physical Education classes [4,6,20,21]. The situation is more worrisome at the upper secondary level, as the focus of education shifts to more academic content. De Verdier and Ek [22] revealed that the level of accessibility of the course depends heavily on the subject teacher's knowledge and willingness, causing students with visual impairment to choose courses based not on their ability and interest, but on accessibility. This implies that they are losing out on opportunities to study higher-level subjects, which may be hindering young individuals with visual impairment from pursuing a particular major in college as well as potentially working in that field.

There are a substantial number of studies indicating that students with visual impairment learning in inclusive settings are not receiving an adequate amount of instruction in the area of the Expanded Core Curriculum (ECC). ECC, which is also known as a disability-specific curriculum for students with visual impairment, includes skills in social interactions and independent living, and is known to have a strong link to positive post-school outcomes [23,24]. Equal attention should be given to academic subjects in higher-level academics.

To identify and synthesize the existing literature on the "perceptions of general education teachers" and "challenges faced by students with visual impairment in accessing academic subjects", the following four research questions were developed:

- What are the perceptions of general education teachers toward the inclusion of students with visual impairment?
- What factors impact attitudes of general education teachers toward inclusion?
- What are the challenges in accessing academic subjects for students with visual impairment in inclusive settings?
- What elements increase accessibility to academic subjects?

After providing a synthesis based on the research questions, salient suggestions for improving current inclusive education with respect to the attitudes of teachers and accessing academic subjects for students with visual impairment were discussed.

2. Methods

This systematic review involved six steps (Figure 1). Steps 1 through 4 were conducted in 2018 as part of another study published by Miyauchi and Paul [1]. The following is a summary of Steps 1–4, followed by Steps 5 and 6, which were newly added to this study. Steps 1–4 were conducted individually by two researchers, and Steps 5 and 6 were conducted by one researcher.
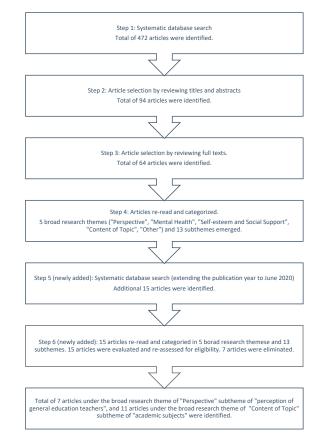

Step 1: Systematic database search
Total of 472 articles were identified.

Step 2: Article selection by reviewing titles and abstracts
Total of 94 articles were identified.

Step 3: Article selection by reviewing full texts.
Total of 64 articles were identified.

Step 4: Articles re-read and categorized.
5 broad research themes ("Perspective", "Mental Health", "Self-esteem and Social Support", "Content of Topic", "Other") and 13 subthemes emerged.

Step 5 (newly added): Systematic database search (extending the publication year to June 2020)
Additional 15 articles were identified.

Step 6 (newly added): 15 articles re-read and categorized in 5 borad research themese and 13 subthemes. 15 articles were evaluated and re-assessed for eligibility. 7 articles were eliminated.

Total of 7 articles under the broad research theme of "Perspective" subtheme of "perception of general education teachers", and 11 articles under the broad research theme of "Content of Topic" subtheme of "academic subjects" were identified.

Figure 1. Process for the selection of articles.

2.1. Steps 1 through 4

A systematic database search was conducted using the following major electronic search engines pertaining to special education: Education Full Text (Wilson), ERIC, EBSCOhost, ProQuest, and PsycInfo. The specific descriptor words and phrases used were: ("visually impaired" or "visual impairment" or "low vision" or blind) AND ("inclusive education" or inclusion or mainstreaming or integration), AND ("academic achievement" or "academic performance" or "academic success") AND ("social skills" or "social interaction" or "social behavior" or "social competence"). Articles were first selected by reviewing titles and abstracts (Step 2) and then reviewing full texts (Step 3), which was done separately by two researchers. Disagreements were resolved by discussions at each stage. The inclusion criteria were as follows:

- The articles must have been published in English in a peer-reviewed journal between 1980 and September 2018.
- The articles must be related to students in a compulsory education program (that is, first grade to twelfth grade) with visual impairment (blind or low vision) and learning in general education classrooms/inclusive settings.
- The articles must be related only to students with visual impairment, with no other disabilities.

The last criterion was set because the challenges faced by such students in inclusive education differ depending on the type of disability and age [22,25].

Step 3 yielded 64 articles, which were re-read and categorized independently by two researchers using thematic qualitative analysis (Step 4). Any disagreements were discussed and resolved. As a result, a total of five broad research themes and 13 sub-themes emerged. The five broad research themes were "Perspective", "Mental Health", "Self-Esteem and Social Support", "Content of Topic", and "Other".

2.2. Steps 5 and 6

For Step 5, a systematic database search was conducted using the same database and the keywords described in Step 1, extending the publication year to June 2020. This step was intended to cover published articles as much as possible after the extensive systematic review done by Miyauchi and Paul [1]. After applying the inclusion criteria, 15 additional articles were identified.

The 15 articles that were identified were re-read and further categorized into five broad search themes and 13 sub-themes, described in Step 4. Of the 15 articles, three were categorized under "Perspective", one under "Self-Esteem and Social Support", nine under "Content of Topic", and two under "Other" (Step 6). These articles were combined with the 64 identified in the former search described in Step 4. Because of the broad themes and ample number of articles, this study focused on two of the most discussed topics: "Perspective", mainly involving the subtheme "perception of general education teachers", and "Content of Topic", mainly involving the subtheme "academic subjects". By focusing on these, a total of nine articles under "Perspective" and 16 under "Content of Topic" were reviewed. A narrative summary of each article was developed and, after reassessing for eligibility, two articles under "Perspective/perception of general education teachers" and five under "Content of Topic/academic subjects" were eliminated because of inconsistencies in the stated results and/or inadequately described methodology.

3. Results

The steps described above yielded seven articles related to "Perspective/perception of general education teachers" and 11 related to "Content of Topic/academic subjects". Tables 1 and 2 present summaries of the research articles. The results are reported for each research question below.

Table 1. Summary of the seven reviewed articles under "Perspective/perception of general education teachers".

Author & Date	Country	Research Purpose	Methods	Participants	Findings
Bardin and Lewis (2008) [Academic engagement]	USA	To clarify the academic engagement of students with VI in general education classrooms.	A modified version of the Student Participation Questionnaire (SPQ) developed by Finn, Pannozzo, and Voelkl (1995) was formatted as an electronic survey and posted.	There were 77 general education teachers (preschool to 12th grade) who had a student with VI placed for academic instruction.	Based on the teachers' perceptions, about half (52%) of the students with VI were performing at grade level, 21.1% above grade level, and 26.7% below grade level. Teachers reported that VI students were engaged between half and most of the time in class. There was a discrepancy between the engagement level perceived by teachers and student performance levels. Possible explanations for this outcome are that the modified SPQ was not appropriate for measuring engagement levels of VI students, or that teachers are more generous in their overall estimates of student performance levels, but rated them more precisely when using the modified SPQ.
Hess (2010) [Attitude]	Israel	To clarify whether school climate, staff attitude towards inclusion, and VI students' quality of life (QoL) are correlated based on two hypotheses.	The research model included multiple variables. To measure school climate components and staff attitudes towards inclusion, a questionnaire developed by Halpin and Croft (1963) was used. For VI students' QoL, a total of six different questionnaires and scales, including the self-esteem scale by Rosenberg (1965), were used.	There were 63 VI pupils (ages 12 to19) and 200 teachers from 40 different schools. The research sample was selected randomly.	When the school climate and teachers' attitudes towards inclusion were positive, there was a significant correlation between the self-reports of pupils and teacher evaluations regarding pupils' emotional and social status. In addition, when both the climate and attitudes were positive, pupils' Felt Stigma was lower, meaning that the impact of stigma was less severely experienced.
Pliner and Hannah (1985) [Attitude] [Factors]	USA	To investigate general education teachers' attitudes towards four types of children with disabilities in relation to children's levels of achievement.	A Pupil Placement Scale (PPS) was developed and used. The four disabilities targeted were orthopedically impaired, VI, hard of hearing, and emotionally disturbed.	There were 83 general education teachers in six elementary schools. The teachers were 30 to 39 years old.	Teachers held negative attitudes only when the child's level of achievement was low. When it was at an acceptable level, teachers were quite positive toward the child with disabilities.
Ravenscroft et at. (2019) [Attitude] [Factors]	Turkey	To clarify the attitudes of elementary school teachers towards inclusion of VI children and factors that influence their attitudes.	Two questionnaires were administered to teachers from rural and urban areas of Turkey.	There were 253 elementary school teachers (72.1% response rate). Stratified random sampling was used, and 64% were working in urban districts and 35% in rural areas. Thirty-eight percent of teachers had at least one student with disabilities included in their classrooms.	Teachers held a positive attitude towards the inclusion of VI children. Rural teachers' positivity score was higher than that of the urban teachers. Previous research suggesting that teacher age and teaching experience do not influence teachers' attitudes towards inclusion was also confirmed. However, the results did not replicate previous research that suggested that female teachers have more positive attitudes than male teachers and that younger teachers are more enthusiastic about inclusion. One factor that contributed to a positive attitude was the teacher's initial and in-service training, highlighting that it is important for schoolteachers to feel prepared to teach. This suggests the need for greater post-qualification training to facilitate inclusion of VI children.
Selickaite et al. (2019) [Attitude] [Factors]	Lithuania	To investigate the validity and reliability of the inclusive Self-Efficacy Instrument for Physical Education Teacher scale (SE-PETE-D) using Lithuanian PE teachers and the impact of the type of disability and personal attributes.	The English version of the SE-PETE-D (Black et al., 2013) was used. The scale was translated to Lithuanian using the back-translation technique described by Brislin (1986).	There were 193 PE teachers working in Lithuanian schools, 60 males and 132 females, aged 22 to 65.	The content and construct validity of the instrument were supported. The types of student disabilities influenced the teachers' self-efficacy, and inclusion of students with VI into PE lessons appeared to be a greater challenge for PE teachers than the inclusion of students with intellectual disabilities or physical disabilities. Adapted PE courses or seminars had significant positive influence on PE teachers' self-efficacy toward inclusion of students with disabilities, including VI. In addition, PE teachers who had experience with students with VI in their PE classes and/or had friends with VI tended to have higher self-efficacy toward inclusion than those who did not.
Mushoriwa (2001) [Attitudes] [Factors]	Zimbabwe	To examine the attitudes of primary school teachers towards the inclusion of blind children in general education classrooms.	A Likert-type questionnaire adopted from Booth and Ainscow (1998) with modifications to fit the context of Harare was used.	There were 400 teachers in the Harare area.	The majority of teachers had a negative attitude towards the inclusion of blind children, and male and female teachers equally rejected the idea. The majority thought that including a blind child would not increase their circle of friends and felt that such a child would be likely to be less well-adjusted socially. In addition, many felt that because the child would use a different mode (braille) to read, they might not grasp concepts at the same pace as others, and, therefore, placement in regular classes would not benefit them. The majority indicated that they were not happy to have blind children in their classes, as they were not prepared to teach them.
Wall (2002) [Attitude] [Factors]	Canada	To explore whether the amount of teachers' previous exposure to people with VI affected their attitudes toward the inclusion of students with VI in general education classrooms.	A questionnaire survey was used.	There were 96 teachers categorized into groups: group 1 with experience teaching VI children, group 2 with indirect experience with VI students, and group 3 with randomly selected teachers without any experience of teaching VI students.	Teachers with direct or indirect experiences with students with VI held a more positive attitude toward inclusion than randomly selected teachers, but only toward students with low vision. All three groups demonstrated similar attitudes and reactions to the inclusion of students with blindness. Teachers with the least experience in interacting with VI students tended to place those students in more restrictive placements, have less confidence in their abilities to interact, and to hold less positive attitudes towards the inclusion of students with VI. Narrative response also showed that a person's attitude depends on ancillary factors, such as the setting, the moods of the people involved, and the comfort level of the interaction.

"VI" stands for visual impairment.

Table 2. Summary of the 11 reviewed articles under "Content of Topic/academic subjects".

Author & Date	Country	Research Purpose	Methods	Participants	Findings
Abrahamson et al. (2018) [Mathematics] [Solution to challenges]	USA	To illustrate how utilizing enactivism and ethnomethodological conversation analysis (EMCA) can enhance universal design for learning (UDL) efforts by contextualizing the thesis and proposing a tool for sensorily heterogeneous students.	A narrative review (without a systematic literature search) was used.	NA	Math contents such as spatial relationships constituting mathematical structures can be apprehended through non-visual sensory modalities. By applying enactivism, it is crucial that students with VI are engaged in experiences of a particular concept through sensorimotor means. Based on EMCA, the produced social encounters allow students to share experiences and the process, and help shape each student's perception of their surroundings. This provides an important analytic complement to enactivism, which enables classrooms with sensorily heterogeneous students to learn together effectively. By combining the concepts of the UDL, the paper proposed an instructional activity for ratio and proportion that enabled sensorily heterogeneous students to collaborate in achieving the enactment, mutual sensation, and mathematical signification of coordinated movements.
De Verdier and Ek (2014) [Braille/literacy]	Sweden	To examine reading development and academic achievement of students with VI learning in inclusive settings and the support they received.	Semi-structured interviews and documents, such as observation reports and grades for each subject, were collected and analyzed.	There were six students with blindness or severe VI in inclusive educational settings and their parents and teachers.	The outcome varied in all three aspects. Two students had satisfactory support from the school; however, most had an unsatisfactory level of support. Overall, there was no difference in reading comprehension for sighted and VI readers found. Differences were seen in decoding and reading speed. All students that attended general education classes had average grades.
Haegele (2019) [Physical education]	USA	To clarify the difference between inclusion and integration and to examine whether the current integrated physical education is inclusive.	For clarification of the terms, a narrative review was conducted. To examine the current situation, a telephone interview was conducted.	The participant was a 24-year-old male with VI.	Several concerns that emerged in the existing literature on integrated physical education were also evident in the empirical study. The participant experienced challenging social interactions with his peers, particularly when the peers misunderstood their impact when attempting to help. The teacher's actions in perpetuating social issues with peers were also impactful. These challenging experiences in integrated physical education had a long-term impact on the participant, as they led to his apprehension toward participating in leisure sports as an adult.
Haegele and Zhu (2017) [Physical education]	USA	To examine the experiences of adults with VI during school-based integrated physical education.	Semi-structured audiotaped telephone interviews were conducted, and an interpretative phenomenological analysis (IPA) research approach was used.	There were 16 adults with VI, aged 21 to 48, 10 females and 6 males. All were individuals who did not consider themselves to be elite athletes.	Three interrelated themes that depict feelings, experiences, and reflections of the participants were uncovered. They were related to: a) frustration and inadequacy by being excluded from activities; b) debilitating feelings arising from PE teachers' attitudes and being treated differently; and c) feelings about peer interactions. PE seems to highlight perceived differences between VI individual and their peers.
Klingenberg et al. (2019) [Mathematics] [Solutions to challenges]	NA	To conduct a systematic review and synthesize the evidence-based literature on math education among students with VI.	A systematic review was conducted on English-language, peer-reviewed articles published from 2000–2017. The Quality Assessment Tool for Studies with Diverse Designs (QATSDD) was used to evaluate the quality of the articles.	NA	There were 11 publications that met the inclusion criteria. The studies focused on various topics, such as teachers' attitudes and experiences, the use of the abacus, tactile graphics, and the development of mathematical concepts. The ability to choose suitable teaching strategies requires qualified and enthusiastic teachers who allow students to experience a sense of accomplishment and success. Only four studies reported eye disorder diagnoses.
Klingenberg et al. (2020) [Mathematics] [Solutions to challenges]	NA	To summarize current evidence-based knowledge about e-learning in mathematics among students with severe VI.	A systematic review was conducted on English-language, peer-reviewed articles published from 2000–2017. The Quality Assessment Tool for Studies with Diverse Designs (QATSDD) was used to evaluate the quality of the articles.	NA	There were 13 publications that met the inclusion criteria. There were 12 reported studies with an intervention or an experimental design, and the thirteenth had a cross-sectional design. The number of VI students in each study varied from 3 to 16. With QATSDD, three were classified as "high quality" and 10 were "good quality". The number of subjects in each study was small, and only a few studies included math skills testing before the start of the study. Eight papers reported the use of audio-based applications as learning aids. Interactive e-learning with audio and tactile learning programs were suggested as useful resources; however, weaknesses in scientific evidence were evident.

Table 2. *Cont.*

Author & Date	Country	Research Purpose	Methods	Participants	Findings
Koehler and Wild (2019) [Science]	USA and Canada	To clarify what pedagogical practices, accommodations, modifications, adaptive equipment, and instructional practices are used in the general science classroom to educate students with VI.	A survey was conducted online. The survey asked how students with VI accessed the science classroom, what instruments they used, what modifications and accommodations were made, and what assistive technology was used. There were 35 questions.	There were 51 specialist teachers for the VI/Orientation & Mobility specialists. Convenience sampling was used to access participants, and 47% had been teaching more than 15 years in settings from preschool to post-high school.	The majority of VI students spent instructional time in science within the general education classroom and received a standards-based education. However, most were not supported by teachers of VI during science. Over half of the teachers said that none of their students took advanced placement science classes. The most common accommodations were preparing tactile images and providing accommodations such as verbal descriptions, extended time periods for tests, and large print materials. The laboratory participation of VI students was low.
Lieberman et al. (2006) [Physical education]	USA	To examine the experiences of students with VI in inclusive general physical education classes, the types of modifications made, and their awareness of their individual education plans.	A survey that contained the following three parts was conducted: (1) questions about modifications to equipment and rules; (2) listing the most and least liked sports activities; and (3) knowledge of individual education plans (IEPs). Intuitive and inductive processes were used for analysis.	There were 60 students with VI (9 to 23 years old) enrolled in inclusive general physical education classes who also attended a one-week sports camp.	Results varied depending on the level of the vision loss. Students with severe VI had experienced more modifications related to sounds and physical and verbal assistance. Groups of students with severe VI liked open sports, although the sports were difficult to modify. The severe VI group was aware of their IEPs, but some of the students with less severe VI were not aware.
Pino and Viladot (2019) [Music] [Solution to challenges]	Spain	To clarify teaching-learning resources and needed support in inclusive music classrooms for VI students, particularly focusing on topics related to teaching-learning strategies and specialized support.	A semi-structured interview was conducted and analyzed based on the ideas of Grounded Theory (Glaser and Strauss, 1967).	There were two music specialists, one music teacher with two VI students in the class, and one VI student who studied music and specialized in piano performance.	The study confirmed that teaching-learning resources (strategies, adaptations, and materials) lie at the core of inclusive teaching in music classrooms. Although the responsibility for inclusive teaching lies with the teachers, specialized centers and support teachers that provide technical and transcribed materials as well as support teachers and VI students are vital. It was evident that for class teachers to introduce the teaching-learning resources needed for the inclusion of students with blindness, they needed instruction on teaching methods. Similarly, provision of support requires more than just mastery of the discipline of music, and specialized knowledge is necessary. The study confirmed the indispensable role played by specialized centers.
Rogers (2007) [Braille/literacy]	England	To clarify the conditions and challenges faced by VI children who read large print but also need to learn braille to increase access to the curriculum in general education classrooms.	A national survey of all local education authorities in England with follow-up interviews via telephone was conducted.	There were 232 questionnaires sent out with a 60% response rate providing information on 107 VI children. Follow-up interviews were conducted with teachers providing information on eight children ranging in age from Reception to Year 7.	Almost all pupils began learning with print in reception, and the majority began learning braille at Key Stage 1. Just over half of the children attended mainstream schools, while 41% attended resourced mainstream schools. Three distinct groups were identified: children who used print as their dominant medium; those who used braille as their dominant medium; and those who successfully used both. The print user group contained children who disliked or were reluctant to learn braille because they did not want to be seen as "different". The decision of whether to pursue braille or print (or both) was complex. The negative impact on attitudes when families and professionals are not in agreement about the need for braille was also highlighted.
Teke and Sozbilir (2019) [Science] [Solution to challenges]	Turkey	To identify the needs of a blind student in an inclusive chemistry classroom and to design and develop tactile materials to teach "energy in living systems".	This was a single case study design. In-depth interviews and classroom observations were conducted.	This was a tenth-grade, congenitally blind, and male student in a public school who was literate in braille.	The student obtained information through the teacher's verbal description or by reading the textbook on his own. The blind student's needs were not being met, and he did not understand the symbolic representations in chemistry. After he was provided with written materials, 2D embossed drawings, and 3D models, the student was able to develop a better understanding.

"VI" stands for visual impairment.

3.1. General Education Teachers' Perception toward the Inclusion of Students with Visual Impairment

Of the seven reviewed articles that focused on the perception of general education teachers, six [19,26–30] pertained to the attitude of teachers toward the inclusive education of students with visual impairment and one [31] to teachers' perceptions about the academic engagement of students with visual impairment in an inclusive setting.

Bardin and Lewis [31] conducted a quantitative study investigating the academic engagement of students with visual impairment based on the perception of 77 general education teachers who had a student with visual impairment for academic instruction. To measure the engagement level of students, a modified version of the Student Participation Questionnaire (SPQ) was used. Although previous studies have proven that the academic engagement levels of students as perceived by teachers and the actual student performance levels are correlated, this study in particular clarified that teachers' evaluations of the engagement levels of students with visual impairment tended to be lower than the students' actual performance levels. Although this result is open to multiple explanations, it implies the possibility of general education teachers perceiving the academic engagement of students with visual impairment more negatively compared to students who are sighted.

Regarding the articles on teachers' attitudes toward inclusion, Hess [26] clarified whether school climate, staff attitudes toward inclusion, and the quality of life (QoL) of students with visual impairment are correlated based on the hypothesis. This research delineated that a positive attitude toward inclusion is significantly correlated to positive emotions and social status in students with visual impairment in inclusive settings, indicating that positive attitudes among general education teachers would be the bedrock of successful inclusive education.

However, the findings from the five studies [19,27–30] illustrated a mixture of positive and negative attitudes among teachers. For example, a qualitative study by Ravenscroft et al. [27] examined the attitudes of 253 elementary school teachers in Turkey using questionnaires, revealing a positive attitude toward inclusion. However, Mushoriwa [29] examined the attitudes of primary school teachers in Zimbabwe using a questionnaire, revealing a negative attitude among most teachers. Pliner [30] conducted qualitative research using a survey of 83 U.S. primary general education teachers, which also revealed negative attitudes toward inclusion, although there were some exceptions.

3.2. Factors That Impact Attitudes of General Education Teachers

Of the six articles that discussed the attitudes of teachers, five [19,27–30] described the factors. There were three major themes within the factors: teacher-related, student-related, and environment-related.

3.2.1. Teacher-Related Factors

Mushoriwa [29], who revealed that the majority of Zimbabwean primary school teachers had a negative attitude toward the inclusion of blind children, indicated several reasons for this. Among them, one was the teachers not understanding the academic or social benefits of inclusion for students with visual impairment. Another was the teachers having a strong sense of reluctance in having students with visual impairment in class because they felt unprepared. Ravenscroft et al. [27], who clarified that Turkish teachers held a positive attitude toward the inclusion of children with visual impairment, identified that teachers' age, teaching experience, and gender had no influence on their attitude toward inclusion. One factor that did contribute to a positive attitude was their initial and in-service training, as it made school teachers feel prepared to teach.

In contrast, Selickaite et al. [28] measured teachers' perceived self-efficacy to explore their attitudes toward inclusive education. Teachers' sense of self-efficacy is a concept developed by Bandura [32] and is interpreted as the belief in one's capacity to attain a certain level of performance. Their investigation on Physical Education teachers delineated that the types of student disabilities influenced the teachers' self-efficacy, and the inclusion of students with visual impairment in Physical Education lessons appeared to be a greater challenge for Physical Education teachers than the inclusion of students

with intellectual or physical disabilities. However, an Adapted Physical Education course or seminar seemed to have a positive influence on Physical Education teachers' self-efficacy toward the inclusion of students with disabilities, including visual impairment. Moreover, Physical Education teachers who had experience with students with visual impairment in their Physical Education class and/or had friends with visual impairment tended to have higher self-efficacy toward inclusion than those who did not. Similar findings were reported by Wall [19], who explored factors that affected teachers' attitudes toward the inclusion of students with visual impairment, clarifying that teachers with direct or indirect experiences with such students see inclusion more positively than those who do not have such experiences. In essence, these results indicated that teachers feeling unprepared and lacking confidence in their ability to teach and support students with visual impairment were strongly linked to negative attitudes.

3.2.2. Student-Related Factors

In terms of student-related factors that have an impact on the attitudes of general education teachers, the students' level of vision and academic achievements were noted. According to Wall [19], although teachers with direct or indirect experiences with students with visual impairment held a more positive attitude toward inclusion, this was only toward students with low vision. When the attitude toward the inclusion of students with blindness was compared with the attitude toward those with low vision, regardless of their experiences with these students, teachers were neutral, if not negative, toward inclusion. In terms of academic achievement, Pliner and Hannah [30] investigated general education teachers' attitudes toward four types of children with disabilities: orthopedically impaired, visually impaired, hard of hearing, and emotionally disturbed. A Pupil Placement Scale was developed and used to clarify the attitudes of 83 teachers in six different elementary schools. They reported that regardless of the condition of the child's disability, teachers reacted more negatively to low-achieving children and more positively toward children who were at an acceptable achievement level. In other words, the level of achievement rather than the levels or types of disabilities determined teachers' attitude toward inclusion.

3.2.3. Environment-Related Factors

From the review of the selected articles, the last type of factor associated with teachers' attitudes toward the inclusion of students with visual impairment was environment-related factors. Ravenscroft et al. [27] reported how rural teachers' positivity scores toward the inclusion of children with visual impairment were higher than those of urban teachers. Wall [19] indicated that teachers' attitudes toward the inclusion of students with visual impairment also depended on ancillary factors, such as the setting, the moods of the people involved, and the comfort level of the integration. These findings suggest that elements surrounding the teachers at the micro and macro levels also impact their attitudes.

3.3. Challenges Pertaining to Access to Academic Subjects for Students with Visual Impairment

A total of 11 reviewed articles pertained to access to academic subjects. Of them, three focused on Physical Education [8,21,33], three on Mathematics [34–36], two on Science [37,38], one on Music [39], and two on Braille/literacy [22,40].

According to De Verdier and Ek [22] and Koehler and Wild [37], regardless of the level and quality of support received, more than half of the students with visual impairment performed at the grade level or above. Students were learning in inclusive classrooms, receiving standards-based education.

However, alarming situations were also highlighted in these studies. Koehler and Wild [37] clarified through a survey of 51 specialist teachers for the visually impaired on how instructional practices are delivered to students with visual impairment in general Science classrooms. The study indicated that, although most of these students were physically in the same environment as their non-disabled peers, participation in Science experiments was low. Along with Science, Physical Education was another subject with a similar challenge. Haegele and Zhu [8] and Haegele [33] depicted

a situation in which many students were left out and did not participate in activities. A retrospective study conducted by Haegele and Zhu [8] examined the experiences of adults with visual impairment during school-based integrated Physical Education by utilizing an interpretative phenomenological analysis approach. According to their findings, the students' feelings toward the Physical Education class rested on the actions, beliefs, and efforts of their Physical Education teachers. In particular, the actions of the teachers in treating students with visual impairment differently from the rest of their peers by putting them to the side or excluding them from activities were understood by the students with visual impairment as a "she is blind, she can't do it" attitude from the teacher, leaving them with debilitating feelings. Unfortunately, this also perpetuated negative peer interaction. The negative experience with Physical Education also led to apprehensions about participating in leisure sports as an adult [33].

Finally, a lack of opportunities for students with visual impairment to opt for higher-level academic courses was also exposed. For instance, Koehler and Wild [37] cited the low rate of students with visual impairment taking advanced-placement Science classes as a concern. There is a possibility that general education classrooms are not providing visually impaired students with the same opportunities as sighted students to study certain subjects at a higher level, such as Science.

3.4. The Elements That Increase Accessibility in Academic Subjects

Of the 11 reviewed articles, five [34–36,38,39] offered solutions to the current challenges regarding access to the academic curriculum. From the articles reviewed, general education teachers possessing a generic set of effective pedagogical strategies, effective teaching-learning tools, and external support were derived as key elements in increasing accessibility.

3.4.1. General Education Teachers Possessing a Generic Set of Effective Pedagogical Strategies

Pino and Viladot [39] clarified the need for support in inclusive Music classrooms for students with visual impairment via semi-structured interviews. Based on their findings, the importance of general education teachers possessing generic sets of effective teaching strategies to allow students with visual impairment to learn and understand were emphasized. The generic sets of strategies dictated in this study included being able to use explanatory language and verbal information to describe visual information specifically and precisely, and when presenting different activities, taking into account the sequential analytical perceptions of blind people to ensure accessibility.

3.4.2. Effective Teaching-Learning Tools

Klingenbert et al. [35] and Klingenbert et al. [36] systematically reviewed and synthesized peer-reviewed articles on Mathematics education for students with visual impairment and e-learning in Mathematics. Based on their findings, learning aids based on audio were popularly used, and interactive e-learning tools that allow auditory and tactile learning seem to be a useful resource. However, the researchers also refer to the weaknesses in scientific evidence among many of the studies reviewed, and warn that the results should be viewed with some caution. The study of Teke and Sozbilir [38], which had a single case study design, developed learning materials in Science that consisted of two-dimensional drawing and three-dimensional models, which proved effective in deepening the understanding of students with visual impairment. Abrahamson et al. [34], on the other hand, illustrated strategies and tools that facilitate inclusive learning by utilizing "enactivism", "Ethnomethodological Conversation Analysis (EMCA)" and the concept of Universal Design Learning (UDL). This particular study focused on Mathematics and stemmed from the ideology that contents, such as spatial relationships constituting mathematical structures, can be apprehended adequately, if not superiorly, through non-visual sensory modalities, such as auditory, kinetic, tactile, and haptic modalities.

3.4.3. External Support

As in the other studies reviewed, Pino and Viladot [39] echoed the importance of adapted teaching strategies and materials, however, with an emphasis on the role of specialist centers with specialized knowledge in visual impairment play. In particular, this study focused on higher-level Music, where blind students' reading and understanding of braille music was vital for understanding musical theory and meeting the demands of musicians. As Pino and Viladot [39] stated, the provision of support requires more than just mastery of the discipline of Music; specialized knowledge of visual impairment, including of braille music, is crucial. Therefore, although general classroom teachers should possess a generic set of effective pedagogical strategies based on the needs of students with visual impairment, it is also important to acknowledge the role of the specialist and specialist centers and to work collaboratively. In Spain, where this study was conducted, a national organization designated for persons with blindness provided multiple levels of support to general education classrooms. That is, it provided direct and indirect services to teachers and students (including training), as well as materials in braille and tactile form.

4. Discussion

4.1. Overview of Findings

As this study revealed, although students with visual impairment were physically in the same classroom with their peers, their exclusion from participation, especially in Science and Physical Education courses, was apparent. This finding supports those of previous studies. For instance, Opie, Deppeler, and Southcott [15] and West et al. [41] clarified that barriers in accessing the curriculum were experienced more in high schools than in primary schools, and were more prevalent in subjects such as Mathematics, Science, and Physical Education. Interestingly, this situation was documented by research studies in countries including the U.S., Australia, Canada, and Singapore, as well as on the African continent, indicating that it may be a universal issue [1]. Unfortunately, these challenges lead to long- and short-term consequences. For example, in Physical Education, the negative experience of being excluded led to such students' apprehensions about participating in leisure sports as adults. The positive outcome of participating in sports as a leisure activity is known to decrease the chances of developing health-related issues, such as obesity and anxiety [42].

This study also highlighted the low rate of students with visual impairment enrolling themselves in higher-level academic courses, such as advanced-placement Science. "Twice-exceptional student" is a term that refers to students who are gifted, that is, students with high cognition and potential for high achievement, and who have a disability at the same time [43]. Whitmore and Maker [44] describe them as the most misjudged, misunderstood, and neglected student population. Although it is estimated that 5% of the total population of students with visual impairment are "gifted", many of them are unidentified and overlooked [45]. One reason for being overlooked is that the giftedness and the disability cancel each other out, making these students appear "average" and thus unnoticeable [43]. Johnson [46] emphasizes the importance of students with visual impairment working with professionals that understand the disability and can look beyond the disability that is masking their true ability.

General education teachers' attitudes toward the inclusion of students with visual impairment were both positive and negative, and they were influenced by teacher-, student-, and environment-related factors. These three factors align with those found in previous research that revealed teachers' attitudes toward students with disabilities [18]. However, in terms of attitudes toward the inclusion of students with visual impairment in particular, whereas research that covers several disabilities has revealed visual impairment to be perceived positively by general education teachers [18], this paper implies the importance of further examining the details of the demographics of the students, such as the severity of the visual impairment.

Finally, as this research revealed, one of the factors contributing to negative attitudes was teachers' feelings of unpreparedness. However, the findings of Porter and Lacey [47] imply that this should not

be taken as dismay. Their research showed that teachers working in generic special schools (that is, special schools not designated for those with visual impairment) felt relatively comfortable teaching students with visual impairment regardless of their lack of knowledge of this disability. The researchers expressed alarm at the situation where teachers' overconfidence can "mask a lack of knowledge" and weaken the incentive to undertake additional training or to seek external specialists' support. Unfortunately, among teachers in inclusive settings, those who remain unaware of their inadequate skills and knowledge in visual impairment, "not knowing what they don't know", are not at all uncommon [48]. These findings demonstrate that it is crucial for teachers to be aware of the reasons behind their apprehension and have access to resources that can alleviate their fear, but it is also important for teachers to first be aware of their own shortcomings.

4.2. Salient Suggestions to Improve Current Inclusive Education

With respect to the two main topics discussed, namely perceptions of teachers and access to academic subjects, the following two salient suggestions can help improve the current situation.

4.2.1. Teacher Training

Because positive attitudes and a generic set of strategies and knowledge in educating students with visual impairment among general education teachers effectively promote inclusion, a teacher training program incorporating these elements would be helpful. The ideal training content would encompass theoretical and knowledge-based content on inclusion and visual impairment along with authentic face-to-face interactions and practical teaching experiences with students with visual impairment. This builds on studies that present teachers with a solid understanding of the value of inclusion as the basis of good practice [49] and wherein teachers with previous experiences with students with disabilities see inclusion more positively [18]. This is especially important because visual impairment is a low-incidence disability, so the chances that these teachers have encountered visually impaired persons would be low.

4.2.2. Holistic Support System with External Specialist Support

Effective teacher training will allow general education teachers to develop different strategies that promote access for students with visual impairment; however, there should be a holistic support system for teachers. Specifically, there should be internal and external support, with internal support incorporating head teachers, teachers, and paraprofessionals. For external support, specialist centers, such as those depicted by Pino and Viladot [39], would be ideal: that is, centers that can provide support at various levels, from the adaptation of learning/teaching materials, to teacher training, consultancy services and direct support for students. Specialist centers that have a strong understanding of subjects that are prone to excluding students with visual impairment (i.e., Physical Education, higher level Music, Mathematics, and Science) are advised. Adequate internal and external support is crucial in accomplishing quality, inclusive education for students with disabilities, and in improving general education teachers' attitudes toward inclusion [17].

5. Conclusions

This study synthesized the findings of 18 articles that were published in English peer-reviewed journals from 1980 to 2020 on the "perceptions of general education teachers" and the "challenges faced by students with visual impairment in accessing academic subjects". With respect to the two main topics discussed, namely perceptions of teachers and access to academic subjects, the importance of teacher training and a holistic support system were emphasized to help improve the current situation.

As implications for future research, studies that allow a better understanding of underlying factors that influence general education teachers' attitudes toward the inclusion of students with visual impairment are needed. Such research should be designed to provide information on students with visual impairment (with detailed demographics), teachers, and the environment in which teachers are

placed. Future research that also examines the relationship between these factors to inform potential teacher training programs will be of value.

Finally, studies aimed at clarifying the mechanism of exclusion in certain subjects, such as Mathematics, Science, and Physical Education, are also needed, as these studies will allow the further development of effective teacher training and holistic support systems.

6. Limitations

The limitations of this study should be acknowledged. Although the study included articles that were published in peer-reviewed journals and eliminated ones that had inadequately described their methods or results, an evaluation of the quality of these studies was not conducted. Evaluation based on the quality indicators developed by the Council for Exceptional Children's Division for Research or using assessment tools such as the Quality Assessment Tool for Studies with Diverse Designs [50] is recommended for future investigation. It is possible that a few relevant studies were unintentionally neglected or that the findings are open to varying interpretations. The interpretations should be evaluated by other independent scholars.

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