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Identifying Research-Based Practices for Increasing Peer Interaction in Children with Hearing Impairment: A Review of the Literature

التعرف على الممارسات المبنية على الأبحاث لزيادة تفاعل الأطفال ذوي الضعف السمعي مع أقرانهم: مراجعة أدبية

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Abstract

Establishing peer interaction is critical for all childhood development, especially for children with hearing impairment (HI), who tend to experience a lot of difficulties in interaction. Practices aiming to promote peer interaction in children with HI need to be informed by evidence from quality research. This paper aims to review and evaluate research studies that focus on interaction between children with HI and their peers (with or without HI) in self-contained and inclusive classrooms. Seven empirical studies published in peer-reviewed journals from 1990 to 2023 were examined and evaluated, using the Council for Exceptional Children (CEC, 2014) quality indicators. Several practice themes emerged after coding these studies: multifaceted training, parallel talk, social intervention, and social stories. Results indicated that most of the reviewed studies met the majority of identified quality indicators, including context and settings, participants, intervention agents, description of practice, and data analysis. However, few studies reported implementation fidelity, and none of the studies met the quality indicator related to outcome measures for dependent variables. The limitations of this review, implications, and suggestions for future research are discussed.

Keywords: peer interaction, social interaction, literature review, hearing impairment, research-based practice

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مستخلص البحث

يعتبر بناء التفاعل الاجتماعي أمرا مهما في نمو الأطفال وبشكل خاص لدى الأطفال من ذوي الضعف السمعي. حيث يواجه هؤلاء الأطفال الكثير من الصعوبات عند التفاعل مع أقرانهم. وبناء عليه هناك حاجة الى مراجعة الممارسات التي تساعد على زيادة التفاعل الاجتماعي لدى الأطفال ذوي الضعف السمعي . هدف البحث الحالي الى مراجعة الممارسات المبنية على الأبحاث التي استخدمت استراتيجيات من اجل زيادة التفاعل بين الأطفال ذوي الضعف السمعي مع بعضهم وأقرانهم العاديين في الفصول الخاصة او فصول الدمج. تضمنت المراجعة سبعة دراسات منشورة في المجلات من عام 1990-2023 تم تقييم جميع الأبحاث وفقا لمؤشرات جودة البحث العلمي في أبحاث التربية الخاصة المقدمة من جمعية الأطفال الاستثنائيين(CEC, 2014). توصلت نتائج المراجعة الأدبية الى مجموعة من الممارسات المستخدمة في الأبحاث وهي: التدريب متعدد الأوجه، الحديث الموازي، التدخل الاجتماعي، والقصص الاجتماعية. أشارت النتائج الى ان معظم الأبحاث التي تضمنتها المراجعة حققت مؤشرات جودة البحث العلمي والتي تشتمل على السياق والمكان، المشاركين، القائم بالتدخل، وصف التدخل، وتحليل البيانات. ولكن يوجد بعض الدراسات التي أشارت الى صدق الإجراءات، بالإضافة الى انه لايوجد دراسة حققت مؤشر الجودة المرتبط بقياس المخرجات للمتغير التابع. وتم مناقشة كل من قيود المراجعة، والتوصيات، والمقترحات للأبحاث المستقبلية.

الكلمات المفتاحية: التفاعل مع الاقران، التفاعل الاجتماعي، مراجعة أدبية، الضعف السمعي, الممارسات المبنية على الابحاث

Introduction

Peer interaction plays a significant role in a child's development since it is linked to success in a variety of future skill areas (Widerstrom, 2005). Establishing peer interaction is critical, especially for children with hearing impairment (HI) (Batten et al., 2013). Many researchers recognize the important effects of peer interaction on the performance of children with HI (Alasim, 2018; DeLuzio & Girolametto, 2011; Yuhan, 2013). Peer interaction can be defined as any communication that occurs between or among individuals of similar age; this includes either positive interaction (e.g. polite requests and refusals, cooperative play, sharing materials, engaging in interactive activities) or negative interaction (e.g. refusing to play or share by yelling, throwing or pushing away, and taking toys without consent (Antia et al., 1994). Additionally, it includes verbal interaction (e.g., initiation of verbal comments) or nonverbal interaction (e.g., sharing materials) (Antia et al., 1994). Peer interaction in children with HI has been widely investigated since positive interaction yields desirable outcomes. Some researchers have concentrated on interactions between children with HI and their peers with the same hearing status (e.g., Raver et al., 2013a), while others have focused on peer interaction between children with HI and their peers with typical development (e.g., Bobzien et al., 2013; Hoffman et al., 2014). Some research has addressed the peer interaction between children with HI and both categories of peers (e.g., Weisel et al., 2005).

Overall, researchers have reported that experiencing successful peer interaction would affect children with HI in different developmental areas, including psychologically, cognitively, socially, and academically (Batten et al., 2013).

Children with disabilities frequently struggle with peer interaction, requiring extra guidance from adults in order to develop the necessary skills (McLean et al., 2014); and children with HI are not an exception. Teaching peer interaction skills for children with HI is important because, as several researchers indicate, children with HI have experienced challenges in interaction (Antia et al., 2011; Weisel et al., 2005), and they tend to manifest developmental delays in maintaining interaction with peers (Yuhan, 2013). This delay, which adversely affects positive interactions in children with HI, is due to several reasons. Children with HI have difficulties with language when they interact with peers (Raver et al., 2013b; Yuhan, 2013), and they interact more with their teachers (Antia et al., 1994).

Further, children with HI tend to have a deficiency in social skills (Antia & Kreimeyer, 1996), and to display more symptoms of depression (Theunissen et al., 2011). Negative peer interaction in children with HI tends to lead to behavioral problems (McElwain & Volling, 2005), feelings of isolation and exclusion (DeLuzio & Girolametto, 2011; Most et al., 2011), and academic difficulties (Batten et al., 2013).

Many researchers emphasize that teachers must use evidence-based practice (EBP) according to federal laws (Lane et al., 2021). Researchers reported the importance of identifying effective practices to support interaction in children with HI (Alasim, 2018; Xie et al., 2014). Cook and Cook (2011) claimed that these effective practices that produce positive student outcomes are less frequently implemented than those that produce limited or negative outcomes. If effective research-based practices (RBPs) are not used in the classrooms, the difficulties associated with peer interaction in children with HI will likely continue (Xie et al., 2014). Practitioners may experience some confusion between RBPs and evidence-based practices

(EBPs). RBPs include interventions supported by any research, even if only by a single low-quality study (Cook & Cook, 2011); however, EBPs rely on more than a single high-quality study (Wendel et al., 2015). Additionally, Cannon et al., (2016) claimed that there are insufficient EBPs in the educational field for students with HI. A plausible explanation might be that the heterogeneity of HI populations as well as diversity of educational placement settings limit the possibility to provide a foundation for EBPs for children with HI (Wendel et al., 2015). It is practitioners' responsibility to select, adopt, and implement EBPs to enhance students' outcomes. Therefore, it is important to identify and implement practices that improve peer interactions in classrooms. Given the limited available reviews of experimental research focusing on peer interaction for children with HI, there is a need to explore existing research in this area.

In light of this, the following review seeks to enhance the existing knowledge of the RBPs that focused on promoting peer interactions. The purpose of the review is to identify RBPs that are practitioner friendly to increase peer interactions in children with HI. The selected studies will be evaluated according to the Council for Exceptional Children (CEC, 2014) quality indicators. The CEC (2014) has established quality indicators to determine the methodological soundness of a study, to help identify EBPs in the field of special education. There are eight quality indicators (CEC, 2014, p. 3-6):

- context or setting
- participants
- intervention agent
- description of practice

- implementation fidelity
- internal validity
- outcomes measures
- data analysis

Each of these quality indicators includes a varying number of subcomponents that are applied to studies in both group comparison and single-subject studies (CEC, 2014).

To illustrate, the first quality indicator, *context or setting*, includes one subcomponent: the study has enough information about important aspects of context and setting (e.g., the type of school or program, socioeconomic status, and curriculum). The second quality indicator, *participants,* has two subcomponents: sufficient relevant information about participants (e.g., gender, ethnicity, age, language); and about the participants' disabilities or risk status and the criteria used to identify them (e.g., using IQ test, teacher selection) (CEC, 2014). The third quality indicator, *intervention agent,* requires a clear description of the individual(s) responsible for delivering the intervention. The fourth indicator, *description of practice*, specifies that practice is explained in detail. The fifth indicator, *implementation fidelity*, ensures that the practice is conducted accurately and consistently. The sixth indicator, *internal validity*, emphasizes that the experimenter must control the independent variable. The seventh indicator, *outcome measures*, shows clear reporting of how the practice affected the study's results. Finally, the eighth indicator, *data analysis*, requires that data be analyzed correctly (CEC, 2014).

Two factors support the rationale for using these quality indicators. First, the CEC includes quality indicators for assessing studies with different methodologies: single-subject designs and group designs in one checklist.

Second, if the study meets all the quality indicators, it helps to classify the practice as an EBP. One research question is addressed in this review: "What RBPs are used to increase peer interaction in children with HI in self-contained and inclusive classrooms?"

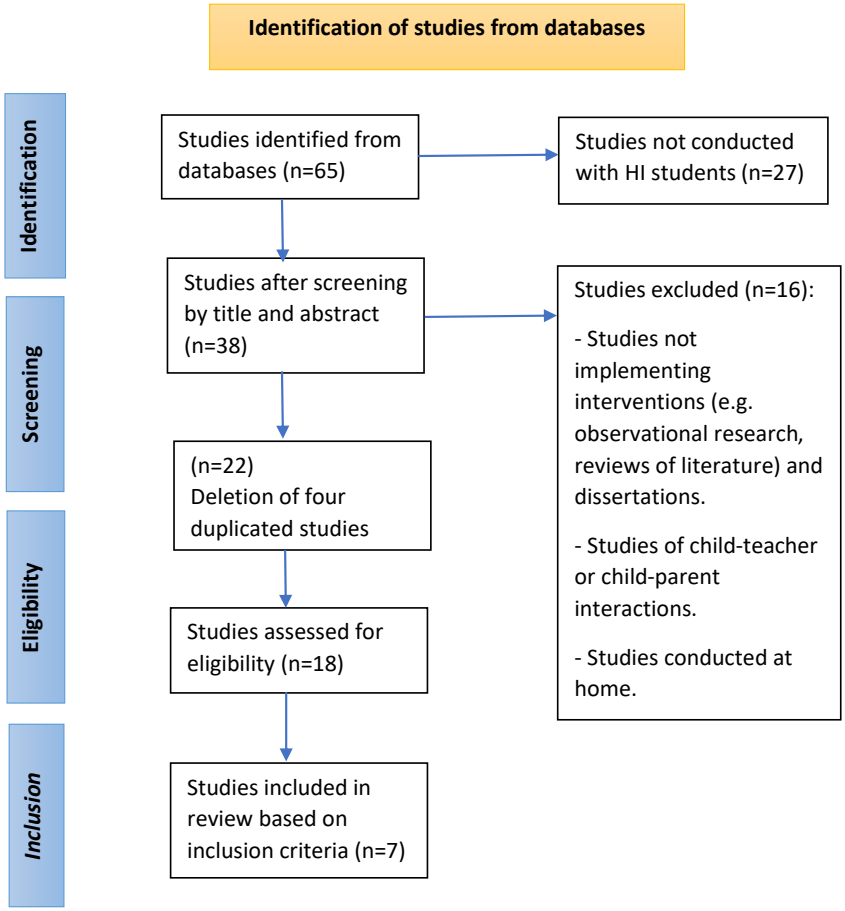
Method

Search Procedure

An electronic search procedure was used to locate studies included in this review. The search was conducted with electronic databases: the Educational Resource Information Center (ERIC), Education Source, Education Research Complete, and PsychINFO. The search used combinations of search terms from two sets: one about interaction (*interaction* OR *social* OR *peer*) and another set of terms about HI (*hard of hearing* OR *deaf* OR *hearing impairment* OR *hearing loss*), . The time frame used to select studies was from 2007 to 2023, including the most recent studies on the topic. However, the search provided a surprising scarcity of results. To locate more studies, the author used the same educational databases and expanded the time frame—from 1990 to 2023. Moreover, the reference lists of the related studies were screened to find other relevant studies. Most of these studies were removed after the initial title screening. Then a search was conducted for more on-topic studies written by authors, who published more than two studies on the same subject, to identify any additional studies. After this, titles, abstracts, and keywords were reviewed. After an elimination of duplicate studies, electronically retrieved empirical studies that met the initial inclusion criteria were evaluated. Figure 1 illustrates the steps in selection studies in this review according to the PRISMA statement (Page et al., 2021) during the four phases: Identification, screening, eligibility, and inclusion.

Figure 1

PRISMA flowchart showing the process of study selection.



Inclusionary and Exclusionary Criteria

The inclusion criteria for selecting studies were (a) participants aged between three and nine years old, (b) participants diagnosed as having HI, (c) studies published in peer-reviewed journals, (d) experimental studies, and (e) studies written in English and conducted in the United States. Studies were excluded if (a) they did not implement interventions (such as qualitative research, observational research, reviews of the literature, dissertations, and position papers), (b) they primarily looked at child–teacher or child–parent interactions, (c) they were conducted at home, or

(d) they evaluated interactions in adolescence or adults with HI. After a close inspection, a total of seven eligible studies were included in this review.

Coding Studies

The author developed the coding data sheet that included the main elements (e.g., experimental designs, participants, independent variables, and dependent variables). Individually, each study was read and coded. Then the studies were grouped into themes based on the identified practices. Table 1 shows important elements integrated in this review.

Table 1

Important Elements Across Reviewed Studies

Study	Design	Participants with HI	Participants with Typical Development	Practice(s)	Target Behavior(s)	Interventionist(s)
Rasing & Duker (1992)	Multiple baseline design across behaviors	9 children (3 boys, 6 girls)	NA	Multifaceted training	Turn waiting Initiation interaction Interacting with others	Teacher Residential staff
Antia et al. (1994)	Group design	49 (28 boys, 21 girls) Oral + signed	56 (31 boys, 25 girls)	Two interventions: 1. Social skills intervention 2. Integrated-activities intervention	Interaction Positive interaction Negative interaction Linguistic interaction Nonlinguistic	General education teacher Special education teacher
Antia & Kreimeyer (1996)	Group design	45 (27 boys, 18 girls) Oral + signed	91 (29 boys, 19 girls)	Two interventions: 1. Social skills intervention 2. Integrated-activities intervention	Positive interaction and negative interaction Linguistic and nonlinguistic interaction Social acceptance	Teacher Teacher assistance
Antia & Kreimeyer (1997)	Group design	43 (26 boys, 17 girls) Oral + signed	48 (29 boys, 19 girls)	Two interventions: 1. Social skills intervention 2. Comparison intervention	Peer interaction Play Child initiation/ peer responses Peer initiation/ child responses	Early childhood teacher Special education teacher

Study	Design	Participants with HI	Participants with Typical Development	Practice(s)	Target Behavior(s)	Interventionist(s)
Raver et al. (2012)	Multiple baseline design across participants	3 (2 boys, 1 girl) Oral only	NA	Parallel talk	Imitative response of adult Vocal/verbal turn taking Initiated/ response vocal/verbal comment Initiated/ response vocal/ nonverbal response Vocal/verbal Questions	Paraprofessionals
Raver, Bobzien, Hester, et al. (2013)	AB design	2 (1 boy, 1 girl) Oral only	NA	Social story	Initiated verbal comments Responded verbal comments Play turn taking	Paraprofessionals
Raver, Bobzien, Richels, et al. (2013)	Single-subject design with generalization probe	4 (2 boys, 2 girls) Oral only	4 (2 boys, 2 girls)	Two interventions: 1. Prior to play, social story with a verbal prompt 2. During play, social story with a verbal prompt and reinforcement	Initiated verbal comments Responded verbal comments Play turn taking	Paraprofessionals

Note. NA = the study did not have children with typical development

Results

The seven studies that met the criteria for inclusion in the review showed a variety of results across participants, settings, and behaviors. The results are divided into two main sections: first, the intervention used across the reviewed studies; and second, the evaluation of the reviewed studies based on the CEC quality indicators. Several intervention themes emerged, including multifaceted training, parallel talk, social skills intervention, and social stories. The most frequently recurring intervention was social skills

training, while the least discussed were multifaceted training and parallel talk. Before proceeding to synthesize the studies, a brief explanation of the studies included in each theme is provided.

Intervention Used across the Reviewed Studies

Research Using Multifaceted Training

Rasing and Duker (1992) evaluated the effectiveness of using multifaceted training procedures to support the acquisition of social communication skills and the generalization of these skills. Multifaceted training consists of two phases: child training and teacher supervision. During the child training phase, the teacher provided nine lessons for the participants. The teacher gave immediate reinforcement if the participants displayed any of the target behaviors. If the participants displayed inappropriate behaviors, the teacher used correction procedures. The teacher also provided verbal instructions for the children and modeled the consequences of both appropriate and inappropriate behaviors. During the teacher supervision phase, the psychologist supervised the teacher during teaching lessons using reinforcement and correction procedures to provide feedback for the teachers. The results indicated that a multifaceted training procedure was a successful intervention: all the participants increased and generalized the target behaviors. However, only four out of the nine participants maintained turn waiting and initiation interaction for five to ten weeks. Additionally, there was no maintenance data for interacting with others.

Research Using Parallel Talk

Raver et al. (2012) conducted a pilot study that examined the impact of a parallel talk strategy to enhance language and interaction skills. This intervention involved adults describing the child's behaviors, feelings and activities, in a verbal commentary to the child. Most importantly, all the language used by the adults was matched with the children's developmental communication level. The results showed that verbal turn-taking was

increased for all three participants. Also, two of the participants increased their initiations and responses. Furthermore, the generalization of skills was displayed in all three participants.

In conclusion, along with the multifaceted training in the previously discussed study conducted by Rasing and Duker (1992), parallel talk was the least used intervention. Both studies implemented the interventions among children with HI only. While Raver et al. (2012) was the only study to examine the effectiveness of parallel talk, this practice shows potential to help improve the social interaction of children with HI.

Research Using Social Skills Intervention

Antia et al. (1994) examined and compared two interventions, social skills intervention, and integrated activities intervention, to enhance social interaction in children with HI and their peers with typical development. The social skills intervention (a teacher-mediated intervention) consisted of six social skills that the teacher taught the children by introducing and modeling the skills during regular interaction routines: "greeting, sharing, cooperating, assisting, complimenting, and inviting" (p. 267). The teachers also provided verbal or physical prompts for all the children. The integrated activities intervention concentrated on familiarizing the children with one another by working and playing together. Unlike the social skills intervention, the teachers in the integrated activities intervention did not model or prompt social interaction for the children. The results showed that positive peer interaction increased during both interventions. Also, social interaction among children in the integrated activities group increased more than social skills in children in the social skills group. Importantly, the nonlinguistic interaction was the most successful interaction between children with HI and their peers with typical development.

In conclusion, while many researchers had a strong conviction that children with disabilities increased their interaction when the teacher

provided prompts and modeled the skills to them (English et al., 1997), this was not the case in this study. The intervention in which the teachers did not provide prompts or modeling had a more effective result in peer interactions. The authors considered familiarity along with the teacher's role as important explanations for this result.

Similarly, Antia and Kreimeyer (1996) examined the same two interventions used in earlier research (Antia et al., 1994). They investigated the effects of social skills intervention and integrated activities intervention on the social interaction and acceptance of children with HI. The authors specifically looked at peer interaction and acceptance among three groups: children with HI and their peers with HI, children with HI and their familiar peers who were typical developed, and children with HI and their unfamiliar peers who were typical developed. Teachers conducted the intervention with groups of four to eight children, half of whom were children with HI. The results showed that peer interactions increased between children with HI and their peers with HI when social skills intervention was used. Moreover, children with HI generalized the social communication skills into free play and maintained learned skills about four months after the intervention ended. Nonlinguistic interaction occurred more frequently compared to linguistic interaction in all the participants. However, no interventions increased peer interaction between children with HI and their peers with typical development, including both familiar peers and unfamiliar peers. Moreover, no single intervention increased the typical developed children's acceptance of children with HI, although the children with typical development increased their recognition of children with HI.

Finally, Antia and Kreimeyer (1997) evaluated the effectiveness of the same social skills intervention and integrated activities intervention discussed in Antia et al. (1994) to increase peer interaction for children with HI and their peers with typical development during free play. Additionally, the authors evaluated whether the children would be able to maintain the learned skills for up to four weeks and up to one year after the intervention was over. The results revealed that the total number of occurrences of

solitary play and parallel play decreased in children who were in the social skills intervention group, and this decrease continued for one year after the intervention ended in outdoor play. In addition, the total number of occurrences of solitary play and parallel play decreased in children who were in the social skills intervention group, and the children maintained social behaviors for four weeks in indoor play settings. However, there was no increase in positive interaction between children with HI and their peers with typical development in either initiations or responses.

There are many similarities between the study of Antia et al. (1994) and those of Antia and Kreimeyer (1996, 1997). The latter studies were systematic replications of the former study, conducted using the same interventions and populations and similar dependent variables (Cannon et al., 2016; Graham et al., 2012). Additionally, both studies (i.e., Antia & Kreimeyer, 1996, 1997) reported the generalization and maintenance of peer interaction in children with HI. Overall, both interventions displayed mixed outcomes in regard to increasing peer interaction in children with HI.

Research Using the Social Story

Raver, Bobzien, Hester, et al. (2013) investigated the effectiveness of reading social stories to enhance social communication skills before free play sessions with children with HI in an oral preschool classroom (i.e., a self-contained classroom). The same social story was read during each session; then the paraprofessional asked the participants to play without her assistance. The results showed improvements in initiating verbal comments and turn taking during play. Additionally, the participants transferred some words from the social story to their play.

Likewise, Raver, Bobzien, Richels, et al. (2013) compared the effectiveness of two interventions used to enhance social communication skills in preschool children with HI in two settings: the oral preschool classroom and the inclusive classroom. The first intervention involved reading a social story prior to a play session with teacher verbal prompting, and the second intervention involved reading a social story with teacher

verbal prompting and reinforcement during play. The results showed that verbal comments and turn taking were increased for three of the four participants in an inclusive classroom during each intervention. However, only two participants increased the same behaviors in the oral preschool classroom, and only two participants generalized the target behaviors.

There are several similarities between the two studies of Raver, Bobzien, Hester, et al. (2013) and Raver, Bobzien, Richels, et al. (2013). Both of these studies used social story interventions to increase the same target behaviors: initiated verbal comments, responded verbal comments, and turn taking during play. Both studies also relied on paraprofessionals to implement the interventions with children. However, an important difference between these two studies is the setting. To illustrate, Raver, Bobzien, Hester, et al. (2013) conducted their research in an oral preschool classroom (i.e., a self-contained classroom), while Raver, Bobzien, Richels, et al. (2013) conducted their research in both settings: in the oral preschool classroom (i.e., a self-contained classroom) and in the inclusive classroom. Another difference between the two studies involved how the intervention was delivered. The social story was read to the children before a play session, and there was no prompt during the play session in the study of Raver, Bobzien, Hester, et al. (2013), while a social story was read with a verbal prompt prior and during the play session in the study of Raver, Bobzien, Richels, et al. (2013). Overall, it seems that teachers or paraprofessionals can implement social story intervention since it does not require sophisticated training in both self-contained and inclusive classrooms.

Evaluation of the Reviewed Studies Based on the CEC Quality Indicators

Settings and Participants.

Four studies were conducted in public school general education classrooms. Two studies were conducted in oral preschool classrooms and one study in a residential school for children with HI. Across the reviewed studies, the population, sample, and participants differed (Antia et al., 1994;

Antia & Kreimeyer, 1996, 1997; Rasing & Duker, 1992; Raver et al., 2012; Raver, Bobzien, Hester, et al., 2013; Raver, Bobzien, Richels, et al., 2013). The participants' ages ranged from two to nine years old. The majority of the reviewed studies provided descriptions of the participants' characteristics, such as their age, race, and gender.

Intervention Agent.

In four reviewed studies, teachers implementing the intervention included special education teachers, general education teachers, and early childhood teachers (i.e., Antia et al., 1994; Antia & Kreimeyer, 1996, 1997; Rasing & Duker, 1992). Paraprofessionals conducted the intervention in three studies (i.e., Raver et al., 2012; Raver, Bobzien, Hester, et al., 2013; Raver, Bobzien, Richels, et al., 2013). However, the researchers and children with typical development did not participate in the implementation of the intervention in any of the reviewed studies.

Research Designs.

Research in peer interaction in children with HI used different types of designs; however, all the reviewed studies were quantitative studies. A single-subject multiple baseline design was commonly used in most of the reviewed studies (Rasing & Duker, 1992; Raver et al., 2012; Raver, Bobzien, Richels, et al., 2013), while an AB single-subject design was only used in the study of Raver, Bobzien, Hester, et al. (2013). Additionally, group design was used in the studies of Antia et al. (1994) and Antia and Kreimeyer (1996, 1997).

Measures.

The measures for each study reviewed were based on the research questions and purpose of each study. One of the reviewed studies measured the outcomes of the multifaceted training procedures by measuring the frequency of social and communication skills (Rasing & Duker, 1992). Three of the reviewed studies implemented two interventions (i.e., social skills

intervention and integrated activities intervention) to measure the social interaction in children with HI and their peers with typical development such as positive social interaction and nonlinguistic interaction (Antia et al., 1994; Antia & Kreimeyer, 1996, 1997). Additionally, two of the reviewed studies used social stories to measure the frequency of social skills (e.g., turn taking, play turn taking, play interaction) and communication skills (e.g., initiation verbal comment and response verbal comment; Raver, Bobzien, Richels, et al., 2013; Raver, Bobzien, Hester, et al., 2013). Moreover, Raver et al. (2012) measured the effect of parallel talk on interactional skills for preschool children based on the frequency of five dependent variables (e.g., verbal turn-taking, initiated nonverbal comment). Only two of the reviewed studies had reported effect sizes (i.e., Raver, Bobzien, Richels, et al., 2013; Raver et al., 2012). Therefore, the measurement included behaviors, social skills, and communication skills before and after the interventions as well as repetitive observational measures of the children's performances.

Interobserver Agreement.

For studies using the single-subject design, most reported the interobserver agreement reliability (IOA) using a specific formula: the total number of agreements divided by the total number of disagreements and multiplied by 100. The one exception was the study conducted by Rasing and Duker (1992), which used a kappa coefficient. The percentage of sessions wherein IOA was assessed varied, and IOA ranged from 82% to 98% across the reviewed studies. However, one of the reviewed studies did not specify whether IOA was measured at 31% in the baseline phases, the intervention phases, or all the research phases (i.e., Raver, Bobzien, Hester, et al., 2013). Overall, IOA was assessed in 27% of the sessions across all phases and behaviors in the study of Rasing and Duker (1992) and 29%–34% of the sessions across all phases in the studies of Raver, Bobzien, Richels, et al. (2013) and Raver et al. (2012). In terms of group design studies, IOA was

calculated using the kappa coefficient: 82% for Antia et al. (1994), 78% for Antia and Kreimeyer (1996), and 89% for Antia and Kreimeyer (1997).

Data Analysis.

In the single-subject design studies (i.e., Rasing & Duker, 1992; Raver et al., 2012; Raver, Bobzien, Hester, et al., 2013; Raver, Bobzien, Richels, et al., 2013), the authors provided information related to means and ranges as well as visual analysis graphs that clearly represent the children's outcomes through all the study phases. However, not all the dependent variables targeted were presented in the graphs across the reviewed studies (e.g., Raver et al., 2012). Also, two of the studies did not have a minimum of three data points in each study phase (i.e., Raver, Bobzien, Richels, et al., 2013; Rasing & Duker, 1992). In the group design studies (i.e., Antia et al., 1994; Antia & Kreimeyer, 1996, 1997), the data analysis technique was ANCOVA.

CEC Standards

All the reviewed studies were evaluated based on the information reported in them and the author's opinion of whether the studies meet the CEC quality indicators (2014) or not. There are eight quality indicators, and each indicator comprises subcomponents; if the study did not fulfil all the subcomponents, that quality indicator was marked as 'not met'. The evaluation indicated that the study reports met most of the CEC quality indicators (2014), including context and settings, participants, intervention agents, description of practice, and data analysis. However, most of the study reports failed to meet the following quality indicators: implementation fidelity, internal validity, and outcome measures/dependent variables. Specifically, the quality rating was 62.5% (5 of 8) in the studies of Antia et al. (1994), Antia and Kreimeyer (1996), Rasing and Duker (1992), and Raver et al. (2012), while it was 75% (6 of 8) in the study of Antia and Kreimeyer (1997). One study attained the lowest quality rating, which was 50% (4 of 8) (i.e., Raver, Bobzien, Hester, et al., 2013). This study had a relatively small

sample size, did not provide graphs for all the dependent variables, and did not measure the effect sizes. In contrast, the highest quality rating among the reviewed studies was 87.5% (7 of 8) (Raver, Bobzien, Richels, et al., 2013). This study measured treatment fidelity across all the study phases and provided sufficient information on how it was measured. This study also reported social validity, provided graphs for all the dependent variables, and measured the effect sizes. Additionally, the study measured and reported IOA for all the participants, behaviors, and phases. Consequently, none of the reviewed studies could be identified as methodologically sound research based on the quality indicators of CEC (2014). More information about which quality indicators were met or not met across the reviewed studies is shown in Table 2.

Table 2

Quality Indicators for Each Study

Study	Context and setting	Participants	Intervention agent	Description of practice	Implementation fidelity	Internal validity	Outcome measures	Data analysis
Rasing & Duker (1992)	✓	✓	✓	✓	X	X	X	✓
Antia et al. (1994)	✓	✓	✓	✓	X	X	X	✓
Antia & Kreimeyer (1996)	✓	✓	✓	✓	X	X	X	✓
Antia & Kreimeyer (1997)	✓	✓	✓	✓	X	✓	X	✓
Raver et al. (2012)	✓	✓	✓	✓	X	✓	X	X
Raver, Bobzien, Hester, et al. (2013)	✓	✓	✓	✓	X	X	X	X
Raver, Bobzien, Richels, et al. (2013)	✓	✓	✓	✓	✓	✓	X	✓

Note. X = does not meet the standard

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Discussion

The major purpose of the review is to identify RBPs that support increasing peer interaction in children with HI. The seven empirical studies included in this review were published in peer-reviewed journals from 1990 to 2023. All the reviewed studies evaluated the effectiveness of practices used to enhance peer interaction in children with HI. Regardless of methodological differences, the participants displayed improvements in peer interaction. The results indicated that four practices were used to increase peer interaction in children with HI: multifaceted training, parallel talk, social intervention, and social stories. Although the reviewed studies suggested that the practices were effective, peer interaction across the participants varied widely in the literature. This variation can be attributed to several factors, such as the heterogeneity of children with HI, different educational settings, different practices, different intervention agents, and practice intensity.

Overall, no practices demonstrated high efficacy in increasing peer interaction in all children with HI based on the reported effect sizes. Although these studies showed positive effects in terms of enhancing peer interactions in children with HI, analyzing these studies underscored several methodological limitations. First, CEC (2014) considers methodologically sound research to have at least three data points that display the experimental effect in each study phase. However, one study with a strong design had fewer than three data points in one phase (e.g., Rasing & Duker, 1992). Another study used a pre-experimental AB design (i.e., Raver, Bobzien, Hester, et al., 2013). Researchers reported that this design is not strong enough to confirm that the independent variable caused the changes in dependent variables because there were not enough replication effect data points (Byiers et al., 2012).

Second, the effect size was infrequently reported across studies (e.g., Antia et al., 1994; Antia & Kreimeyer, 1996). Reporting effect sizes is

important to determine whether the intervention had not only statistical significance but also practical significance (Travers et al., 2017).

Third, there were unclear operational definitions and overlap among different operational definitions for dependent variables in the study of Antia et al. (1994). For instance, the authors included “sharing materials” in definitions for three dependent variables: interaction, positive interaction, and nonlinguistic interaction. As a result, how the coders distinguished among these dependent variables while coding was also unclear. This limitation makes it difficult to replicate the study.

Fourth, the reported implementation fidelity varied with each study. The CEC (2014) considers implementation fidelity one of the quality indicators to determine whether the research is considered methodologically sound. It is one of the quality indicators of single-subject research (Horner et al., 2005) and group experimental research (Gersten et al., 2005). High-quality research should not only report the implementation fidelity but also report how it is measured (Gersten et al., 2005). It determines whether the lack of children’s progress is due to an ineffective practice or less rigor in implementing the practice; as a result, educators can decide whether a practice should be implemented or replaced (Collier-Meek et al., 2013). Only one study met this criterion (i.e., Raver, Bobzien, Richels, et al., 2013). Although some of the reviewed studies reported the treatment fidelity, they did not explicitly state whether they measured it across all interventions, participants, and behaviors. Likewise, they did not specify whether they measured it throughout the intervention implementation (i.e., at the beginning, middle, and end) of the study (e.g., Raver, Bobzien, Hester, et al., 2013). Other studies did not report implementation fidelity at all (e.g., Antia & Kreimeyer, 1997).

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Fifth, the number of children used in the intervention groups varied across the studies, and no numbers for ideal outcomes were noted by the researchers. Two studies implemented the intervention in groups ranging from four to eight children: half of them were children with HI, while the rest were children with typical development (i.e., Antia et al., 1994; Antia & Kreimeyer, 1996). Another study paired a child with HI and a child with typical development (i.e., Raver, Bobzien, Richels, et al., 2013). Researchers found that better outcomes emerged when a child with HI was paired with one peer with typical development compared to being paired with two peers with typical development (Martin et al., 2010). Relatedly, a few of the reviewed studies sometimes pulled children out of their classrooms to implement the intervention instead of implementing all interventions in naturalistic environments (e.g., Antia & Kreimeyer, 1997). Some researchers do not prefer pulling children out of their naturalistic environments because those children might not be able to generalize or maintain social interaction (Bellini et al., 2007).

Sixth, the Division for Early Childhood (DEC) emphasizes using peer-mediated strategies to teach social communication skills for young children with disabilities (Sandall et al., 2005). Far less attention has been paid to using peer-mediated strategies to increase peer-to-peer interaction in children with HI. None of the reviewed studies used peers as a primary interventionist to enhance peer interaction in children with HI.

Finally, there is an overlap in authorship among the reviewed studies (e.g., Antia et al., 1994; Antia & Kreimeyer, 1996, 1997). Given the importance of implementing EBPs, it is essential for replication research to have a “cumulative knowledge base” (Brandt et al., 2014, p. 217) and to have a level of confidence in the published literature when implementing the practices (Frank & Saxe, 2012). However, Makel and Plucker (2014) found

that only 0.13% of education research was replicated, and most of these replications had overlapping authorships. One criterion used to identify the practice as an EBP is intervention research conducted by three different researchers and in three different institutions without having overlapping authorships (Kratochwill et al., 2012). By doing so, it would increase the use of intervention with generalizability and improve the use of practices (Makel & Plucker, 2014).

In sum, several gaps in the reviewed studies are reported: design issues, infrequently reported effect sizes, vague operational definitions, infrequently reported implementation fidelity, varied numbers of paired children with HI, limited use of peer-mediated strategies, and overlaps in authorship. Given this information, the limitations of this review, implications for practice, and suggestions for future research will be explained in the final section of this paper.

Limitations

Several limitations should be acknowledged in this review. First, since HI populations are identified as having low incidence (Cannon et al., 2016), an insufficient number of experimental studies have been conducted. Thus, the number of reviewed studies was considered relatively sparse. Consequently, it is challenging to ensure that the most effective practices have been used to increase peer interaction in children with HI. Second, most of the reviewed studies are old. Therefore, it is difficult to evaluate existing research based on the CEC quality indicators (2014) because the researchers who conducted the previous studies did not have foreknowledge about the rigorous standards of methodological research that are currently in use (Cook, Tankersley, & Landrum, 2009). Third, the reviewed studies did not meet all the quality indicators (CEC, 2014).

Therefore, there is insufficient evidence to determine whether these practices should be considered EBPs or if they can be identified as RBPs. Fourth, evaluating studies based on those standards relied solely on the author's personal judgment as to whether each study meets the CEC quality indicators (2014) or not. Consequently, interrater reliability was not measured. Finally, this review focused on peer interaction in children with a range of HI degree (e.g., mild & severe), limiting the review findings' reliability.

Implications for Practice

Several implications for practice are derived from this review's findings. The results inform practitioners of five main points. First, they should correctly target best practices that are EBPs and suitable for the needs of children with HI instead of relying on informal strategies to improve peer interactions. Second, regardless of whether the practice is considered an EBP, it does not necessarily work for everyone (Cook & Odom, 2013). Thus, practitioners should continuously collect data on children's progress to determine whether the practice is working. If necessary, practitioners should make alterations to the practice according to children's needs (Gischlar et al., 2009). Third, practitioners should pay special attention to structure interactional opportunities in early ages and in different activities (e.g., table activities, play time).

Fourth, practitioners should consider the potential benefit of peers' participation as interventionists and focus on training them. With peer-mediated intervention, children with HI may display positive outcomes since children learn more from their peers than they learn from adults (e.g., emergent language; Lester & Russell, 2014). Finally, practitioners should plan to implement effective practices in naturalistic environments because

children with HI may be able to generalize and maintain the learned skills once the practice is over (Bellini et al., 2007).

Suggestions for Future Research

Researchers should consider the following for future research. Given a paucity in the number of studies that adhere to the CEC quality indicators, conducting more empirical studies that are rigorous and meet and report all the CEC quality indicators (2014) is critical to identify EBPs for children with HI. Moreover, researchers may consider conducting more systematic replication to examine different kinds of effective practices that promote peer interaction in children with HI. Systematic replications help not only researchers but also educators to generalize the results for different participants, behaviors, and settings (Byiers et al., 2012; Graham et al., 2012).

Conclusion

This review provides information about research quality in the area of peer interaction in children with HI. Its main purpose was identifying RBPs that support peer interaction in children with HI and synthesizing empirical studies. Several practice themes emerged from the reviewed studies: multifaceted training, parallel talk, social intervention, and social stories. The results revealed that all these practices showed positive outcomes in terms of increasing peer interaction in children with HI regardless of the variation of study qualities. Additionally, most of the reviewed studies met the majority of identified quality indicators. Although none of the reviewed studies were identified as methodologically sound research based on the CEC quality indicators and there is a need to conduct additional research to strengthen the evidence of the used practices, these experimental studies added appreciable contributions and practical values to the field. This review

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supports the claims that researchers and practitioners select and apply research-supported methods and effective practices to enhance peer interaction in children with HI. This review also highlights the importance of conducting high-quality experimental studies that align to identify quality indicators.

Ethical Declaration

Disclosure of potential conflicts of interest

The author declared no potential conflict of interest in this research.

Research involving human participants and/or animals

This research has no participants because it is a review not an experimental research.

Informed consent

This research has no informed consent because it has no participants.

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