

Multicomponent Interventions in Early Childhood Education: A Systematic Review

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Abstract: Early interventions influence later school success. Nevertheless, these mostly are domain specific rather than combining the components that are considered important. In this study, it is investigated whether multicomponent interventions combining key domains such as language, mathematics, social-emotional, and cognitive competences show positive effects and support preschoolers in early learning settings. A systematic review of the literature revealed the existence of six multicomponent interventions. These studies used standardized tests for academic learning measures. Measures related to behavior were based on teachers' assessments. The studies all showed significant positive effects concerning speech development and literacy skills, behavior and attention. Further important characteristics and related effects as well as the practical relevance of these studies for future research will be discussed.

Keywords: language, maths, cognition, social-emotional, preschool, prevention

INTRODUCTION

Preventive interventions offer important inputs to help young children cope with challenges in academic and social-emotional learning and therefore should be a priority even in the early years. Many studies have cited the influence of early inputs on later school success (e.g., Duncan et al., 2007; Ehm & Hasselhorn, 2017; Hohm et al., 2017). Children at risk in particular need extra inputs to overcome inequalities and transfer their competences to academic learning settings successfully (Ehm & Hasselhorn, 2017; Frank & Martschinke, 2012). Hence, preschool can be an adequate setting to support early learning and later school success.

Children should be accompanied and encouraged to face individual learning occasions (Eckerth & Hanke, 2015). For this purpose, it seems necessary to engage equally in multiple academic learning domains, such as language, early mathematical skills, social-emotional competences, and cognitive skills. Although effects have not been compellingly verified for all four domains at the same time, strong interactions and connections between them have been substantiated multiple times (Duncan et al., 2007; LeFevre et al., 2010; Lessing, Thomsen, Mähler, & Greve, 2017; Mähler, Petermann, & Greve, 2017; Viljaranta, Lerkkanen, Poikkeus, Aunola, & Nurmi, 2009). The prevalence of learning difficulties in the field of mathematics has been reported to be around three to eight percent (Fischbach, Schuchardt, Mähler & Hasselhorn, 2010; Landerl, Vogel & Kaufmann, 2017). Among preschoolers and first graders, 25-30 % already have obvious problems in speech development (Fried, 2004).

Although most children overcome such problems relatively quickly, nearly 10 % suffer from speech-related problems in school. Moreover, 15-50 % of children from families at risk for poverty have an insufficient level of literacy in their first language. Jungmann (2014) attributes this to the low quantity and quality of the language used in their surroundings. Hohm et al. (2017) support these findings showing a correlation of low income and residual linguistic development: the risk for poverty and delayed speech development can possibly contribute significantly more to behavioral difficulties at early age than risk for poverty and more proficient speech development. It emphasizes that especially the amount of language use is more predictive than social background. Combined learning disabilities occur in 2-8 % of children aged 8 to 12 (Dirks, Spyer, Lieshout, & Sonnevile, 2008; Fischbach et al., 2010; Gold, 2018). Landerl and Moll (2010) found that 40-50 % of 8-to-11-year-olds with striking mathematical problems also have troubles reading and writing (Landerl et al., 2017). In the German Health Interview and Examination Survey of Children and Adolescents (Studie zur Gesundheit von Kindern und Jugendlichen in Deutschland (KiGGS)) by the Robert Koch Institute 16,9 % of 3-to-17-year-olds were found to have mental health problems that could possibly result in emotional and behavioral problems (Klipker, Baumgarten, Göbel, Lampert, & Hölling, 2018).

These mutual connections provide reasonable arguments for combining domain-specific interventions in early child educational settings to counteract various inequalities (i.e., socioeconomic status or predispositions) and develop a consistent basis for later learning (Ehm & Hasselhorn, 2017). Compensatory interventions can be implemented in the daily routine or in planned sequences by the teachers. In their meta-analysis of 213 school based, universal social and emotional learning (SEL) programs involving 270.034 students from kindergarten to high school, Durlak, Weissberg, Dymnicki, Taylor, and Schellinger (2011) introduce four practices, i.e. Sequenced, Active, Focused, Explicit (SAFE). These practices have been associated with effective skills training in social and emotional learning in the context of school-based universal interventions. However, we think they can possibly be applied to early childhood education toward implementing preventive interventions in the early years. Belwitt et al. (2018) reported positive effects of a specific training on social-emotional competences in preschool-age children. In their meta-analysis, they found little-to-moderate effects of universal programs on emotion regulation strategies, learning strategies, and social-emotional competences training. Wang, Firmender, Power and Byrnes (2016) also found moderate effects of precursors in mathematics on preschoolers. The effects on language-focused interventions are certainly limited in their relevance in different languages. However, positive effects of phonologically oriented interventions on preschoolers have been found in international studies. According to these promising results, Wolf, Schroeders, and Kriegbaum (2016) carried out a meta-analysis on interventions in teaching German language skills. They reported small and moderate effects in early writing skills. Positive effects of cognitive-oriented interventions were cited in the meta-analysis of Camilli, Vargas, Ryan, and Barnett (2010).

Thus far, no effects among preschoolers have been reported for combined interventions that implement all four domains at the same time, despite their relevant impact in later school and learning success. Therefore, it is necessary to find feasible ways to create and implement such interventions for children of early age in childcare centers, given that many children spend most of the daytime in these settings and deserve high-quality use of their time. Single-domain interventions have proven to be effective and sustainable for many years during children's school career. Nevertheless, the combination

of all domains can be an enhanced option to focus on toward achieving substantial learning in early educational settings. There is no overview of such interventions at present. Therefore, a systematic literature search is necessary to determine whether combined interventions that implement language, early mathematical, social-emotional, and cognitive skills training exist in early childcare centers. If such previous works are found, it would be of interest to examine the effects associated with the target interventions.

METHOD

Literature Search

Based on previous research (e.g., Beelmann, Pfof, & Schmitt, 2014; Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011), five criteria were applied in the literature search:

1. The children targeted for the interventions must be ages 4 to 6 years.
2. The interventions must be center-based; preventive interventions delivered in medical centers, in the families' homes, or at family childcare settings were excluded.
3. The intervention must contain and deliver at least two of the four educational domains (language development, mathematical precursor competences, cognitive skills, social-emotional competences) in unspecified combination.
4. Studies eligible for the review must include an assessment of the efficacy of the treatment, in which the students were given pretest and posttest measures, and the design applied control groups.
5. The studies must be published in peer-reviewed journals from January 2000 to July 2018.

To identify relevant results, a systematic literature search was done in six academic databases: Academic Search Complete, ERIC, PsycARTICLES, PsycINFO, PSYINDEX and SocINDEX. The following terms were used and combined to find relevant titles and abstracts: (1) educational aim of the intervention (academic achievement, development, attainment, subsequent), (2) target domain of the intervention (*mathematics*: numerical, mathematics, precursor, processing, arithmetic; *language*: phonological awareness, word recognition, spelling, reading, literacy, language; *cognition*: cognitive, learning, category, induction, intelligence, strategy, generalization, working memory, attention; *social-emotional learning*: social, emotional, externalizing, internalizing, behavior, regulation, prosocial, resilience, protective, resource), (3) concept of the intervention itself (intervention, program, training, prevention, modification, support, multicomponent, multifacet), and (4) setting of the intervention (kindergarten, preschool). The titles and abstracts of the resulting sources were reviewed and filtered by applying the inclusion criteria.

A total of 2,339 studies were identified. After deleting duplicates in the research list by using EBSCOhost, 1,712 studies remained. Of these, 1,610 studies were excluded because they did not meet the criteria regarding the targeted methodological or substantial approach (see Fig. 2). After screening the remaining 102 studies one by one, 54 more sources showed to not meet the first three criteria, 29 studies were duplicates, and 16 sources did not have appropriate treatment efficacy measures. Reevaluation of the rejected sources resulted in identifying three more useable studies. These studies actually did meet the applied criteria; thus, they were added to the list (Brigman, Lane, & Switzer, 1999; Brigman & Webb, 2003; Rossbach, Sechtig, & Freund, 2010). Nevertheless, one source fell

just outside the defined time span as it was published in 1999. As it extended the time span for only one year and completely fitted the inclusion criteria it was include in the current literature search. Thus, a total of six studies were used in the review.

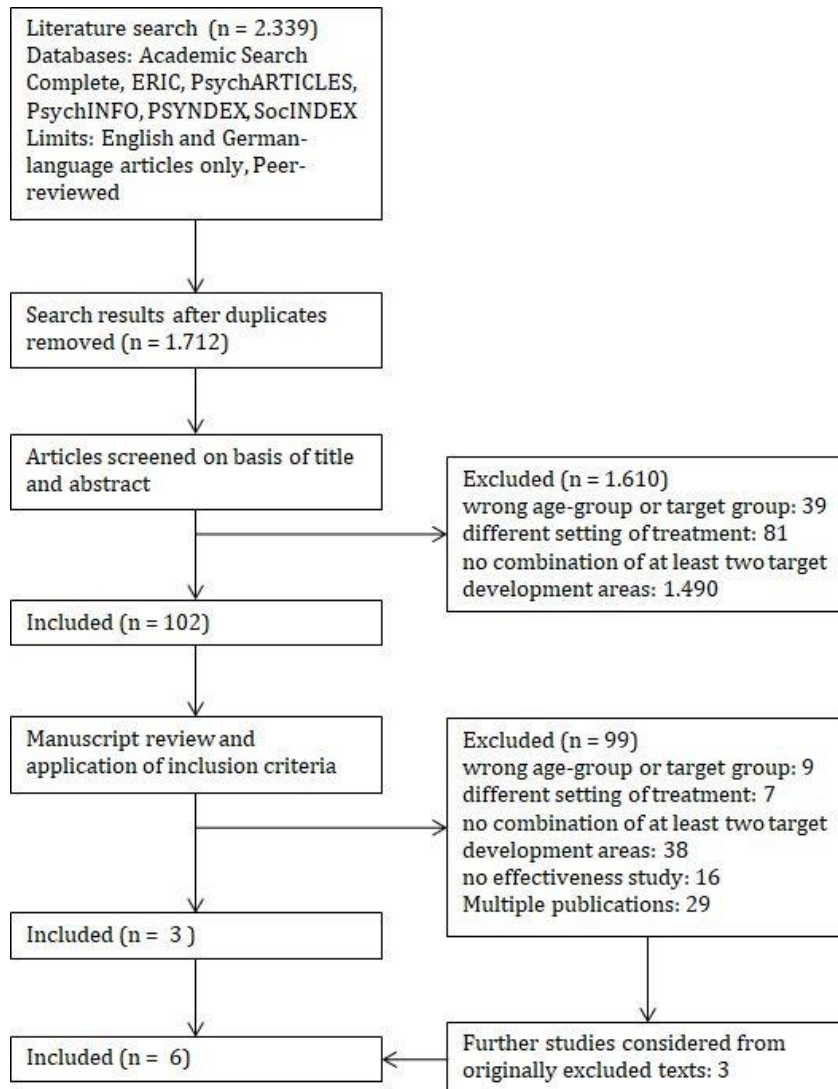


Figure 2. Flow chart showing the results of the literature search.

RESULTS

Table 1 gives an overview of the main characteristics of the resulting sources. Five of the studies were implemented in the United States, and one was carried out in Germany (Rossbach, Sechtig, & Freund, 2010). In sorting the studies, the conceptual difference of early childhood education needs to be considered for further information and discussion of the interventions. The interventions found were arranged according to target age group and related field of practice in chronological order: American pre-kindergarten and the German preschool (pre-K) and other American studies in kindergarten (K).

Table 1. Results and overview of the studies obtained in the literature search.

Setting	Study	Sample & Design	Program characteristics ^a	Measurements	Results ^b
Pre-K	Brigman et al. (1999)	N = 145 (78 treatment, 67 control), crct, pre-post follow-up test	RTL-PreK curriculum, manualized, universal, teacher, group, 12 weeks, 2 hr 1 or 2 x per week, 14-hr workshop	listening comprehension ^s , attention ^t , social skills ^t ; k = 4	listening comprehension (story structure) (r=.21*), behavior (r=.19*) and attention (r=.31***)
Pre-K	Nix et al. (2013)	N = 356 (178 treatment, 178 control), crct, pre-post follow-up test	Head Start REDI & PATHS curriculum, manualized, universal, teacher, group, entire preschool year, 3 or 4 x per week, 24-hr in-service training/weekly meetings	vocabulary ^s , literacy skills ^s , emotion understanding ^s , SPS ^{s&t} , reading ^s , learning ^t , social behavior ^t ; k = 8	increase in vocabulary (β =.25*), emergent literacy skills (β =.24***), emotion understanding and competent social problem solving (β =.36**), and positive social behavior (β =.33**)
Pre-K	Rossbach et al. (2010)	N = 191 (138 treatment, 53 control), crct, assessment at 3 time points during Pre-K and follow-up	KiDZ, unstructured, universal, teacher (team teaching of educator and elementary school teachers), individualized learning plan, preschool year, daily, domain-specific training	vocabulary ^s , literacy ^s , maths ^s , social behavior ^t , intelligence ^t ; k = 12	increase in emergent mathematical competences and literacy skills
K	Blair & Raver (2014)	N = 756 (443 treatment, 316 control), crct and resulting sample, pre-posttest	ToM curriculum, manualized, universal, teacher, individualized, 20 weeks, weekly, 2-year professional development cycle	academic achievem. ^s , vocabulary ^s , EF ^s , working memory ^s , attention ^s , neural efficacy ^s ; k = 9	EF (ES=.14*), attention (ES=.12*) and stress response physiology (ES=.82*)
K	Brigman & Webb (2003)	N = 260 (130 treatment, 130 control), crct, pre-posttest	RTL-K curriculum, manualized, universal, teacher, group, 12 weeks, daily, 16-hr workshop	listening ^s , behavior ^t ; k = 2	positive difference between the groups in listening comprehension (r=.71*) and behavior (r=.79*)
K	Daunic et al. (2013)	N = 57 (30 treatment, 27 control), resulting sample (school) and ird (student), pre-posttest	SELF lesson, manualized, universal, teacher, group, max. 7 weeks, 2 or 3 x per week (16 lessons total), none mentioned	reading ^s , vocabulary ^s , behavior ^t ; k = 8	internalizing behavior (r=.29*), competence (r=.36**), and behavior regulation (r=.58*)

Pre-K: Pre-Kindergarten; K: Kindergarten; N: sample size; crct: cluster randomized control treatment; ird: individual randomized design; a: name, conception of treatment, program format, service delivery personnel, treatment format, program duration, frequency of service contact, training for service delivery personnel; s: self-reported measure; t: teacher/parent-reported measure; k: total number of measures in the study; b: only statistically significant findings are reported; * p =.05, ** p =.01, *** p =.001

Study characteristics

All the studies found in the literature search applied systematic concepts to train academic and socio-emotional competences in young children in early child education centers. The works also intended to support the strengthening of early competences to decrease discrimination and disadvantages at an early age. While fostering social-emotional competences, all programs targeted language-related competences but in different ways. Only the KiDZ project focused on mathematics and science. The ToM project addressed executive functions (EF) as a key element in the concept.

All the studies implemented the training of teachers or educators to provide them with the theoretical and methodological basics of the programs. During the intervention phases, teachers and educators were visited or invited by the coordinators to participate in regular meet-ups to work on teaching practices.

The sequences of the programs were implemented in the educational centers and were either replaced by the present educational work (KiDZ) or, as in all other cases, added to the current pedagogical and educational concept. A secondary aim of the programs was to support and enhance teaching instructions and methods. In the KiDZ project, the instructional quality was evaluated, and a survey on the acceptance of the program by educators, teachers, and parents was carried out.

The methodological approaches of the six programs differed from each other. In two programs (RTL-PreK/K and SELF), topics and social problems were introduced with the help of storybook reading methods. In addition, scaffolding techniques, cooperative learning strategies, or age-appropriate games were used in the sequences. The KiDZ and ToM projects applied an individualized learning plan for each child.

All six studies were demonstration programs. RTL-PreK and K, REDI+PATHS (PATHS-Curriculum: Promoting Alternative Thinking Strategies-Curriculum), and KiDZ were cluster-randomized within the institutions. The ToM project and the SELF curriculum used the available samples in participating school districts. All projects collected data at least at two different time points, i.e. before and after completion of the intervention. The studies in pre-K settings also collected data in kindergarten or even during the first year of primary school. Data on the participating children's behavior were gathered from adults, such as the educators and teachers involved and sometimes also the parents. Academic learning measures were obtained directly from the children.

Programs and effects

The Ready to Learn curriculum (RTL; Brigman, Lane, & Switzer, 1999; Brigman & Webb, 2003) is a concept of training children at preschool age and has been evaluated for different age groups. In spite of the prevailing criteria of the literature search the RTL-PreK (Brigman, Lane, & Switzer, 1999) was added to the list of studies because we identified it as an important study when we scrutinized one of the sources we actually rejected. The program focuses on problem solving in social situations, which are introduced to the children by storybook reading or by having them listen to the story as an audiobook. While the children work on social problem solving (SPS), they are introduced to learning strategies indirectly. The teachers who administer the program can use storybooks, an audio recording on tape, and a manual for instructions. The instructional learning strategies are limited to five, which are used to structure the individual sequences. These sequences are implemented for two

hours weekly over a total of 12 weeks. In the kindergarten version, the authors recommended and applied the program on a daily basis over a period of 12 weeks. In both settings, the target measures listening comprehension and student story (re)telling were collected directly from the child by testing. In contrast to the kindergarten version of the RTL curriculum, in the pre-kindergarten setting, the coordinators also observed the on-task behavior, which was found to be significantly different between the control and the intervention group. Moreover, a significant effect in the story (re)telling measures was found in the pre-kindergarten program. In the kindergarten version, listening comprehension improved significantly compared with the control group. In both programs, a significant difference was found in the assessment of the children's behavior.

Nix, Bierman, Domitrovich, and Gill (2013) tested the Research-based, Developmentally Informed (REDI) curriculum, which was part of the Head Start program. The aim of the REDI intervention was to improve children's early language and emergent literacy skills by also training emotion understanding, social problem solving, and positive social behavior at the age of four. The social-emotional elements of the training were added by the Preschool Promoting Alternative Thinking Strategies (PATHS) curriculum (Domitrovich, Greenberg, Kusche, & Cortes, 2005). Dialogic reading and scripted questions, as well as multiple sound games, were encouraged by the Head Start teachers to improve the narrative skills and vocabulary of the children. Selected toys and a manual for instructions, i.e., for alphabet centers, were available for use in the sequences. Listening comprehension tasks were used to improve phonological awareness. The teachers implemented multiple sequences during the week. The PATHS curriculum gave twice weekly focus on social skills, such as sharing with others and friendship with peers, as well as emotion regulation and problem solving in social situations. The program lasted throughout the entire preschool year. Behavior assessments were done by parents and teachers. Measurements of language-related skills and emotion understanding were assessed with the child. Significant effects of the treatment were found in behavior, children's vocabulary, and emergent literacy skills.

Rosbach, Sechtig, and Freund (2010) was the only non-American study found in the literature search. The Kindergarten of the Future (Kindergarten der Zukunft; KiDZ) program was implemented from the beginning of the children's stay in pre-kindergarten until they transferred to school. During this time, the children were supported in learning language-related skills and in improving their social-emotional competences, mathematical precursor competences, and science-related skills and knowledge. A manual provided instructions for the planned sequences and the pedagogical methods. In addition to an evaluation of the children's improvements, the project also analyzed the feasibility of the program. A new concept in this project was the cooperative work of educators and teachers in the child education centers and in the sequences. Academic measurements were applied to the children; behaviors regarding social skills, positive social behavior with others, and problematic behavior were assessed by educators and teachers. Improvements were found in mathematical and language skills. However, the treatment did not show any improvements on the behavioral measurements assessed by educators and teachers.

In the Tools of the Mind (ToM) program (Blair & Raver, 2014), mathematical and literacy skills, as well as science-related competences and social skills, were trained. The teachers initiated individual learning for each child, aided by individual learning plans and scaffolding technics. With instruction and help from the teachers, the children were trained in self-regulation strategies, executive functions, and meaningful interactions with

classmates over a period of 20 weeks. All measurements were collected from the children. The coordinators collected saliva samples from the children to obtain information on their physical reactions. The treatment results showed a difference in executive functions, attention, and physiological parameters of stress level.

In the Social-Emotional Learning Foundations (SELF) curriculum, Daunic et al. (2013) evaluated a treatment for students at risk. Social situations and problem solving were introduced by storybook reading and scripted group discussions, after which the children were asked to answer w-questions or retell the stories. The sequences of the SELF curriculum were taught twice or thrice weekly over a period of seven weeks. Reading and vocabulary were tested with the children individually. Internalizing and externalizing behavior, and behavior regulation were assessed by the teacher. Significant treatment effects were found on internalizing behavior and related knowledge on emotion regulation. Moreover, behavior regulation showed significant treatment effects.

DISCUSSION

The aim of the literature search was to find multicomponent interventions on the target domains, namely, early language skills, mathematical precursors, social-emotional competences, and cognitive learning strategies. Six studies were found to meet the criteria; however, these contained varying concepts of multicomponent interventions.

Content

Multicomponent interventions. The literature search showed that most interventions combined language and social-emotional content in early child educational settings. Mathematical or other cognitive elements of early development, such as executive functions, were included in only two of the studies (KiDZ and ToM). In the RTL pre-kindergarten program, the attentional abilities of the children were also of interest. Although all the interventions trained cognitive concepts, and thus language or quantitative understanding in early child development, an explicit cognitive training was often not present in early interventions. According to Schründer-Lenzen (2013), the training of language skills is of primary interest in early child interventions and therefore attracts much more attention than the other components of cognitive learning, as shown in recent politics, pedagogical and didactic approaches, and the current literature discourse (i.e., Mähler, Petermann, & Greve, 2017). However, domain-specific deficits can result in serious problems for children during their school career and can lead to single or multiple learning difficulties (Gold, 2018; Mähler, Petermann, & Greve, 2017). Nevertheless, there is no certainty as to which domain exactly plays a role in these discontinuities.

Academic learning can also be related to behavioral problems. Martinez and Semrud-Clikeman (2004) report correlations of single learning difficulties (reading or math), emotional adjustment, and school functioning. According to them, children with reading disabilities have less problems in emotional adjustment and school functioning compared to children with difficulties in math. Hence, children with multiple learning disabilities may have even more problems in school functioning and emotional adjustment in school, because of comparisons with their typically achieving peers and the experience of repeated academic failures. Although math has a huge impact on school success, fewer studies have

taken it into account compared with works in other domains (Visser, Büttner, & Hasselhorn, 2018). Anyhow, two of the resulting studies (RTL-PreK and ToM) focused on cognitive functioning strategies in early childhood education, mirroring the current interest in the literature (Gold, 2018; Koenigs, Schuchardt, & Mähler, 2018; Schründer-Lenzen, 2013).

Effective preventive intervention. Both the SAFE criteria by Durlak et al. (2011) and the principles of early learning interventions (Glaser & Grünke, 2017) were applicable in the studies under discussion. Not only were all interventions operated by the teachers in the institutions, thus enabling them to provide knowledge and skills explicitly, but also the early entrance and multiple-week duration within early childhood education met the criteria (Wilson & Lipsey, 2007). The interventions mostly used self-regulatory and cooperative learning methods, which allowed the children to manage and control their own behavior and also trained them with their peers. Glaser and Grünke (2017) emphasized that error correction had to be carried out immediately for assimilation and storage of appropriate knowledge. However, the extent to which error correction was practiced in the interventions was not apparent.

Implementation. Successful implementation is an important feature of preventive interventions (Wilson, Lipsey, & Derzon, 2003; Wilson & Lipsey, 2007). All the interventions under discussion were implemented during multiple weeks. The SELF curriculum, which took seven hours, was the shortest of all six interventions. The KiDZ program was implemented throughout the three years that children are commonly in early child centers in Germany. Among the combined interventions found in the literature search (excluding KiDZ), the REDI+PATHS program was the longest, with a total duration of 12 months. Regarding frequency, all interventions took place weekly. In their meta-analysis, Wilson and Lipsey (2007) stressed the positive influence and referred to the significant positive effects on behavior of regular weekly sequences.

All the studies showed positive effects on the academic learning measures, which were obtained directly from the children. In contrast, the behavioral measures, collected through external assessments by teachers or parents, showed clearly lower results. The differences in the reported effects could be explained by the data collection methods applied in the studies. Academic learning measures test knowledge about a specific field, whereas behavioral aspects determine behavior as perceived by teachers and parents; the latter was not part of the interventions. The differences in the effects related to knowledge on one hand and external assessments of behavior on the other hand have been previously validated in the meta-analysis by Beelmann et al. (2014). External assessments are economic in implementation and evaluation; however, they obtain behavioral measurements that need to be understood, accepted, and integrated into an individual's behavior to an extent that it becomes observable by others. This process takes time for both the individual and the observer to recognize and therefore can result in very low or even no effects at all. Furthermore, the authors of the RTL curriculum reported differences in results, which could serve as a basis for further evaluations to verify the effects. The studies obtained in the literature search did not indicate the extent to which the program implementation was controlled.

Improvement of intervention quality. All the studies evaluated the intervention for children of preschool age. In addition, the researchers also aimed to improve the quality of instruction by the teachers. By carrying out process-oriented workshops and regular visits to the sequences by the research teams, the teachers in the institutions were supported in applying new instructional competences regarding contents and methods, thus creating

advantages for both the children and the teachers. Accordingly, some researchers, such as Klibanoff, Levine, Huttenlocher, Vasilyeva, and Hedges (2006) and Reicher and Jauk (2012) confirmed that learning could be even more successful when teachers are more proficient. Only the KiDZ study evaluated the quality of instruction and the acceptance of the intervention from the perspective of the teachers, with the results showing general popularity.

Limitations

Because of the extensive combination of search terms, additional results could have been missed. Three studies have been added to the result list which have not been identified by the designated terms. The problem could be that the concerning field of multicomponent interventions on preschoolers still needs to find characteristics in order to be noticeable and traceable. Besides, the studies in the results list were considered when they met only two of the four domains. The combination of all four key domains would have been desirable; however, this was not realistic because multicomponent interventions are still not that common in early child education settings. This, in fact, represents a novelty within the current discourse and therefore produces the above-mentioned complex combination of search terms. More terms, such as *language* or *development*, could have been added to the search terms, which could have resulted in more hits.

Also, the comparability of early childhood educational approaches was limited by the different national preconditions. According to the Organisation for Economic Cooperation and Development (OECD, 2006), there are two types of preschool systems; the United States applies the “readiness for school” approach, whereas Germany applies the “social pedagogy” approach. The latter term refers to the tendency to let the child prepare for life, while the other term describes an orientation on cognitive development, skills and knowledge, whereas the rather traditional approach in Nordic and Central European countries has been criticized for rejecting teaching-oriented efforts in early educational settings (OECD, 2006; Rossbach, Sechtig, & Freund, 2010; Schründer-Lenzen, 2013). Not surprisingly, there were more studies from the United States in the research list. Considering the difference between the German preschool system and the multiple conditions in the North American preschool system, the term *pre-kindergarten* should have been added to the term list to specify the age group or setting.

Implications for Research and Practice

A total of six studies on combined and evaluated preventive interventions for early child educational settings were found in the literature search. All studies had positive significant effects on most of their variables. Four programs (RTL-PreK, Head Start REDI & PATHS, KiDZ, RTL-K) had positive significant results on academic learning related measures, such as vocabulary, reading, literacy, listening comprehension and maths. The RTL-PreK curriculum shows a significant increase in listening comprehension, behavior and attention. The later version for kindergarten (RTL-K) attains large effects in listening and behavior. The REDI & PATHS training in the context of Head Start program also shows positive effects on the vocabulary and literacy related variables. This training also reports positive effects on the variables concerning behavior (emotion understanding, problem solving, and positive social behavior). The KiDZ training shows positive increase in the fields of early

mathematical skills and also literacy. Two of these studies also were successful in achieving social-emotional knowledge (RTL-K, Head Start REDI & PATHS curriculum). The ToM and SELF curriculums were successful teaching Executive Functions and further social-emotional competences. They both attained small to big effect sizes in their variables. Nevertheless, such interventions are sparse and combine only specific domains. The current discourse suggests the combination of the four central domains, namely, language, math, cognition, and social-emotional learning, to foster the development of these competences and to best prepare children for their school career. Although there are different perceptions and approaches to early childhood education, the potential of early education should be reconsidered toward managing and creating meaningful and sustainable learning settings for young children.

The present work shows the importance of executing studies of early multiple component interventions for children of pre-kindergarten and preschool ages. An important question is how such interventions could be organized and implemented successfully. In addition, determining which domain-specific methods are effective and encouraging is also of special interest.

REFERENCES

References marked with an asterisk indicate studies included in the systematic review.

- Beelmann, A., Pfof, M., & Schmitt, C. (2014). Prävention und Gesundheitsförderung bei Kindern und Jugendlichen. *Zeitschrift für Gesundheitspsychologie*, 22(1), pp. 1-14. <https://doi.org/10.1026/0943-8149/a000104>
- Belwitt, C., Fuller-Tyszkiewicz, M., Nolan, A., Bergmeier, H., Vicary, D., Huang, T., . . . Skouteris, H. (2018). Social and Emotional Learning Associated With Universal Curriculum-Based Interventions in Early Childhood Education and Care Centers. A Systematic Review and Meta-analysis. *JAMA Network Open*, 1(8), pp. 1-19. <https://doi.org/10.1001/jamanetworkopen.2018.5727>
- *Blair, C., & Raver, C. C. (2014). Closing the Achievement Gap through Modification of Neurocognitive and Neuroendocrine Function: Results from a Cluster Randomized Controlled Trial of an Innovative Approach to the Education of Children in Kindergarten. *PLoS ONE*, 9(11), pp. 1-13. <https://doi.org/10.1371/journal.pone.0112393>
- *Brigman, G., & Webb, L. (2003). Ready to Learn: Teaching Kindergarten Students School Success Skills. *The Journal of Educational Research*, 96(5), pp. 286-292. <https://doi.org/10.1080/00220670309597641>
- *Brigman, G., Lane, D., & Switzer, D. (1999). Teaching Children School Success Skills. *The Journal of Educational Research*, 92(6), pp. 323-329. <https://doi.org/10.1080/00220679909597615>
- Bundesministerium für Familie, Senioren, Frauen und Jugend (2018, 06 20). *Kita und Hort: Zahl der betreuten Kinder wächst*. Retrieved 01 11, 2019, from <https://www.bmfsfj.de/bmfsfj/themen/familie/kita-und-hort--zahl-der-betreuten-kinder-waechst/126700>
- Camilli, G., Vargas, S., Ryan, S., & Barnett, W. S. (2010). Meta-Analysis of the Effects of Early Education Interventions on Cognitive and Social Development. *Teachers College Record*, 112(3), pp. 579-620.

- *Daunic, A., Corbett, N., Smith, S., Barnes, T., Santiago-Poventud, L., Chalfant, P., . . . Gleaton, J. (2013). Brief Report: Integrating Social-Emotional Learning with Literacy Instruction: An Intervention for Children at Risk for Emotional and Behavioral Disorders. *Behavioral Disorders*, 39(1), pp. 43-51.
<https://doi.org/10.1177/019874291303900106>
- Dirks, E., Spyer, G., Lieshout, E. C., & Sonnevile, L. (2008). Prevalence of Combined Reading and Arithmetic Disabilities. *Journal of Learning Disabilities*, 41(5), pp. 460-473.
<https://doi.org/10.1177/0022219408321128>
- Domitrovich, C. E., Greenberg, M. T., Kusche, C. A., & Cortes, R. (2005). *The preschool PATHS curriculum*. South Deerfield, MA: Channing Bete.
- Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., . . . Japel, C. (2007). School Readiness and Later Achievement. *Developmental Psychology*, 43(6), pp. 1428-1446.
<https://doi.org/10.1037/0012-1649.43.6.1428>
- Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The Impact of Enhancing Students' Social and Emotional Learning: A Meta-Analysis of School-Based Universal Interventions. *Child Development*, 82(1), pp. 405-432.
<https://doi.org/10.1111/j.1467-8624.2010.01564.x>
- Eckerth, M., & Hanke, P. (2015). *Übergänge ressourcenorientiert gestalten: Von der KiTa in die Grundschule*. Stuttgart: Kohlhammer.
- Ehm, J.-H., & Hasselhorn, M. (2017). Kompensatorische Zusatzförderung zur Erhöhung der Schulbereitschaft. In U. Hartmann, M. Hasselhorn, & A. Gold (Eds.), *Entwicklungsverläufe verstehen - Kinder mit Bildungsrisiken wirksam fördern. Forschungsergebnisse des Frankfurter IDeA-Zentrums* (pp. 295-311). Stuttgart: Kohlhammer.
- Fischbach, A., Schuchardt, K., Mähler, C., & Hasselhorn, M. (2010). Zeigen Kinder mit schulischen Minderleistungen sozio-emotionale Auffälligkeiten? *Zeitschrift für Entwicklungspsychologie und Pädagogische Psychologie*, 42(4), pp. 201-210.
<https://doi.org/10.1026/0049-8637/a000025>
- Frank, A., & Martschinke, S. (2012). Förderung emotionaler, personaler und sozialer Kompetenzen in Kindertagesstätte und Grundschule. In S. Pohlmann-Rother, & U. Franz (Eds.), *Kooperation von KiTa und Grundschule* (pp. 137-153). Köln: Carl Link.
- Fried, L. (2004). *Expertise zu Sprachstandserhebungen für Kindergartenkinder und Schulanfänger. Eine kritische Betrachtung. Schlüsselkompetenz Sprache*. Retrieved 04 04, 2018, from
https://www.dji.de/fileadmin/user_upload/bibs/271_2232_ExpertiseFried.pdf
- Glaser, C., & Grünke, M. (2017). Kinder und Jugendliche mit Verhaltensproblemen und Lernschwierigkeiten. In M. Philipp (Ed.), *Handbuch Schriftspracherwerb und weiterführendes Lesen und Schreiben* (pp. 347-360). Weinheim: Beltz Juventa.
- Gold, A. (2018). *Lernschwierigkeiten. Ursachen, Diagnostik, Intervention* (2. ed.). (M. Hasselhorn, W. Kunde, & S. Schneider, Eds.) Stuttgart: Kohlhammer.
- Hohm, E., Laucht, M., Zohsel, K., Schmidt, M. H., Esser, G., Brandeis, D., & Banaschewski, T. (2017). Resilienz und Ressourcen im Verlauf der Entwicklung. Von der frühen Kindheit bis zum Erwachsenenalter. *Kindheit und Entwicklung*, 26(4), pp. 230-239.
<https://doi.org/10.1026/0942-5403/a000236>

- Jungmann, T. (2014). Sprache. In A. Lohaus, & M. Glüer (Eds.), *Entwicklungsförderung im Kindesalter. Grundlagen, Diagnostik und Intervention* (pp. 161-182). Göttingen: Hogrefe. <https://doi.org/10.1026/1616-3443/a000299>
- Klibanoff, R. S., Levine, S. C., Huttenlocher, J., Vasilyeva, M., & Hedges, L. V. (2006). Preschool Children's Mathematical Knowledge: The Effect of Teacher "Math Talk". *Developmental Psychology*, 42(1), pp. 59-59. <https://doi.org/10.1037/0012-1649.42.1.59>
- Klipker, K., Baumgarten, F., Göbel, K., Lampert, T., & Hölling, H. (2018). Mental health problems in children and adolescents in Germany. Results of the cross-sectional KiGGS Wave 2 study and trends. *Journal of Mental Health Monitoring*, 3(3), pp. 34-41.
- Koenigs, J., Schuchardt, K., & Mähler, C. (2018). Wirksamkeit eines kombinierten Lese-Rechtschreib- und Aufmerksamkeitstrainings. *Lernen und Lernstörungen*, pp. 1-12. <https://doi.org/10.1024/2235-0977/a000248>
- Landerl, K., & Moll, K. (2010). Comorbidity of learning disorders: prevalence and familial transmission. *The Journal of Child Psychology and Psychiatry*, 51(3), pp. 287-294. <https://doi.org/10.1111/j.1469-7610.2009.02164.x>
- Landerl, K., Vogel, S., & Kaufmann, L. (2017). *Dyskalkulie. Modelle, Diagnostik, Intervention*. München: Ernst Reinhardt.
- LeFevre, J.-A., Fast, L., Skwarchuk, S.-L., Smith-Chant, B. L., Bisanz, J., Kamawar, D., & Penner-Wilger, M. (2010). Pathways to Mathematics: Longitudinal Predictors of Performance. *Child Development*, 81(6), pp. 1753-1767. <https://doi.org/10.1111/j.1467-8624.2010.01508.x>
- Lessing, N., Thomsen, T., Mähler, C., & Greve, W. (2017). Selbstregulation und flexible Zielanpassung im Vorschulalter. *Kindheit und Entwicklung*, 26(1), pp. 19-27. <https://doi.org/10.1026/0942-5403/a000212>
- Mähler, C., Petermann, U., & Greve, W. (2017). Sozial-Emotionale und Kognitive Fertigkeiten als Regulationskompetenzen. *Kindheit und Entwicklung*, 26(1), pp. 1-6. <https://doi.org/10.1026/0942-5403/a000210>
- Martinez, R. S., & Semrud-Clikeman, M. (2004). Emotional Adjustment and School Functioning of Young Adolescents with Multiple Versus Single Learning Disabilities. *Journal of Learning Disabilities*, 37(5), pp. 411-420. <https://doi.org/10.1177/00222194040370050401>
- *Nix, R. L., Bierman, K. L., Domitrovich, C. E., & Gill, S. (2013). Promoting Children's Social Emotional Skills in Preschool Can Enhance Academic and Behavioral Functioning in Kindergarten: Findings From Head Start REDI. *Early Education & Development*, 24(7), pp. 1000-1019. <https://doi.org/10.1080/10409289.2013.825565>
- Organisation for Economic Cooperation and Development (2006). *Starting Strong II. Early Childhood and Education*. Retrieved 09 10, 2018, from https://www.unicef.org/easterncaribbean/spmapping/Implementation/ECD/StartingStrongII_OECD_2006.pdf
- Reicher, H., & Jauk, M. (2012). Programme zur Förderung sozialer Kompetenz im schulischen Setting. In M. Fingerle, & A. Beilmann, *Prävention von Verhaltensauffälligkeiten bei Kindern und Jugendlichen. Programme auf dem Prüfstand* (pp. 29-48). München: Ernst Reinhardt.

- *Rossbach, H.-G., Sechtig, J., & Freund, U. (2010). Empirische Evaluation des Modellversuchs "Kindergarten der Zukunft - KiDZ". Ergebnisse der Kindergartenphase. Bamberg: University of Bamberg Press.
- Schründer-Lenzen, A. (2013). *Schriftspracherwerb* (4 ed.). Wiesbaden: Springer. <https://doi.org/10.1007/978-3-531-18947-5>
- Viljaranta, J., Lerkkanen, M.-K., Poikkeus, A.-M., Aunola, K., & Nurmi, J.-E. (2009). Cross-lagged relations between task motivation and performance in arithmetic and literacy in kindergarten. *Learning and Instruction*, 19, pp. 335-344. <https://doi.org/10.1016/j.learninstruc.2008.06.011>
- Visser, L., Büttner, G., & Hasselhorn, M. (2018). Komorbidität spezifischer Lernstörungen und psychischer Auffälligkeiten: ein Literaturüberblick. *Lernen und Lernstörungen*, pp. 1-14. <https://doi.org/10.1024/2235-0977/a000246>
- Wang, A. H., Firmender, J. M., Power, J. R., & Byrnes, J. P. (2016). Understanding the program effectiveness of early mathematics interventions for prekindergarten and kindergarten environments: A meta-analytic review. *Early Education and Development*, 27(5), pp. 692-713. <https://doi.org/10.1080/10409289.2016.1116343>
- Wilson, S. J., Lipsey, M. W., & Derzon, J. H. (2003). The Effects of School-Based Intervention Programs on Aggressive Behavior: A Meta-Analysis. *Journal of Consulting and Clinical Psychology*, 71(1), pp. 136-149. <https://doi.org/10.1037/0022-006X.71.1.136>
- Wilson, S., & Lipsey, M. W. (2007). School-Based Interventions for Aggressive and Disruptive Behavior. Update of a Meta-Analysis. *American Journal of Preventive Medicine*, 33(2S), pp. 130-143. <https://doi.org/10.1016/j.amepre.2007.04.011>
- Wolf, K. M., Schroeders, U., & Kriegbaum, K. (2016). Metaanalyse zur Wirksamkeit einer Förderung der Phonologischen Bewusstheit in der deutschen Sprache. *Zeitschrift für Pädagogische Psychologie*, 30(1), pp. 9-33. <https://doi.org/10.1024/1010-0652/a000165>

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