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Effective early childhood care and education: Successful approaches and didactic strategies for fostering child development**Kaspar Burger***

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ABSTRACT: This review attempts to determine strategies that can be used to support children's cognitive and social-emotional development in early childhood care and education programs. By synthesizing empirical evidence about pedagogical techniques that promote children's competencies, the review aims to identify those characteristics of programs that ultimately contribute to the effectiveness of early childhood care and education. In particular, the review summarizes strategies that foster children's acquisition of language, math, and social-emotional skills. In so doing, it responds to the needs of program staff who struggle to understand and address the numerous developmental needs of young children and it provides concrete guidance for policymakers and management personnel who aim to design purposeful programs which benefit child development effectively.

RÉSUMÉ: Cette étude cherche à déterminer les stratégies qui permettent de soutenir le développement cognitif et socio-affectif de l'enfant dans l'éducation et l'accueil de jour de l'enfance. En synthétisant des données empiriques sur des techniques pédagogiques encourageant les compétences de l'enfant, l'étude vise à identifier les éléments qui, en fin de compte, contribuent à l'efficacité de l'éducation et l'accueil de jour de l'enfance. En particulier, l'étude résume des stratégies qui favorisent l'acquisition de compétences linguistiques, mathématiques et socio-affectives. Ce faisant, elle répond aux besoins des professionnels du domaine de l'éducation de la petite enfance qui essaient de comprendre et satisfaire les besoins de jeunes enfants. En plus, l'étude fournit des conseils concrets pour les responsables politiques et pour le personnel de gestion qui veulent développer des programmes favorisant le développement de l'enfant de manière appropriée et efficace.

RESUMEN : Este estudio trata de determinar las estrategias que permiten apoyar el desarrollo cognitivo y socio-afectivo del niño en guarderías. Sintetizando datos empíricos sobre técnicas pedagógicas que incentivan las competencias del niño, el estudio pretende identificar los elementos que, al fin y al cabo, contribuyen a la eficiencia de la educación y la acogida de día de los niños. Mas específicamente, el estudio se centra en resumir las estrategias que favorecen las competencias lingüísticas, matemáticas y socio-afectivas. De este modo, atiende a las necesidades de profesionales del sector de la infancia que pretenden comprender y satisfacer la necesidades de jóvenes. Además, el estudio ofrece consejos concretos para los responsables políticos y para el personal de gestión que quieren desarrollar programas a favor del desarrollo de los niños de manera adecuada y eficiente.

ZUSAMMENFASSUNG: Diese Überblicksarbeit versucht auf der Grundlage empirischer Studien didaktische Strategien zu bestimmen, welche in Programmen der frühkindlichen Bildung und Betreuung zur Förderung der kognitiven und sozial-emotionalen Entwicklung von Kindern genutzt werden können. Die Arbeit versucht somit zentrale Determinanten zu eruieren, welche zur Effektivität von frühkindlicher Bildung und Betreuung beitragen. Im Einzelnen zeigt die Arbeit konkrete Strategien auf, welche den Erwerb von sprachlichen, mathematischen und sozial-emotionalen Fähigkeiten unterstützen. Die Arbeit liefert frühpädagogischem Fachpersonal sowie politischen Verantwortungsträgern Handlungsanleitungen für die Ausgestaltung von frühkindlichen Bildungsprogrammen, welche die kindliche Entwicklung effektiv unterstützen.

Keywords: Early childhood care and education; fostering skills; effective approaches; language, math, and social-emotional development

Introduction

There has been much interest in the effectiveness of different strategies for fostering child development. Numerous studies have attempted to determine how children's acquisition of early skills can be best supported. The present study reviews recent empirical research in order to identify pedagogical strategies that benefit child development effectively. It summarizes evidence from studies aiming to inform research-based practices in early childhood care and education. In particular, this review study looks at strategies that support the development of language, mathematics, and social-emotional skills. Thus, it attempts to determine a set of strategies that form the basis of effective early childhood care and education, providing evidence not only for researchers but also for staff working in the early childhood education sector as well as for policymakers who need practical information about techniques that promote children's skills in various developmental domains effectively. This study is not an exhaustive review insofar as it does not include all the studies which addressed a given research question and were published within a given period of time. Instead, it summarizes evidence from studies which addressed different research questions relating to beneficial child development. Thus, the study reports pedagogical strategies that impact favorably on the acquisition of skills which children will need to cope with everyday challenges during both preschool and school years. It includes three major sections, synthesizing strategies to encourage (1) language development, (2) mathematical skills, and

(3) social-emotional development. Furthermore, it discusses ethical dimensions of fostering child development and draws conclusions as to how child development can be facilitated.

Fostering language development

Language acquisition takes place to a great extent during a child's preschool years and is a crucial aspect of child development. It is a significant predictor of children's progress in school as it supports children's success in learning to read (NICHD 2000; Wasik 2006) as well as acquisition of various academic skills because language skills are essential for understanding instruction on various other skill sets (Storch and Whitehurst 2003). In this regard, language acquisition may be considered as a means through which other skills are acquired. For instance, children whose language is further developed can participate more easily in school activities that require language, and they are more likely to be socially well integrated (Esser 2006). Thus the importance of language acquisition for children's subsequent well-being and educational attainment is widely acknowledged (Roulstone et al. 2011).

Moreover, early experience with language is essential in particular for children who grow up in impoverished linguistic environments where the quantity and quality of language interactions between adults and children are low (e.g., deaf parents, adults speaking only pidgin; cf. Warren and Walker 2005). Young children who experience environmental risk factors are more likely to have constraints on their subsequent command of language. Infants from extreme poverty backgrounds, for example, produce fewer vocalizations (Oller et al. 1995). In addition, relative to children with many language-learning opportunities in their homes, young children with fewer opportunities to learn language are more likely to perform poorly on receptive and expressive language measures (Walker et al. 1994). They also use language less frequently and are at risk of developing more limited vocabularies (Hart and Risley 1999).

Given that the *Matthew effect* applies to language development, the demand for providing developmentally appropriate language environments for young children becomes evident. Applied to language development, the Matthew effect describes what happens when some children enter into a positive feedback loop, whereby children are able to acquire better language skills the better their language skills already are (Stanovich 1986). That is, it describes a process whereby early gaps in language skills increase over time. An intervention study on vocabulary development established that children who entered the study knowing the most words ended the study knowing even more words despite the intervention of multiple readings and teacher explanations (Penno et al. 2002). That suggests that strong foundations for acquisition of language should be laid early in life. Early childhood care and education facilities therefore ought to provide an environment that facilitates language development.

Researchers have described various facets of language, including vocabulary (terms or codes used to name entities, attributes, and relationships), semantics (meaning of terms and relationships among terms), syntax (rules specifying the order in which individual elements of a language are concatenated to form larger expressions such as sentences), and pragmatics (principles of use or application of a language). While any of these aspects is important in language development, a great deal of research has focused specifically on *vocabulary*

development (August et al. 2005; Huttenlocher et al. 1991; Mervis 1983). This is partly due to the fact that there are marked differences in vocabulary development between children whereas other dimensions such as syntactic development, for instance, are believed to be more similar across individual children (Huttenlocher et al. 1991). Moreover, acquisition of new words allows children to accurately label objects and activities, learn new concepts, and communicate with others. For instance, a certain amount of vocabulary must be acquired before words can be combined into sentences (several months elapse between the time when children start producing words and the time when they start producing multiword utterances). Furthermore, there are at least two other reasons for the interest in vocabulary development: First, vocabulary is not independent of other aspects of language. For example, verbs frequently encode actions that involve relations among entities (e.g. offer, help, read to, etc.). Second, individual differences in vocabulary size are strongly associated with a variety of linguistic and cognitive abilities such as reading comprehension by school age (Anderson and Freebody 1981; Carlisle 2007). Thus vocabulary has been highlighted as a central component of language development. Children should therefore have frequent opportunities to incorporate new words into their vocabulary to enhance their language skills during the preschool years.

Research found that *exposure to speech* is essential to the acquisition of vocabulary (Brent and Siskind 2001; Hurtado et al. 2008). Children who lack all interaction with human adults do not acquire human language. Based on this observation, Huttenlocher et al. (1991) aimed to analyze the extent to which exposure to speech plays a role in children's early vocabulary growth. They focused on the relation between the amount of speech that parents addressed to their children during the period of accelerated vocabulary growth (at several time points from 14 to 26 months) and the rate of vocabulary growth in those children. Their results suggest that overall amount of parent speech input accounts for a substantial amount of variation among children in acceleration in vocabulary growth. However, vocabulary development reflects a mixture of innate capacity and exposure to language. Hence the results of this study do not preclude the possibility of differences in children's innate capacity to learn from language input. Both parent speech and child vocabulary might depend on a third factor such as a hereditary similarity between parent and child; that is, talkative parents may have higher verbal ability and this ability may be transmitted to their children. Yet the relation between parent and child vocabulary is not a strong one, suggesting that hereditary factors are not solely responsible for vocabulary growth (Huttenlocher et al. 1991). Furthermore, the assumption that exposure to speech influences vocabulary development is in accordance with research that found relations between language input from non-parental caregivers and children's vocabulary acquisition where hereditary factors could not act as confounding variables (Adamson 1995).

However, the mere fact of being exposed to speech cannot explain a child's language acquisition. Characteristics of parent speech other than overall quantity are also essential (e.g. quality of speech, clarity of pronunciation, amount of speech used in informative contexts). Evidence indicates that during formal schooling, about 90 % of the approximately 3.000 words children acquire each year are learned through exposure to words in discourse contexts that are *relevant* to the learner (Baumann and Kame'enui 1991). Hence not any kind of exposure to language effectively boosts vocabulary. Furthermore, despite the importance of

vocabulary for language development, a well-developed vocabulary is not sufficient for children to succeed in everyday life including formal schooling. Effective communication requires more than just vocabulary. Language development should be understood as a holistic process that encompasses the acquisition of various components - vocabulary, syntax, semantics, and pragmatics - which jointly allow for successful communication. In addition, language acquisition is a holistic process insofar as it is intertwined with a child's cognitive and social development. The more adults engage in conversations with children, the quicker children learn language and the higher their IQ scores are (Hart and Risley 1995). The communication environment experienced by the child during the first years of life does not only influence vocabulary development but also impacts on a child's reading, math, and social skills in the first years of formal schooling. How adults communicate and how they interact with children and what they can offer in terms of resources such as books in the first years of a child's life was shown to be essential to children's subsequent performance in various domains (Roulstone et al. 2011). Hence although hereditary factors play a role in language development – as they determine, for instance, universal properties of human language, the existence of a sensitive period for language acquisition, and normal children's rapid acquisition of language (Stromswold 1998) – research shows that environmental influences are indispensable to language development (Hayiou-Thomas 2008).

Four concrete strategies to foster language development

In view of the importance of children's language skills, it is necessary to study how adults can support a child's language development. As theory shows, learning language is a socially based activity even if it has genetic foundations (Grant and McLaughlin 2001). Young children learn language through interactions with other children and adults. They talk with others, ask questions, listen to competent speakers interact, and hear language that describes experiences in their environment. While adults cannot systematically supervise how children talk and interact with each other, they can determine how they themselves interact with children to foster their language skills. Adults can use specific strategies to create opportunities for children to learn language skills. The following paragraph summarizes four strategies to support children's language development: dialogic reading, use of refined words, multiple readings of a story including explanation of unfamiliar expressions, and interactive book reading.

Dialogic reading

Dialogic reading involves techniques such as asking children open-ended questions and having conversations during book reading. Dialogic reading provides children with opportunities to express themselves, to build upon existing language, and to witness language-rich models. It is based on three broad principles: (1) *Encourage the child to participate*: The reader ought to use evocative techniques to assist the child in using language and becoming an active participant in the story telling as opposed to a passive listener. Such techniques include asking questions that encourage novel speech (e.g. 'where are they going?') (2) *Provide feedback to the child*: Adults are to use feedback providing instructive information. Various types of feedback can be appropriate, including recasting what the child has uttered

(rephrasing a child's utterance by correcting one or more components – subject, verb, object – while still referring to its essential meaning), expanding by giving additional information, praising, and labeling particular aspects that the child refers to. (3) *Adapt the reading style to the child's increasing linguistic abilities*: The reading style should be commensurate with a child's command of language (Lever and Sénéchal 2011). Research shows that dialogic can promote children's language development. For instance, children who are asked open-ended questions develop better language skills and make fewer simple utterances than children who are asked questions that require one-word responses or "yes-or-no-responses" (Whitehurst et al. 1988).

Use of refined words

Children's vocabulary acquisition can be facilitated by adults' use of a sophisticated vocabulary. In an experimental study, preschool teachers had to conduct an activity with children. Previously, half of the teachers had been trained to use particular vocabulary words during conversations and as part of their instructions. The other half had not received this training. This study yielded two main findings. First, teachers who were trained to label objects precisely and to use target vocabulary words in meaningful contexts did so during the activity with children whereas teachers without this specific training more often used pronouns, referring to objects as 'it' and 'that' but not using the appropriate labels. The second finding concerned children's language learning process: children whose teachers introduced vocabulary words in multiple meaningful contexts acquired more of the target vocabulary compared to children whose teachers did not provide opportunities for children to pick up the words (Wasik 2006; Wasik and Bond 2001). This is in line with evidence according to which repeated exposure to words increases the likelihood that young children will acquire new vocabulary (Sénéchal et al. 2008).

Multiple readings of a story and explanation of unfamiliar expressions

Multiple readings of a story can increase children's understanding of different words and phrases. However, adults need to provide explicit explanations of unfamiliar expressions. Research showed that children who received explanations during book reading acquired a larger vocabulary than children who did not get any explanations (Penno et al. 2002; Robbins and Ehri 1994). In addition, children who are engaged in dialogue and conversations that go beyond the explicit information presented in a story acquire better language skills than children who do not benefit from such supplementary information (Haden et al. 1996).

Interactive book reading

Interactive book reading includes reinforcing the vocabulary in books by presenting concrete objects that represent the words and by offering children multiple opportunities to use the book-related vocabulary. During interactive book reading, children are engaged in conversations about the book, and they are provided with materials to carry out a book-related activity in practice (e.g. cooking vegetables). In interactive book reading, the use of demonstrations can be a useful tool to promote language development. For example, when describing an abstract activity such as twirling, teachers can demonstrate the action. Research

suggests that children whose teachers provided multiple opportunities to interact with language learn more book-related language skills than children who were exposed to just the books. That is, interactive book reading – which actively involves children and includes discussion of the text as the book is read – can improve children’s language skills (Mol et al. 2009; Wasik and Bond 2001).

Common elements of the four strategies to foster language development

The strategies described above share at least three elements. First, they provide children with opportunities to hear and use language. Even the adults’ use of refined words is not an end in itself. Rather, it is supposed to allow children to adopt new words into their vocabulary so that they can use these words on their own. Second, the four strategies intend to expose children to language models who use language in meaningful contexts that are relevant to children. Adults demonstrate the use of language. They present and explain language purposefully, aiming to engage children in situations that expand and develop their language skills. Third, all the strategies involve direct interactions and a shared focus between adults and children, requiring children’s active involvement. Typically, adults thereby enter in a dialogue with children which is tailored to children’s understanding.

Three types of interactions to put the above mentioned strategies into practice

Dialogic reading, specific use of words, multiple readings of stories including explanation of expressions, and interactive book reading are concrete strategies which adults can use to help children acquire language. However, the efficacy of these strategies depends on how they are applied and put into practice. It is therefore necessary to reflect on the mode in which such strategies can be translated into action. Researchers have distinguished three modes of language intervention to describe how exactly adults can or should interact with children so that children have a learning effect: responsive interaction, milieu teaching, and direct instruction (e.g. Kaiser et al. 1992; Thiemann and Warren 2004; Warren and Walkers 2005). Each of these intervention modes can be regarded as a technique characterized by a specific form of interaction between the adult and the child. Note that different modes of interaction can be used to apply a given strategy to foster language. It is therefore necessary to describe the three modes of language interventions separately from the above mentioned strategies to foster language. Notably, they are discussed in the following paragraphs.

Responsive interaction

In a responsive interaction, the child typically initiates and controls the interaction. Adults follow the child’s attentional lead and respond contingently to the child’s behaviors in a way that is congruent with the child’s immediate interest. Responsive communicative interactions encompass modeling language, recasting language, and expanding a child’s communication attempts. In contrast, the use of directives such as elicited imitation (e.g. “See, this is a dog! What is it?”), commands (e.g. “say dog!”), and testing questions about the child’s attentional focus (“what do you see?”) is discouraged (Yoder et al. 1995).

Milieu teaching

Milieu teaching is a naturalistic, conversation-based language intervention that relies on children's interests as opportunities to model and prompt language in everyday contexts (Hancock and Kaiser 2006; Kaiser and Trent 2007). Milieu teaching approaches are embedded in ongoing interactions, activities, and social routines. They include incidental teaching as well as mand-model procedures.

In the incidental teaching procedure, the child initiates an episode such as pointing at something or vocalizing about something (the child may also be stretching for an object beyond his reach or asking for information etc.). Subsequently, the adult evokes the target response such as a particular word. For instance, a child reaches for a ball and then the adult says "can you say *ball*?" That is, the adult *models* the correct word and attempts to evoke the child's vocalization. Typically, when a child initiates the incidental teaching situation verbally or nonverbally, the adult responds first with the signal of adult presence and attention, and, if the child does not respond to this signal with spontaneous speech, the adult offers a verbal cue. Incidental teaching takes place in naturally occurring, unstructured interactions such as free play which are used by the adult to transmit information or give the child practice in developing a skill.

In the mand-model procedure – an extension of the incidental teaching procedure – the adult observes the focus of the child's interest and initiates the teaching episode by using mands: questions, commands, or directives which require a specific response from the child (LeBlanc et al. 2006; Rogers-Warren and Warren 1980). For example, the child's attentional focus is on a ball on the shelf and the adult says "what do you want?" That is, the adult *prompts* a child's vocalization without modeling the target word(s).

Both techniques share a common feature, notably that adults follow the child's lead. When using milieu teaching, adults wait for children to be prepared (and willing) to learn. When children focus attentively on a particular object or event, they are likely to be motivated to learn something about that object or event. Thus by focusing on a specific object or event, children co-determine to some extent when a teaching episode begins.

Direct instruction

Direct instruction, sometimes referred to as didactic instruction or direct teaching, is characterized by specific prompting, reinforcing, and giving immediate feedback on vocabulary or grammatical targets in structured and scripted sessions. Direct instruction teaching typically presupposes controlling every controllable variable that may affect the child's learning process: teachers act out a prescribed, choreographed teaching sequence. In other words, the instructional variables – including the examples, wording, timing of the words, responses to the learner, use of the hands – are controlled to the greatest possible extent. In direct instruction, the tasks are structured and the teachers' execution of the presentation including the pacing, articulation, corrections etcetera are planned in advance (Hollingsworth and Ybarra 2009).

How the three types of interactions affect children's language development

In an exploratory study, responsive interaction and milieu teaching were compared in terms of their effects on children's language development (Yoder et al. 1995). In this study, responsive interaction included teachers' contingent imitation of children's communicative attempts, expansions, self-talk, and parallel talk. Milieu teaching consisted of prompting children to comment on particular aspects of events and objects, requesting to imitate, asking questions and instructing to verbalize. The study established that milieu teaching was more effective than responsive interaction in facilitating receptive language and expressive vocabulary for children who began the treatment with relatively low receptive and expressive language levels (i.e., a mean length of utterance below 2.5). Responsive interaction, in contrast, was more effective than milieu teaching in promoting receptive language and expressive vocabulary for children who began the treatment with relatively further developed language skills (i.e., a mean length of utterance above 2.5). This suggests that the effectiveness of particular language intervention approaches depends on the level of child development. Children may have to acquire sufficient attentional and memory capacity in order to learn effectively from responsive interactions which require children to differentiate between their own utterance and the adult's subsequent utterance. Children whose processing capacities are only rudimentarily developed benefit from milieu teaching.

In another study, the effectiveness of incidental teaching – a type of milieu teaching which consists of modeling language – was analyzed. Hart and Risley (1975) examined the effects of incidental teaching to five-year-old children whose IQ was below average. This study highlighted that after incidental teaching (i.e., modeling) of compound sentences, increases in unprompted use of compound sentences and spontaneous variety in speech were observed for children (for further evidence on milieu teaching, see Worthington 2011).

However, milieu teaching is not the only strategy that yields positive outcomes. Direct instruction which includes elicited language production prompts such as “what do you see?” have been demonstrated to be effective for children who have already acquired a certain level of language skills (Kinder and Carnine 1991). That is, while younger children and less skilled children seem to benefit in particular from environmentally designed instructional strategies, these strategies might lose their advantage as children become older, increasingly skilled, and more experienced (Sweeting and Rink 1999). Note, however, that there has not yet been a study that compared all three types of interactions (responsive interaction, milieu teaching, and direct instruction) simultaneously.

Overall, the results reported above indicate that dichotomies which pit direct instruction against other forms of teaching strategies such as milieu teaching or responsive interaction are artificial and should not be considered as state of the art of the research. Rather, research supports the notion that children need *balanced instruction* including opportunities for self-directed learning and child-centered discovery as well as more teacher-directed techniques where children are presented with explicit information such as vocabulary (Kraft and Santos 1997). Landry and colleagues (2006) also point out that strategies which facilitate development effectively are sensitive to children's levels of understanding, they adapt to children's varying needs and interests, they are contingently responsive to children's signals, they avoid high levels of restrictions, and they maintain attentional focus as required. Yet such strategies are not exclusively responsible for children's language development. Peers also affect a child's language acquisition. A child's ability to speak and understand words (i.e.

expressive and receptive language) develops more quickly when peers have better language skills. Hence exposure to peers with strong language competencies provides an important resource for language development (Mashburn et al. 2009). Despite the importance of language skills, however, early childhood care and education does not only foster children's language. Instead, effective programs also focus on other domains including mathematical skills.

Fostering mathematical skills

Preschool children have the potential to learn relatively complex mathematics and their knowledge of mathematics can predict not only subsequent math achievement (Jordan et al. 2009) but also overall school success (Clements and Sarama 2011). Furthermore, as with language development, a gap exists between the mathematical knowledge of young children from socio-economically disadvantaged and privileged backgrounds and this gap progressively widens over the course of formal schooling (e.g. Ramani and Siegler 2011). Hence engaging young children – especially underprivileged children with few informal learning opportunities – in mathematical experiences is cognitively foundational. This section exemplifies how children's mathematical knowledge can be fostered in practice. It describes two well-known preschool mathematics programs – the Rightstart program and the Building Blocks program – which aim to enable all preschool-aged children to develop a solid foundation for mathematics as well as, in particular, to increase the mathematical knowledge of children considered to be at risk for school failure. This section does not claim to provide an exhaustive overview of preschool mathematics programs. Rather, it presents a selection of practical exercises designed to enhance children's mathematical knowledge. The two programs are briefly summarized here because multiple studies suggest that they successfully help children develop a foundation of mathematics (see below). As many other reports on mathematical programs (e.g., Clements and Sarama 2011), this section uses the terms 'mathematical knowledge' and 'mathematical skills' interchangeably.

Typically, the mathematical knowledge that children develop early in life includes an understanding of size, shape and patterns, and counting verbally. Somewhat later, children learn to recognize numerals and identify quantity as well as one-to-one correspondence (e.g. matching sets) (Bowman et al. 2001). However, in order to develop this knowledge, children need to acquire a mental number line, that is, an inner representation of a numerical series (e.g. the sequence of numbers from 0 to 10).

The Rightstart program (later renamed Number Worlds), designed to support children's acquisition of a mental number line, improved children's knowledge of number, which in turn supported their learning of more complex mathematics at the beginning of primary school (Griffin et al. 1994). The said math program drew on a variety of games and experiences with diverse models of number including groups of objects, pictures, and thermometers. For example, in one game, two children each roll a die, and the child who rolled the highest number may move his or her token along a number-line path on a playing board. The first child to arrive at the end of the path wins. This game aims to support children's knowledge of number magnitudes and help children count forward along a number line as well as make one-to-one mappings of numbers onto concrete objects when counting. Another game was

designed to give 3- to 4-year-olds an intuitive knowledge of subtraction: Children are given a number of counting chips and told to pretend their chips are cookies. Each child receives the same number of 'cookies' but a different color. Children are asked to count their cookies and then to deposit them in a jar for safe keeping. While the children are sleeping, a mouse takes one cookie from the jar. Children are then asked: whose cookie did the mouse take? Children quickly learn to empty the jar and count the cookies that bear their color. However, it takes significantly longer for many children to understand that if they now have one cookie less the mouse has taken one of their cookies. In the program, children explore this problem by counting and re-counting the remaining cookies and comparing them to each other (e.g. by aligning the cookies). When children make a prediction as to whose cookie the mouse took, children search the mouse's hole to test their prediction. This game allows children to improve their counting skill and also gives them the opportunity to learn about quantity transformations (Griffin 2004).

Beyond the Rightstart program, the Building Blocks program also enhances children's learning of mathematics (Clements et al. 2011). This program was based on teacher professional development stressing teaching by the use of learning trajectories and technology such as computer software, books, and game sheets. A learning trajectory consists of setting a mathematical goal, following a developmental path along which children develop to reach that goal, and using instructional activities or tasks matched to each of the levels of mathematical skills in that path that supports children's development of skills. (Clements and Sarama 2009). The program comprised mathematical themes such as sorting and sequencing, communicating, reasoning, representing, and mathematical problem solving. The instructional approach of the program involved guiding children to extend and mathematize their everyday activities. In practice, children were taught to identify the mathematics in and develop mathematics from their concrete experiences and interests. This occurred in block building, art, songs, and puzzles, through sequenced activities throughout the day. The program involved daily activities and games in whole- and small-group settings, free-choice learning centers, and ideas for integrating mathematics throughout the day. One of the scenarios used in the program is summarized as an example hereafter. It includes activities on recognizing and comparing number, counting, and arithmetic. In order to stimulate *early number recognition and comparing*, children are asked to match pizzas with the same number of toppings. *Counting* is encouraged in a task that consists of creating a pizza with the same number of toppings as a given pizza. *Counting to produce a set that matches a numeral* is fostered through a task that consists of creating a pizza that has a given number of toppings given only a numeral. These tasks are administered through computer software which presents tasks, contingent on children's success, along learning trajectories (e.g. by moving a level forward or backward depending on children's performance). Off-computer activities such as learning-center activities involve corresponding games. Teachers guide children by discussing the tasks, eliciting children's strategies, and modeling successful strategies where applicable. An experimental study established that relative to children who were not exposed to this program, children in the program group showed greater gains in particular in learning to subitize (i.e., determining the number of elements on an object that is shown for a brief period of time only), to sequence, and to identify shape as well as shape composition (i.e., knowing

the shape of an object such as a triangle; and knowing the shape that would result if an original shape were cut) (Clements and Sarama 2007).

There are a number of other preschool math programs targeting children from both socioeconomically disadvantaged and more privileged backgrounds that have been shown to be effective although the magnitude of the positive effects usually diminishes over time after the end of an intervention (e.g. Arnold et al. 2002; Klein et al. 2008; Ramani and Siegler 2011; Siegler and Ramani 2008; Starkey et al. 2004; Young-Loveridge 2004). While the didactic and pedagogical approaches as well as the complexity of the approaches varied with individual programs, most programs involved fostering number sense, enumeration, and arithmetic reasoning including addition and subtraction. Pertinent studies also provide evidence that math-relevant activities should be incorporated in daily routines (Arnold et al. 2002) and that a playful approach to teaching mathematical understanding may be particularly beneficial for young children's mathematical development (Ramani and Siegler 2008). These results suggest that teaching techniques per se are not solely responsible for children's acquisition of mathematical reasoning and skills. Rather, research shows there is also a strong relationship between young children's social-emotional development and their chances of early academic success (e.g. Raver 2002).

Fostering social-emotional development

Social-emotional development is recognized as an important aspect of human development and academic achievement (Denham 2006; Raver and Knitzer 2002). *Social development* involves learning the values and skills that are needed to interact with others, including approaching others, listening, taking turns, sharing, treating others with respect, showing affection appropriately, resolving conflicts, communicating effectively, self-control, and others (ibid.; Underwood and Rosen, 2011). On the other hand, *emotional development* encompasses, amongst others, acquisition of the ability to recognize emotions in one self and others, to channel feelings into socially acceptable behaviors, and to regulate both positive and negative emotions (Broadhead et al. 2010; Nadel and Muir 2005). Children's early experiences and relationships set the stage for how they relate to others and how they manage their feelings. Moreover, their social and emotional adjustment is as essential for school success as intellectual preparedness (Raver and Zigler 1997). As a consequence, early childhood care and education programs have to attend to the social and emotional needs of children. A number of intervention and prevention programs designed to promote young children's social-emotional development – including the development of impulse control, emotional problem solving, and prosocial behavior – have been analyzed (e.g. McMahon et al. 2000; Reynolds et al. 2001; Serna et al. 2000; Webster-Stratton et al. 2001; Yoshikawa 1994). However, amongst these programs it is difficult to identify the approaches that support young children's social-emotional development most effectively because they frequently weave together activities to promote social-emotional as well as academic competencies. Furthermore, many study reports shed little light on how exactly programs promoted children's social-emotional development. Nevertheless, for some interventions explicit information is provided about the techniques used to enhance particular skills. Research about such interventions indicates that effective social-emotional training programs typically

include three main components: parent education, teacher training, and child-directed social skills and problem-solving training (cf. Webster-Stratton and Reid 2004). (1) *Parent education* means providing parents with positive parenting strategies which includes reducing hostile, rejecting, and inconsistent parenting, diminishing conflict, being emotionally positive rather than harsh and insensitive, and giving attention to children's positive rather than to their negative behaviors. In some cases, parent education also includes suggesting and reinforcing adequate family communication. (2) *Teacher training* involves increasing positive teaching strategies and enhancing responsive social interactions as opposed to ignoring the child or reacting unpredictably. It also involves instructing teachers to assist children in learning and practicing social and emotional skills during everyday activities and social interactions (e.g. in group discussions). Teachers can be taught to engage in joint play activities with children in order to promote contacts with peers and support peer interactions. (3) *Child-directed training* can be manifold but often includes discussing and practicing (group) rules as well as modeling social and emotional skills by means of (life-sized) puppets and videotape examples. Furthermore, child-directed training involves guided practicing using positive skills in role plays and games as well as coaching skills during group activities (e.g. commenting on children's actions and reactions). Finally, child training also encompasses helping children to accurately identify, label, and regulate emotions. For this purpose, instructors or educators use cue cards, photos, and/or videos that depict emotions which can be matched to the child's own emotions. Furthermore, emotional management is modeled and explained. For instance, children are encouraged to take a deep breath and/or think a happy thought in case of anger (see Gross et al. 2003; Kazdin et al. 1987; Shure 1994; Webster-Stratton 1999; Webster-Stratton and Reid 2004). Powell and Dunlap (2009) synthesized information on interventions designed to help children below six years of age improve their social-emotional functioning. They found that many interventions used group activities including songs, musical activities, discussion, and brainstorming to facilitate a sense of community and provide practice in social skills and problem-solving in groups. According to Guralnick (2010) interventions targeting children with (mild) developmental delays ought to draw on inclusive approaches by bringing together typically developing children with children with delays in free-play activities in order to facilitate social play and relationships and, in so doing, the social-emotional development of the less developmentally advanced children.

To sum up, research indicates that interventions can strengthen children's social-emotional development (e.g. Bierman et al. 2008; Domitrovich et al. 2007; Joseph and Strain 2003; Juffer et al. 2005). Unfortunately, the extent to which individual components of interventions – i.e., parent education, teacher training, child training – influence social and emotional skills has been insufficiently explored in the studies reviewed here. As a consequence, it is difficult to estimate the impact that each of these components typically has on children's social-emotional development.

Ethical considerations

Early learning processes and early child development set the stage for how a child learns and develops later on in life. Fostering young children's cognitive and social-emotional development is therefore undoubtedly important and the programs designed to improve child

development discussed in this review are helpful to address this challenge. However, in order for such programs to be developmentally appropriate and effectively beneficial for child development, they should avoid *hothousing* young children, that is, they should refrain from over-stimulating the development of a child's capacities (Sigel 1987). Children should not be hurried or caused to acquire skills and knowledge that are typically acquired at a later developmental level. Rather, programs need to acknowledge that beyond the right to education children also have a right to the present day, as noted by Janusz Korczak, an early vigorous advocate for children's rights. Korczak's concept of children's rights was buttressed by the notion that a child is a human *being* rather than a human *becoming* and therefore a being with the inalienable right to grow into the person that he or she was meant to be. By conceptualizing children as right-owners, Korczak aimed to ensure that children are not at the mercy of adults. Where adults provide arrangements for early childhood care and education, they should therefore respect the right of children to meaningful participation in decisions that affect them. Emphasis should be placed on the right of the child to be treated respectfully as well as on the right of the child to make mistakes, to fail, to be taken seriously, and to be appreciated for what he or she is (Korczak 1991, 2008).

Conclusion

Drawing on empirical findings, the present review of research analyzed what actually contributes to the effectiveness of early childhood care and education. It highlighted a number of techniques that can be applied to stimulate acquisition of language, mathematical, and social-emotional skills, providing tools for practitioners as well as a knowledge base for decision-makers who wish to implement programs that serve children's multiple developmental needs. In particular, the review established that adults need to create a variety of opportunities for children to develop and learn. These opportunities should be sensitive to children's needs, interests, and experiences and they should include possibilities for both self-directed learning and adult-directed instruction. Adults play an essential role in children's development inasmuch as communication and interactions between adults and children are indispensable for children's acquisition of skills. (Peer relationships are another important element in child development; however, this study did not focus in depth on the ways in which these relationships affect children's development.) Overall, the review showed that acquisition of cognitive and social-emotional skills is a process that occurs in social contexts and can be supported by use of appropriate pedagogical and didactic strategies which involve, amongst others, materials such as books, pictures, objects, and games. Adults should encourage children to participate actively in learning situations and they should provide children with appropriate feedback which is sensitive to children's levels of development and understanding as well as to children's needs and interests. It is essential that adults foster children's cognitive and social-emotional skills as children need the active presence and support of adults in order to develop. However, by the same token, adults need to remain mindful of children's learning capacities. They must not over-stimulate children's development but provide care and education responsively to children's needs and abilities.

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