

Building Adult Capability with the Intent to Increase Executive Function and Early Literacy in Preschool Children

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planning, problem solving, mental flexibility and abstract reasoning (Diamond and Lee 2011). Likewise, *emergent literacy* (EL) refers to the literacy development that occurs *before* children learn to read. Both executive function and emergent literacy are fundamental to positive brain development and can be enhanced in the preschool years with targeted programming (Diamond et al 2007). It has been reported that fortifying EF and EL in the preschool period of life provides a means for improving school and life success by contributing to a lifetime of productive learning skills (Mustard 2009; Moffitt et al 2011). Fortunately, the preschool period of life is considered the most economically efficient period of human development for targeted intervention (Heckman 2007). In other words, investments in early childhood programming to promote brain development in preschoolers have a much higher economic benefit than interventions undertaken at any other time during the lifespan. This is in large part due to the high degree of brain plasticity that characterizes the first five years of life. We also know that the foundation for a child's life path is based on primary educators (ie, parents and early childcare educators) knowing and modelling these two critical learning skills. Yet, although mounting evidence is demonstrating the importance of well-developed EF and EL skills for kindergarten readiness and school success, most parents are unfamiliar with these terms and findings.

Abstract

Well-developed executive function and early literacy skills are paramount for school and life success. Yet many adults (parents and early child educators) are unaware of what these skills entail and how they can be developed in preschoolers. In a pilot study, a curriculum designed to enhance executive function and early literacy in children ages two to five years was introduced to parents and the early childhood educator at a Stay and Play program running at the Coalhurst Parent Link site in southern Alberta. Although the study is still under way, preliminary reports suggest that parents and the early childhood educator have improved their understanding of executive function and early literacy and are enjoying the activities that build these skills in children.

Background

Executive function (EF) is a blanket term used to describe the important functions of the brain's executive—the prefrontal cortex. EF is considered to include attentional control, self-regulation, inhibition, working memory, goal setting,

The Problem

Alberta Education has recently begun to test kindergarten children across the province for school readiness using the Early Development Instrument (EDI). The EDI tests five components of development: social competence, language and thinking skills,

physical health and well-being, emotional maturity, and communication skills and general knowledge. In a recent release of the EDI results for the County of Lethbridge (Early Child Development Mapping Project Alberta 2013), the Coalhurst area was shown to have a higher percentage of children entering kindergarten experiencing great difficulty (32.4 per cent) in one or more areas of development than both the rest of the county (20.5 per cent) and the provincial average (26.85 per cent). This result suggested a need for targeted early childhood and family support in this community.

Given the evidence that improvements in EF and EL can be made through intentional activities with preschool children (Bierman et al 2008; Bodrova, Leong and Akhutina 2011; Center on the Developing Child at Harvard University 2011; Ciccantelli and Vakil 2011; Diamond et al 2007; Diamond and Lee 2011; Kray and Ferdinand 2013; Müller et al 2009; Zelazo, Carlson and Kesek 2008), the authors sought to develop a curriculum consisting of activities (games) that have been reported to be effective in improving these skills.

In addition, several studies have examined the importance of intentional early parenting in the support and scaffolding of EF (Bernier, Carlson and Whipple 2010; Bibok, Carpendale and Müller 2009; Dennis 2006; Hammond et al 2012; Hughes and Ensor 2005, 2009; Landry, Smith and Swank 2002).

The goal of the current Child Strength study was to design a curriculum aimed at supporting EF and EL acquisition by providing adults who routinely engage with preschool children (ie, parents and early childhood educators [ECEs]) with pragmatic strategies to engage and immerse young learners in developmentally appropriate activities. A systematic review of the literature regarding skill development and outcomes for both EF and EL was conducted. Playful activities that were reported as effective in improving these skills were considered for inclusion in the curriculum. Step-by-step activity sheets were developed for each game and a paragraph detailing the EF and EL skills that were targeted for development was included to inform the parents about the purpose of the activity. The curriculum was introduced to parents during the Stay and Play program offered twice weekly at each Parent Link Centre site. The program received human ethics approval from the University of Lethbridge before the study was undertaken.

Pre- and Postassessment

All parents were asked to complete a demographic survey reporting on level of education, daily language interactions with their children and types

of play activities. This was a researcher-created form intended to capture the parental understanding of EL. In order to assess the EF, the Behavioural Rating for Executive Function—Preschool Version (BRIEF-P) (Gioia, Espy and Isquith 2003) was completed by parents for their child(ren) at the beginning of the program. The ECE in charge of the Stay and Play program conducted Ages and Stages (ASQ) evaluations of the participating children during the first three months of the project. This represents the baseline data to which the postassessment results will be compared. Both the BRIEF-P and the ASQ will be completed again at the conclusion of the project. At completion of the pilot project, parents were asked to respond to questions related to their increased awareness and understanding of EL and EF for their child(ren), as well as general feedback on the activities that were introduced in their weekly program. We intend to interview parents and to ask them to complete a parent engagement survey as a postprogram assessment.

The Program

The Child Strength program started with a parent information night geared toward developing in parents and early childhood educators in the targeted communities an understanding of the importance of EF and EL and how best to support their development. At the information night the audience was shown the short video *How Brains Are Built: The Core Story of Brain Development* (Alberta Family Wellness Initiative 2013) to raise awareness of the importance of early experiences and strong EF skills in a child's life. The video depicts EF as air traffic control and makes a case for having strong skills in this domain to prevent "collisions," or problems, later in life. A comment from one of the mothers attending the session was "My husband and I watched the brain video and we were very surprised that a little stress is okay. We thought no stress at all would be the best for our children. We loved the video—it was only five minutes long and it really touched us as parents."

Our pilot study featured a developmentally appropriate activity each week that was explained step-by-step on a printed handout sent home with the parent. The activities were selected to target a child's ability to resist distractions, control his or her thinking and engage in goal-directed activities that promote learning. The activity sheet also highlighted the features of EF and EL that were supported by the activity. The ECE was briefed about the activities before the parents were introduced to them, and the research team answered any questions that arose during that briefing. The entire curriculum

(ten activities) was offered over the course of ten weeks in the pilot study for the project.

We learned from the preliminary feedback that the activities seemed rushed and it was hard for parents and their children to embrace so many new activities over such a short time period. As a result, the study was altered to focus on one activity each month and the number of activities offered to parents was reduced from ten to eight. The current program started in September 2014 and will run until June 2015. Another new feature of the Child Strength program is a monthly visit by the research team to the Parent Link Centre at each site to talk with parents and answer any questions they may have.

In one example of the monthly activities, the "Stroop task" (Gerstadt, Hong and Diamond 1994), children are shown two pictures in a deck of ten that have opposite depictions (day/night, clean/dirty and so forth). They are required to respond to the picture, as quickly as possible, with the "false" answer. For example, when shown the sun, children should respond with "night"; when shown the moon, children should respond with "day." A tally of correct answers is recorded and children are encouraged to increase their correct responses in the next hand. Once the child has mastered a deck of cards with a single theme, another theme may be added to the deck. Multiple themes can be added to a single deck as the child progresses. There are two main concepts supported by this activity—*inhibit* and *shift*. Children are required to inhibit their natural tendency to respond with the correct answer and to respect the oral instructions. They are required to shift their responses when more than one theme is added to a deck, in order to be successful. In addition, working memory is required by the children to remember the instructions, so that they know what they are supposed to be doing. Monitoring is required of the children to play the game (looking around, hearing feedback). The children must exhibit emotional control whether or not they complete the game successfully.

If the executive function skills are the air traffic control, then emergent literacy (EL) skills might be likened to airplanes—they enable the children to get to their destination of understanding and using effective communication. Given that EL skills during the early years are foundational for future academic success and effective language development, various activities were used in the Child Strength research study to further enhance EL skill development. It was ensured that the selected activities emphasized a range of skills such as oral language, alphabet knowledge, vocabulary building, phonological awareness and print concepts—all of which will

build upon and contribute to future conventional literacy skills acquired in the classroom. For instance, "circle time with lips and ears" (Bodrova, Leong and Akhutina 2011) requires children to take part in a turn taking, where pictures of ears and lips are distributed among the group. Children are encouraged to take turns listening (when given ears) and sharing information (when given lips) during circle time. Although this activity exercises various EF skills, it also promotes narrative and vocabulary skills pertaining to EL. More specifically, the child's ability to share information or describe a story or event places great emphasis on narration. Additionally, vocabulary—both expressive and receptive—is being used, allowing the child to verbally share information on a decided topic, as well as the ability to isolate words required for understanding what is being heard by others. On the part of the listeners, listening comprehension is greatly promoted, because children must attend to directions prior to the start of the game and during the game.

A third example of a monthly activity is shown in Figure 1, which demonstrates the type of information given to the parent(s) with each activity.

ECE Comments

The researchers learned from the ECE at the test sites that she found her understanding of EF and EL was increased by her engagement with the program components (activities and handouts, researcher involvement, and parent discussions).

As the facilitator of the program called Stay and Play where parents with child(ren) ages 0–5 attend together, this project has enhanced my program. The project has given me activities to introduce to parents during circle time, snack time and/or free-time play. It has given me purpose and an understanding of the importance of what I do with the families that attend my programs. I find the parents are now using terms that before the project would have never happened. I am thrilled to be part of this project with the University of Lethbridge and to supply my parents with cutting-edge research and knowledge of early childhood development. Parents really want their children to reach their potential and are excited to receive the activities. I am truly shocked at what children are able to understand at such a young age. To see a 17-month-old child stop dancing and look at the card I was holding and put their hands on their head to match the card—I wish I had gotten that on video. It was amazing.

My boys ages 2½ and 4½ play Red Light Green Light without support from me. They take turns; it is really fun to watch. That learning happens all day, every day. They are like sponges.

I added a twist to Red Light Green Light. The kids pretended to be mice and I held out cheese. When they saw cheese they could move (green light), when I covered the cheese they stopped (red light).

It's okay for a child to be disappointed, sad, frustrated before the age of five. They need to have all emotions when they are young, less likely to have road rage when they are an adult.

I have raised my expectations of what my child is able to do and understand.

The activities are not difficult to understand. I love how the activities are broken down into steps. I like the list of skills attached to each monthly activity. I know what they are working on.

Sometimes, we get a little bored in the house. The activities are a wonderful way to keep them busy on cold winter days. They seem to be happier after we play together.

I'm really interested in these activities. I have gone online and found more executive functioning activities for children five and under.

I find myself being intentional about how I interact and look for clues that their executive functioning is working. For example, I give my oldest a set of three instructions and then I wait to see if he can do them. So often, he is distracted and wants to play with his brother instead, so he needs a reminder, but slowly, slowly, I can see him prioritizing my instructions over his own desires.

Expected Outcomes

Through the parent information night combined with the activities included in the developmentally appropriate curriculum, this program aims to increase parent awareness of brain development and the importance of EF and EL skills, thereby building adult capability. A potential strength of the current program is its informative nature. There are step-by-step descriptions of activities that have been shown to build EF and EL skills in preschool children that parents can use to engage with their children.

As researchers and authors, we would be remiss if we failed to mention the importance of strong nurturing relationships in building healthy brains (Brazelton and Greenspan 2000). The program described will undoubtedly increase parents'

interaction time with their children and will help strengthen the quality of the existing relationships. This change in relationship, in turn, could have a positive influence on observed outcomes. Ultimately, the goal is to strengthen EF and EL skill in preschoolers; the means by which this goal is achieved is of secondary importance. The main purpose for implementing the Child Strength curriculum is to improve EDI outcomes of the kindergarten children in this community. By improving kindergarten readiness through enhancing EF and EL, we expect children will show better school and life success (Moffitt et al 2011).

Conclusion

The Child Strength Study is still under way, so it remains to be seen if the program has had the desired effect: strengthening EF and EL in preschool children by improving adult capability with respect to these concepts. Effects will only be known after the postprogram assessment is complete.

What we have learned from parent feedback is that the knowledge they have gained by participating in the study is both valued and important. The research team would like to thank the ECE at the study sites for her skillful modelling of the activities. Her helpful insights on how to inform the parents while engaging the children in their care in the curriculum activities is much appreciated.

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Parent Comments

The unsolicited parental comments provided to the ECE and set out below demonstrate that the parents are thoughtfully observing their children in play. This mindfulness parlays into awareness of how to adapt and adjust the activities, hence differentiating

them in order to engage their child in play situations to reinforce the learning opportunities. As stated by numerous parents, the EF and EL activities are used in unstructured ways as a means to interact with their children. It is plausible that the parents are forming a closer attachment [with their children] while reinforcing EF and EL skill development.

Red Light Green Light [5 minutes]

Activity Description: Younger children should attend to the oral instruction; older children should attend to the sign and oral instructions.

DIRECTIONS

1. Have the children line up (side by side) at one end of your space facing the adult.
2. The adult stands opposite of the children and faces the children.
 - a. Instructions are provided to the children at this point.
 - b. All children must attend to the oral directions and or to the colour sign
 - c. Children can either start the game at the back of the room and move toward the adult during the game (goal is to get to the adult) OR play within one-minute segments and see how much space the child can travel within the room.
3. When the adult shouts "Green Light!" the children walk quickly or run (depending on your space) towards the adult or around the room if that is the instruction (re 2c).
4. When the adult shouts "Red light!" the children stop where they are and freeze.
5. The adult continues to shout "Red light" or "Green light" until the children get to her and then all the children go back to the starting line and the game starts again.
6. Play the game again (attend to the directions in #2), but this time alter the words to words that are similar to red and green but change either the beginning sound or ending sound. For example, red = bread, said, Ned, stead; green = greel, Greek, greed.

Optional: Children also take turns being the ones to shout "Red light" and "Green light," to display the colour signs or, for older students, to create differing words for red and green.

SKILL DEVELOPMENT

EF: Supporting two big concepts: *Inhibit* to respect the red light and *Shift* the behaviour. In addition, *Working Memory* to remember the instructions about what you are supposed to be doing, *Monitoring* what you are doing (looking around, hearing feedback) and *Emotional Control* related to achieving successful completion of the game (or, alternatively, controlling one's emotions if not successful).

EL: Supporting two big concepts: *Listening comprehension* for attending to the directions prior to the game and during the game, and *Concepts about print* for connecting the words to the print on the signs. In addition, *Rapid naming of objects and colours* for identifying the signs, and *Phonological awareness or sensitivity* to distinguish between the sounds in the words. The signs were made by the ECE: green on one side and red on the other with go printed on the green side and stop printed on the red side. Parents were asked to construct one for their own use at home.

Figure 1: An example of an activity sheet handout distributed to parents of children participating in the program. The activity is detailed in step-by-step instructions with suggestions of alternate ways to play. The skill development section alerts the parent to the aspects of EF and EL that are supported by the activity.

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