

Toys as Instructional Tools in Developing Problem-Solving Skills in Children

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Abstract

This study determined possible uses of toys as instructional tools in the development of problem-solving skills among preschoolers. It aimed to identify the common toys found in preschool and how these toys can be used in lessons to develop students' problem-solving skills. The first phase of the study was the selection of toys to be used in the lesson. The second was the designing of lessons integrating the development of problem-solving skills using toys identified in phase 1. The last is the evaluation of lessons developed in phase 2. Data were gathered using survey, observation, and document analysis. Lessons were developed using the Wallace and Maker Problem Solving Wheel. The study shows that the five commonly found toys in preschool classrooms have the potential to develop problem-solving skills in preschool children.

Keywords: toys, problem-solving skills, instructional design, preschool

Children today are growing up in a fast changing world that continuously gives rise to dramatic shifts in what children are expected to know and do. Higher and tougher standards of learning are demanded for all types of learners to be assured of a successful future. Access to new information and knowledge is becoming fast and easy. Discoveries and inventions are piling up at a rapid rate. The explosion of information poses problems on how schools should teach their students to deal and cope with the changes and developments in society. Schools should not confine themselves to mere transmission of information and knowledge. They should also set a high value on teaching problem-solving, thinking, communication, social, and learning skills. However, it must be emphasized that education should be most interested in the developing the students' ability to solve everyday problems (Drake, 1993). The increasing demand to solve problems requires the educational system to produce people who are well prepared to deal with the progress and challenges of daily living. It is, however, unfortunate that most schools limit the teaching of problem solving skills in subjects like Mathematics and Science.

The 1987 Constitution of the Philippines requires basic education to empower the students for lifelong learning. One of the life skills cited by the Department of Education (2002) in its Basic Education Curriculum is problem solving. One of the objectives of preschool education in the Philippines in DECS Order No. 107 (1989) is to develop the child in every aspect of development to become self-propelling, thinking, and contributing individual, able to make decisions which will prepare him/her for the more complex demands of future life.

Dodge and Colker (1998) observed that children who are effective problem solvers are better prepared for meeting the demands and challenges of an increasingly complex world. Accordingly, these children are more likely to be flexible in their thinking and able to use a variety of problem solving strategies. However, there are limited studies done on problem solving in younger children.

In response to the pressing need to develop problem-solving skills among young children, this study aimed to contribute in finding alternative and effective ways of developing problem-solving skills among young children. In this study the use of toys as instructional tools in developing problem-solving skills among young Filipino children was explored. Toy is defined as an object or thing that can be used or manipulated to amuse and encourage playfulness. Reiber, Luke, and Smith (1988) noted that toys as instruments of play make learning fun and more effective especially if the toy is voluntarily chosen, involves active engagement, and is pleasurable.

Toys appeal to children of all ages across the globe. Abrams and Kaufmann (1990) opined that toys are intrinsically motivating. The right toys available at the right time can spontaneously guide children to greater heights of accomplishments. Toys that have the right degree of novelty can ignite creativity, stimulate imagination, awake, wonder, and bring enjoyment to children. They should have both familiar and unexplored features to make them attractive and challenging. Wise selection of toys for every developmental stage of a child will go a long way in enhancing learning. Insightful teachers can utilize the natural appeal of toys to understand and capture a child's perception of the world and himself. Toys can be powerful teaching and learning tools and teachers need guidelines and frameworks to help maximize their use in the classroom. However, there are limited studies done on the utilization of toys in the classroom.

Toys that develop problem solving skills

Toys are the essence of play and play is an essential activity of children, which helps them organize and understand themselves and their environment. Cuffaro (1995) said materials such as toys are the text of early childhood classrooms. They can be the means or the path for a child's entry to the structured and ordered knowledge of the adult world. Alward, Nourut, Scales, and Van Horrn (1993) suggest that the best toys for young children have the quality that encourages playfulness. It should allow children to adapt the toy to their individual needs and stages of development. The environment of children must also contain

materials that have elements of familiarity connecting them with their experiences and novel materials that expand their horizons (Alward, Nourut, Scales, & Van Horn, 1993).

Different types of materials used in the classroom develop different types of thinking. Guilford (1967) classified these materials into convergent and divergent materials. Convergent materials are toys with single or prescribed uses, and encourage convergent thinking. De Bono (1992) described convergent thinking as vertical thinking because it involves moving back and forth between higher and lower levels of thought. For convergent thinkers, there is only one acceptable answer, and so they are compelled to look for such. Puzzles, simple card and board games, and sorting and stacking materials are examples of convergent materials found in a pre-school classroom. Divergent materials like blocks and building sets are toys that lead to multiple uses and are more open-ended, and thus, encourage divergent or lateral thinking. Divergent thinkers search for many different ways of defining or interpreting a problem. De Bono (1992) added that it is the blending of literal and imaginative thought that is necessary for problem-solving. Cliatt, Shaw and Sherwood (1980) opined that divergent thinking - the generation of many appropriate responses to a question - is a valuable tool in problem solving. Yinger and Blaszk (1995) wrote that divergent materials invite a variety of children's responses through exploration, experimentation, and original thinking.

Bredekamp (1987) emphasized the appropriateness of materials to the developmental stage of a child. These materials provide concrete, real, and meaningful experiences to children. She further added that these materials are basic to early childhood programs because they support child-initiated and child-directed learning, stimulate the imagination, facilitate recall, and aid communication.

Playing with toys can set the foundation for reading, writing, mathematical reasoning, social interaction, and creativity. Children who experience success during playtime want to repeat the experience, and they also want to take on a new or more difficult challenge during their next opportunity to play. Segatti, Du-Paul, and Keyes (2003) wrote in their article in the National Association for the Education of Young Children journal, *Young Children*, that children innovate with toys, and these innovations are signs that children are learning to use their thinking skills to solve problems. Experiences in problem-solving activities help children develop curiosity and patience, along with thinking skills such as flexibility and understanding of cause and effect. They learn to work toward achieving a goal, and gain confidence in their ability to reach a solution. They noted that materials used in problem-solving activities encourage children to explore, provide opportunities to find simple cause and effect relationships, and provide open-ended experiences for making choices and decision.

Early childhood practitioners and experts suggest that toys, to be effective in developing problem-solving skills in children, must have the following attributes: (1) safe, durable, and attractive; (2) have varied use; (3) developmentally appropriate; (4) encourage exploration and experimentation; (5) stimulate original thinking; (6) provide simple cause

and effect relationships; and (7) provide open-ended experiences for making choices and decisions (Guilford, 1967; Bredekamp, 1987; Bronson, 1995; Isenberg & Jalongo, 1997; Segatti, Du-Paul & Keyes, 2003). These toys are tools that can enhance the learning process of children and the teachers have the responsibility to define the environment in which these toys will be utilized in the context of developing the problem-solving skills of preschool children.

Instructional design used in developing problem-solving skills in children

Children learn through active exploration, participation, and interaction with adults, other children, and materials. Piaget (1954), Vygotsky (1978) and Bruner (1966) asserted that a child is capable of constructing his own learning by interacting with his environment. Hence, teachers should base their instruction on this premise as they develop the learners' problem-solving skills. Blake, Hurley, and Arenz (1995) opined that educators of young children can enhance the development of problem-solving thought processes through daily activities in their classroom. They reasoned that even very young children are capable of problem-solving processes that are on the appropriate developmental level. They added that educators of young learners influence how children think, and are responsible for what curriculum is taught in daily programs. Berger and Thompson (1996) reiterated that preschoolers have considerable difficulty with formal problem-solving tasks such as problems requiring the analogy from one situation to another and logical deduction or step-by-step procedure despite exposure to practical problem-solving situations. Rudimentary skills related to problem solving begin to develop during the play years. These rudimentary skills namely intuition, memory, reasoning or logic, metacognition, and creativity as proposed by Maker and Wallace (2004) are independent and interactive during the problem-solving process. Supportive guidance by an adult is essential in facilitating the development of these cognitive skills in preschoolers.

Wallace, Maker, Cave, and Chandler (2004) believed that all children's learning capacity could be improved through the systematic and coherent teaching of the processes underpinning problem-solving. They devised a Problem Solving Wheel to guide teachers and students in the problem solving process. The stages of the problem solving wheel are:

1. **Gather/organize: What do I know about this?**
Using and improving memory is an important part of the whole problem-solving process. As learners connect and link bits of information, their memories become more efficient. It is the teacher's role to encourage learners to make links on what they know and guide them into organizing and refining the learners' collection of ideas.
2. **Identify: What is the task?**
Clarifying the task involves both analytical and creative thinking. Some learners lose track of the task they are undertaking, so it is the role of the teacher to clarify what learners need to do, and to point out the criteria that will make the task successful or excellent.

3. **Generate: How many ideas can I think of?**
Generating ideas involves high level creative thinking. The teacher is expected to encourage learners to think and consider several ideas before deciding on the best course of action.
4. **Decide: Which is the best idea?**
When making decisions, learners need to prioritize and to give reasons for their choices, rather than deciding impulsively. This decision making process involves analytical and evaluative thinking. Teachers should be accepting of the learners' decision.
5. **Implement: Let's do it!**
It is in the doing that learners maximize their full potentials. In this stage all the prerequisite knowledge and skills come to play as the learners try out the probable solution or course of action that they have decided on. Teachers should provide the guidance and encouragement needed to make sure learners finish the task.
6. **Evaluate: How well did I do?**
Learners need to be trained to evaluate themselves. The process of evaluation needs to be both formative and summative, with learners feeling that every task can be improved because they are learning how to learn. Teachers should provide the atmosphere of objectivity and help learners create their own criteria of a "good" work.
7. **Communicate: Let's tell someone!**
Learners need a real audience in order to feel the thrill of communicating and sharing their ideas and the results of their efforts. Teachers should provide the venue for learners' to communicate the result of their work.
8. **Learn from experience: What have I learned?**
The final stage of reflecting is both a formative and summative process aimed at consolidating and transferring what have been learned. This metacognitive stage is vital in teaching learners to transfer the new skills into other areas of their lives.

Problem solving is a process that can be learned and applied repeatedly in any situation. But children need the guidance and assistance of an adult for them to develop these higher-order thinking skills. In a classroom environment, teachers play a pivotal role in the selection of toys and the planning of instruction that focuses on the development of problem-solving skills.

Methodology

This study attempted to determine how toys can be utilized to develop the problem-solving skills of kindergarten students. The research was descriptive in nature and the data-gathering techniques included survey, observation, and document analysis. The research involved three phases:

Phase 1 involved the selection of toys to be used in lessons. In determining which among the toys could be used for developing problem-solving skills among preschoolers, the researcher used a questionnaire-checklist.

The researcher developed this questionnaire-checklist based on Isenberg and Jalongo's (1997) checklist of prescribed toys for preschool curriculum. This is a one-part questionnaire with a list of toys. Respondents were asked to identify the possible uses of each toy in the classroom and how each can be used for developing problem solving skills. Based on this questionnaire, the researcher selected the toys that could be used in the lessons for developing problem-solving skills.

A questionnaire-checklist was given to ten pre-school teachers (from different private schools) whose teaching experiences range from five to ten years in a pre-school setting. This part of the research was designed: (1) to determine which toys are usually found in the participants' preschool classroom; (2) to identify the instructional activity where these toys are used; and (3) to find how they can be used for developing problem-solving skills.

Among the most common toys chosen by the teachers, five were selected by the researcher using the following criteria identified to be effective in developing problem-solving skills (Guilford,1967; Bredekamp,1987; Bronson,1995; Isenberg & Jalongo, 1997; and Segatti, Du-Paul & Keyes,2003):

1. safe, durable, and attractive;
2. developmentally appropriate;
3. has varied use;
4. encourages exploration and experimentation;
5. stimulates original thinking;
6. provide simple cause and effect relationships; and
7. provide open-ended experiences for making choices and decisions

Phase 2 involved the designing of lessons integrating the development of problem-solving skills using toys identified in phase one. Lesson plans for each of the most common toys were developed using the Problem Solving Wheel proposed by Maker and Wallace (2004). The Problem Solving Wheel was used because it has been tested and found to be effective in developing problem-solving skills among primary school students. The effectiveness of the Problem Solving Wheel was chronicled in the published work of Wallace, Maker, Cave and Chandler (2004).

Phase 3 involves the tryout of lessons developed in phase two. The lesson plans developed were tried out for a week. One lesson plan lasting from 30 to 45 minutes was used daily to the same group of preschool children aged 4 ½ and 5. The same teacher conducted the try out for all the lessons and used both English and Filipino to communicate with the children. Before the tryout, the teacher was briefed and oriented on (1) the purpose of the study, (2) the basic assumptions of the study, and (3) the activities of the lesson plan. Clarifications and questions about the lesson and probable situations that might arise during the tryout were also discussed.

The researcher observed the tryout and recorded the (1) time spent on the lesson, (2) teacher's execution of the lesson, and (3) behavior of the learners. The teacher's record of inference and observation of the learners' responses to every instructional activity of the lesson was also compiled and noted by the researcher. The learners' outputs in all activities were collected and analyzed.

Results and discussion

The survey identified the most common toys found in preschool classrooms. The toys were ranked to determine which among the toys were most common. The result is shown in Table 1.

Table 1
Common toys found in preschool classrooms (N=10)

Toys	Frequency of Responses	Rank
• Puzzles		
• Simple card and board games	10	3
• Beads	10	3
• Building sets	10	3
• Blocks	10	3
• Balls	10	3
• Sorting and stacking materials	8	6.5
• Pegs	8	6.5
• Dough	7	9
• Dolls	7	9
• Picture lotto	7	9
• Housekeeping toys	6	13.5
• Pots and pans	6	13.5
• Musical instruments	6	13.5
• Sticks and twigs	6	13.5
• Leaves and flowers	6	13.5
• Buttons	5	17.5
• Woodworking materials	5	17.5
• Miniature life toys	4	19.5
• Bottles	4	19.5
• Climbers	3	21.5
• Riding toys	3	21.5
• Puppets	2	23

The researcher found that these toys identified by the teachers as common in their preschool are the same toys prescribed by early childhood researchers and practitioners.

As shown in Table 2, the survey also reveals that there are seven toys commonly found in preschool classroom that are perceived by the respondents to develop problem-solving skills.

Table 2
Common toys viewed to effectively develop problem-solving skills (N= 10)

Toys	Frequency of responses
Puzzles	10
Blocks	9
Simple card and board games	8
Beads	8
Building sets	8
Balls	8
Sorting and stacking materials	8

All respondents perceived puzzles as toys that could develop problem-solving skills. According to Abrams and Kaufmann (1990) puzzles are good in developing dexterity, hand and eye movement, vision, spatial/time awareness, imagination and creativity. Blocks can be used to develop critical and creative thinking according to the teachers/respondents. They view blocks as toys that children can be manipulated to create, build, and construct replica of different things they see in the real world. Alward, Nourut, Scales, and Van Hoorn (1993) labeled blocks as construction toys that can be manipulated and used to create new objects. Isenberg and Jalongo (1997) also considered blocks as construction materials and further noted that blocks offer endless possibilities that support inventive thinking.

The respondents viewed simple card and board games as useful in developing problem-solving by encouraging quick thinking, using different strategies, and creating opportunity for children to choose and decide. They also added that simple card and board games make children finish a task. Isenberg and Jalongo (1997) categorized simple card and board games as skill/concept materials with limited possibilities for creative and divergent thinking.

The respondents found building sets as facilitative of the development of problem-solving skills through the use of exploration, planning and evaluation. Furthermore, they noted that building sets can enhance children's creativity and strategizing techniques. Just like blocks, building sets are considered by Isenberg and Jalongo (1997) as construction materials that develop inventive thinking.

Beads are described by Isenberg and Jalongo (1997) as manipulative materials that develop fine motor skills, basic concepts, and eye-hand coordination. They noted that beads also provide opportunity for cooperative problem solving. The teacher-respondents view beads as materials for patterning and sequencing activities that encourage logical thinking and creativity.

All the toys mentioned are labeled to have the following characteristics:

1. catch attention
2. encourage reasoning and logical thinking
3. enhance memory and strategizing techniques
4. develop creativity
5. provide opportunity for reflection and decision-making
6. encourage exploration and discovery

The respondents and early childhood practitioners and experts are one in their view that these characteristics of the selected toys make them effective instructional tools in developing problem solving skills.

From the seven toys identified to be effective tools in developing problem-solving skills, five toys were used for the lesson. These toys were selected by most teacher-respondents as the toys to be most commonly found in a preschool classroom. Table 3 shows the examples of lessons tried out and found to be effective in developing problem-solving skills using toys.

Table 3
Sample lessons in effectively developing problem-solving skills using toys

Lessons	Topics / Themes	Subject Areas
Creating a necklace of beads using a color pattern	<ul style="list-style-type: none"> • Colors • Patterns 	<ul style="list-style-type: none"> • Arts • Mathematics • Language
Completing a picture puzzle	<ul style="list-style-type: none"> • Picture puzzles 	<ul style="list-style-type: none"> • Arts • Mathematics • Language
Creating a bridge using different sized blocks	<ul style="list-style-type: none"> • Bridges 	<ul style="list-style-type: none"> • Arts • Mathematics • Science • Values • Social Studies
Creating a community using different pieces of a building set	<ul style="list-style-type: none"> • Communities 	<ul style="list-style-type: none"> • Science • Language • Social Studies • Mathematics
Identifying pictures or things that are the same	<ul style="list-style-type: none"> • Alike and different 	<ul style="list-style-type: none"> • Mathematics • Language • Social Studies

The result of the try-out shows that there are specific lessons wherein toys can be utilized effectively in developing problem-solving skills. The lessons using blocks and puzzles were able to develop more problem-solving skills, although, all lessons develop problem-solving skills. Puzzles are toys that already present problems on their own thereby

making them effective instructional tools in developing problem-solving skills. They encourage children to think of ways to put the pieces together. Children manipulate the pieces while making sense of how they work. Puzzles encourage children to construct their own learning. During the tryout of the lesson, the children together with the teacher discussed how to complete the puzzle. The children immediately knew that they were to complete a picture of a tree by noting the parts of a tree like the branches and the roots. They based their decision on what they already knew about a tree. They immediately knew that since a piece of a puzzle had a picture of the root then that piece was located on the lower part of the puzzle. They also identified the similarities and differences of the different puzzle pieces. The children also recognized the mistake they made. When one piece of a puzzle did not fit, they rotated the piece and tried again. Since the puzzle had only one probable solution (the pieces being fit together), it did not present much potential for creativity.

Blocks, meanwhile, stimulated the children's creativity. The teacher as an expert provided the problem using blocks and encourages the children to decide on a solution. Blocks provide open-ended experiences, hence they make an effective instructional tool in developing problem-solving skills. During the tryout of the lesson, the children presented many designs for a bridge and they chose a design that they would make using the different sized blocks. They reasoned out on why they made such decision based on their discussion with the teacher about the structure and uses of a bridge. Children's comments included: "*gawa sa kahoy at semento*" (made of wood and cement) and "*dadaanang car*" (for cars to pass by). They also noted the similarities and differences of the bridges that they had seen before. They also negotiated with each other on whose design/drawing they would make and which blocks to use. They made sure that the bridge they made had toy cars on it and was on top of beams. The children also made changes in their design/drawing when they noticed that the blocks did not match with the design/drawing. This lesson generated more ideas from the children. Subsequently, the discussion with the teacher became more interactive. The children were also enthusiastic with their work and presentation.

The teacher's record of inference revealed that using toys as tools allow teachers to design lesson plans that are focused on developing important problem-solving skills. The result of the study showed that teachers play a vital role in this process. Hence, the skills of the teacher to ask questions and to facilitate discussion are important. This supports the study of Vygotsky (1978) on the importance of the environment in children's learning.

The medium of instruction also plays an important role in this process. The researcher observed during the tryout that the use of Filipino, the children's first language, contributed to the active participation in all activities. The children were able to express different ideas and opinions, ask questions, and validate information learned using their first language.

The study revealed that the commonly used toys in the lesson are effective in developing the rudimentary skills associated with problem-solving process. Table 4 shows the problem-solving skills developed by the most common toys found in preschool.

Table 4
Problem-solving skills developed by common toys

Toys	Problem-solving skills				
	Intuition	Memory	Reasoning or logic	Metacognition	Creativity
puzzles	√	√	√	√	
blocks	√	√	√	√	√
simple card and board games	√	√			
beads		√	√	√	
building sets		√		√	√

Blocks and building sets are considered divergent materials that lead to multiple uses and are more open-ended (Guilford, 1967). The study showed that these toys have high potential in developing creativity, a problem-solving skill that encourages novel ideas and solutions. The children manipulated and controlled these toys as they pleased. These encouraged them to develop and implement their ideas. Blocks are unstructured, diverse in playability, and simple in design thereby stimulating children's imagination and creativity. These characteristics of blocks made them effective tools to also develop intuition, memory, reasoning and logic, and metacognition. The teacher's skill in planning and implementing lessons using blocks and building sets is crucial in developing problem-solving skills in children. The use of cognitive apprenticeship through modeling, coaching and scaffolding will greatly benefit students (Tharp & Gallimore, 1988).

Puzzles on the other hand are considered convergent materials having a single acceptable solution to a problem. They compel children to look for this solution as they manipulate the pieces and find the perfect match. The study showed that this characteristic could also be observed with simple card and board games. The rules of the game encourage children to think through a problem (the goal of the game) thus, activating intuition and memory. However, puzzles provide more opportunities for making choices and decisions than simple card and board games, as children rely more on chances and luck in reaching the goal. This characteristic of puzzles makes them an effective instructional tool in developing reasoning and logic and metacognition. This study revealed that puzzles have limited potentials to develop children's creativity because puzzles have usually only one acceptable solution.

Beads can be considered divergent or convergent materials depending on the lesson. The teacher's role is vital in its effectiveness to develop problem-solving skills in children. The potential of beads to develop creativity relies on the planning and implementation of a lesson.

Certain toys have characteristics that already present problems in themselves like puzzles, while others have the potential to provide problems for problem solving activities. The study shows that teachers of young learners play a crucial role in defining the

environment that will provide experiences for the development of problem solving skills. Bruner (1966) emphasized that children learn best when they interact with their environment through the different materials, situations, and events. In this concept of discovery learning, a teacher or an expert adult will provide the scaffold that children need as they construct and organize their knowledge and make sense of their world. The study also showed how the teacher's interaction with the children affected their behaviors. The teacher's warmth and accepting personality encouraged the children to explore and experiment, thereby motivating them to be more confident in finishing the task. The teacher's questions and statements gently urged the children to focus on the objectives of the different activities. The teacher's knowledge of the developmental stage of the children also helped in the implementation of the lesson plan.

The instructional design, Maker and Wallace's Problem-Solving Wheel, used during the tryout was proven to be effective in developing problem solving skills among preschoolers. It was explicit and detailed that the teacher did not have difficulty in following the different activities in the lesson plan provided. The children were also engaged throughout the different activities.

Conclusion

The study is successful in its aim to show how toys can be used as instructional tools in the development of problem-solving skills among preschoolers. The study supports and agrees with the effectiveness of Wallace and Maker's instructional design in developing problem-solving skills among young learners. The instructional design is successful in incorporating toys as an instructional tool. The study however acknowledges the need for teachers to acquire the skills in asking questions and facilitating discussion to truly aid in the development of problem-solving skills in young learners.

Toys are an essential part of a preschool classroom but they are usually used in free play or for content-specific lessons. The study showed that toys, as instructional tools, have the potential to enhance learning among young learners and may aid in the development of other cognitive skills. The study paves the way for teachers to design lessons using toys as a tool in targeting the different components of problem-solving skills. It presents an effective instructional design that teachers may adapt as a guide in planning their lesson and preparing the children's environment. The study concludes that the use of toys as instructional tool is effective in developing problem-solving skills among preschoolers. Furthermore, it provides insights for early childhood advocates to explore the many possibilities of toys as an instructional tool.

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