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Learning through Play - Improving Academic Performance through Play

K. Madhumathi and P. Senthil Selvam

Abstract

The education in the early period provides the cognitive development of the child. Globally world organizations are thriving hard to increase the literacy percentage of the children, as education forms the base for the economic improvement of the country. Depending upon educational skills the individual will be placed in the appropriate job. Education in childhood is focused much on the past few decades. Learning through play is a traditional concept of developing the cognition level. At present, an educational scenario also focuses on Game-based pedagogy for teaching and learning. To some extent, this method will reduce school dropouts in developing countries. The children are more attracted to video games and the learning becomes easy for them. In this digital era, blooming technology is the milestone in the educational sector. The grandma's game is now transforming into the digitalized version. Designing video games by keeping the concepts of traditional games will enhance the learning outcome of the students, especially in early education. Structured, goal-oriented, educational outcome-based video games are necessary to improve the growth and development of the children.

Keywords: Milestones, pedagogy, literacy, spatial language, early education

1. Introduction

The development of the child is the holistic approach which includes physical, mental, social, emotional, behavioral, and cognitive aspects of the development. Delay in any aspect of the development will result in an indirect impact on the future of the child. One of the cornerstones in child development is early education. Most of the countries have laws, government organizations, and movements to uplift the education for all the children irrespective of their disability either mental or physical, economic status, culture, race, gender difference, and status of the parent's job and literacy. "Early childhood refers to the period between birth and 8 years of life. The widely used term early childhood care and education (ECCE) refers to a range of processes and mechanisms that sustain and support development during the early years of life: it encompasses education, physical, social, and emotional care, intellectual stimulation, health care, and nutrition. It also includes the support a family and community need to promote children's healthy development" – UNICEF [1]. In the era of digitalization, the game-based learning approach is the keystone for early childhood education. Digital game-based learning provides fun, increase motivation level, easy to play, self-learn, on spot rewards and scores,

team play, and education-based, so the traditional games are replaced by the digitalized play. Even though there are some disadvantages to video games, with some modifications it can be used as an educational tool for early education.

2. Impact of digitalization on education

Historically the learning started from the traditional play before the emergence of the schooling system. Every country has its own traditional “grandma’s games” which strengthens the physical, social, emotional development of the child and intellectual aspects like problem-solving, logical reasoning, memory, critical thinking, and leadership qualities. Owing to global digitalization, these traditional games are now overlapped by video games. The emergence of electronic gadgets made game-based learning even easier. Despite some drawbacks of video games, it is considered a tool for education outcome-based learning and implemented as the pedagogical method not only in the early period of the child but also in the later college curriculum. A lot of research supports the ideology of improvement in the academic performance of the students with digital game-based learning. “The video games can produce broad enhancements in perceptual, motor, and cognitive skills” [2].

3. Milestones and play

Milestones are the foundation for the growth and development of the child. The delay in milestones will give a clue that there is some problem in the normal development of the child and early intervention is required to overcome this. The gross motor (example – sitting, standing, walking, running) and fine motor (example – buttoning, grasp, release, dressing, combing) development are the basic to the children for further interaction with the environment. These skills are learned through simple play like peek a boo, hide and seek, Tag, and Hopscotch, and finger games either with parents or the peer group. These plays do not have formal rules and regulations are mostly termed as “Grandma’s Games”. So, child development starts with play that is often unnoticed.

4. Cognition and play

The cognitive level of the child is measured by the IQ test and graded according to the scores obtained. It determines the participation level, the implication of winning strategies, and the sportsmanship of the child. On the other side, playing itself will induce improvement in the cognition quotient like problem-solving, creative thinking, memory, logical reasoning. Concerning video games like puzzles and maze, logical thinking and problem-solving skills are necessary. Digitalized Puzzles and maze games provide real-time navigation, increases the intrinsic motivational level, put forward possible ways to find the way in the maze, and yield visual treat. Visuospatial cognition plays a notable factor in playing games especially games focused on academic and educational outcomes.

5. Spatial language and play

Spatial language, in\out, up\down, top\bottom, inside\outside, small\big, near\far, on, in front\behind, right\left, middle\corner, understanding of this spatial

concept is the fundamental principle while we play a game. Without understanding this concept, the child cannot play. In the early period of growth and development, the child usually identifies the objects by relating to other objects and their environment. Through the concept of spatial relations, the child plays and learns the primary arithmetic skills. In the early period of human evolution, the stone age people learned through symbols, patterns, identification marks, numerical lines. This historic concept of spatial knowledge is incorporated in the stimulated digital video games like identifying patterns, matching shapes, finding a way to home, shopping in a mall, paying the bill, parking the car. The spatial abilities are related to academic performance in later life of the children [3].

6. Spatial skills and academics

Spatial skills blended video games are said to improve the spatial ability or even playing the video game itself will enhance the spatial skills. This conceptualization is reinforced by findings of the researchers that “Spatial skills and cognitive skills are the benefits of video game practice a spatial task has three spatial skills. Spatial perception, mental rotation, and spatial visualization. “spatial perception is the ability to infer the orientation of an object to one’s orientation. Mental rotation is the ability to imagine the rotation of a visual stimulus. Spatial visualization is the most difficult ability to describe precisely” [4]. Since video games are boosting the cognitive level, it can be used as the pedagogical method for early childhood education.

7. Video game as pedagogical method of teaching and learning

“A game which we play thanks to an audiovisual apparatus and which can be based on a story” is called a video game [5]. With the advancement in digitalization and electronic gadgets, the use of video games has reached tremendous heights in recent years. The smartphone like iPhone, iPads, Android phones, usage of multimedia is now seen in the educational sectors for easy teaching and learning method. The primary school children are listening to rhymes, narrative stories, analogy method of teaching. The play integrated method has changed the educational outcome of the small children to the next level. Since stimulated video games mimic everyday activities, it provokes a good understanding of the day-to-day participation of the child socially and emotionally. Playing digitalized games like a maze, puzzle, mental rotation, building blocks, matching shapes, identifying objects and spatial language will improve the spatial knowledge of the children and their academic performance.

8. Digitalized spatial games and their effects on cognition

Maze – a game in which the player must find a way or path to reach the stipulated place or point. Within the given maze many pathways are present but only one correct path will reach the destination point. Playing maze in the early period of life, the child develops logical thinking and problem-solving skills. The child must apply the spatial knowledge to explore the way by ruling out the incorrect path. To solve the maze, the child requires a combination of cognitive processes which includes attention, visuospatial, visuo-constructional, and executive function [6]. The difficulty of the maze is increased by adding more wrong shorter or longer

tracks, by displaying multiple different correct start and endpoints within the same maze, and by providing stipulated time to finish the game. The game can be structured in a way to provide hints whenever necessary and a reward & point system at the winning time. The digital game delivers pleasant visual feedback of the real movement of the object in the way. This will intensify the inner motivational level of the child to play.

Puzzle – a game or toy, where the player needs to logically arrange the broken pieces or numbers or words or objects to solve it. The logical arrangement of the broken pieces is termed as the jigsaw puzzle and it is seen as early educational toys in most of the pre-primary school (kinder garden). The sequential position of the fragmented section of the object needs proper visualization, rotation of the bits & pieces mentally, and spatial relation. The increase in the number of broken and smaller pieces will raise the complexity of the game. No structured templates are needed to design a jigsaw puzzle, just to break the full picture into different pieces and join again to solve it. Since it is easy to make, it can be designed by anyone like parents or teachers in the school. The puzzle game can be given to the child with or without the reference image to solve it. Everyday images like fruits, vegetables, animals, birds, good habits, grooming activities, objects seen in the living room, kitchen, bedroom, study room, classroom, vehicles, can be used in the design. It will further boost up the cognitive level of the child and helps in the academic outcomes. “The nature and duration of this type of games are typically equivalent to another type of learning task for the classroom and field trip activities [7].

Mental rotation – has “five sequential cognitive-processing stages, perceptual coding of the stimulus, identification of the stimulus and orientation, mental rotation of the stimulus, a judgment of parity, and response and execution”. It needs eye movement, maintaining gaze, eye tracking, and fixing the visual information [8]. The mental rotation task has one original image on one side and two or more images on the other side. The original image is the reference image to find out the exact image on the other side which is rotated. The child must rotate the image mentally to match it with the original\reference image. Basic pictures like alphabets, cars, geometrical shapes can be used in designing mental rotation. The player first needs to analyze the characteristics of the original image, even to note the small details in it. Second, they must spatially relate all the details of the original image to images present on the other side. Third, visual tracking of both images must be done to fix the correct image. With specific to the mental rotation, almost all the images look alike. The complexity of the mental rotation is done by increasing the details of the original image or by adding the mirror images. When this game is played digitally, the complexity will be decreased as it gives more visual clues.

Building blocks: Block games can be played as a free game or a structured game. In a free game, the child can arrange the block with his or her imagination, but in structured play, the kid must build the block with some reference pictures like house, car, vehicles, fruits, vegetables, stationaries, etc. The use of day-to-day objects handled by the kids will attract them to play and thereby the learning process can be made easier. With the same given blocks, multiple images can be built and it depends upon the cognitive level of the child. The block game needs mental rotation, spatial relation, spatial perception, and visualization of the images. The numerical skill of the child can be improved by playing the block game since it increases the spatial ability of the children. Besides, learning to build with blocks, the child learns “the concept of balance, mathematics, constructional and problem-solving skills [9].

Shapes – there is a strong connection between the basic shapes and normal things we use in daily activities. For instance, books are rectangular shape, ball

– spherical, egg and vegetables like mango are oval, fruits like orange, berries, grapes are circle, grooming clothes like towels are either in rectangle or square. So, even before the schooling starts for the kids, the shapes are incorporated in their daily living in the above-mentioned form. The knowledge of shapes is also important in the later development of the mathematical skills of the children. Digital game of Matching shapes needs identification of the shape and tracking the same shapes which are present elsewhere on the screen. The cognitive process involved in this game is visualization, identification, eye tracking, and fixing the shapes.

9. Play and its uses

Attention – Attention “is a complex cognitive function involving different processes like selectively attending to specific stimuli, focusing for prolonged periods, or regulating and monitoring actions [10]. The teacher should focus on selective attention to visual, auditory stimuli, duration of the class, and get feedback from the students. This is made easy using play during the class. The play can either be formal or informal, structured, or unstructured mode. Also, the video version of the game provides excellent visual treat, limited time duration, and feedback during the task. So, the attention level of the children can be maintained throughout the play session.

Interest – Interest refers to “relations between individuals and objects, domains, events, or topics that are personally meaningful” [11]. The video game grabs the interest of the children for an extended period. The learning process is made easy by increasing the attention span of the children.

Motivation – Academic motivation refers to “a wide range of traits, such as individual’s relevant beliefs, perceptions, values, interests, enjoyment, and attitudes [12]. For academic and school achievements the kids need a high motivational level to learn. Research says the motivational level of the students can be elevated through playing games. The games provide visual and auditory treats throughout the play session.

Team play – one of the important skills in the development period of the child is working with the peer group. In pretend play and role-play the mutual understanding between the team is needed. This type of play needs some rules and regulations to understand and to follow accordingly. It can be included by the teacher while educating the kids about moral values. According to Vygotsky, “the most efficient learning occurs in a social context” [13].

Flexibility – Cognitive flexibility is “a cognitive system that underpins the ability to change perspective, shift attention between tasks or mental sets, and adjust to changing demand and problems” [13]. The play improves cognitive flexibility, which is one of the foundations in later adult life.

Easy to learn – most of the games do not have a hard rule to follow. This basic character makes the children involve in play without extrinsic motivation. The academic pressure of learning is reduced in game-based pedagogy and teachers are happy to implement this type of teaching method in early education.

Interactive – “learn by doing”, the children have interactive learning when they play either virtually or with the peer groups. The interaction between two or more people will improve the cognitive aspects of logical thinking and problem solving and works as a bridge in teamwork.

Repetition – it allows the children to redo the task again till they master it. The failure boredom is reduced, and joyful moment of victory is increased. “practice make a man perfect”. It will redefine the skills and the students will start to explore the environment both physically and mentally.

An integrated approach – the learning is effortless if it is an integrated approach. By this approach, the children inter-relates the concepts of simple to complex, easy to hard, and thereby reforms the learning process.

A real challenge – the textbook method of learning is usually dull, so the children lack the motivation to learn. In the play, the child faces real challenges and find the answers to finish the task. This exposure to real challenges is necessary for the child to become strong socially and emotionally in their later period of life.

Learn to practice \practice to learn – learning is the first step, followed by practice. Through practice, the learned concept can be mastered as skills. This skill set is the base for upcoming years to the child. The early the child, masters the task, the stronger the memory will be.

“Practically all children play computer games at one time or another, and this may affect their behavior”. The research findings say that play will modify the processing of spatial attention. Games like driving, maze, puzzle, role-playing, strategy games, adventure, affects spatial cognition. The child has higher arousal and motivation when they play their favorite game [14].

10. Video game for the special population in early education

The differently-abled children are using digital games therapeutically and for academic learning with some modifications like appropriate instructions, level, hints, feedback, rewards, scoreboard, uncluttered screen design, visual and verbal rewards, minimal motor skills. The “virtual environment-based spatial training, in which students navigated mazes or manipulated objects, led to an improvement in executive function and verbal regulation of spatial functioning for students with motor disabilities”. The intellectually disabled people have increased attention after playing computer games. The disabled students are benefited from video games specific to the workforce in the later period. The games which are not technically designed for disabled children are also meant to have some benefits and academic outcomes [15]. The video games designed according to the school curriculum was effective in promoting learning among the students [16].

11. Conclusion

The increased academic pressure leads to more dropouts in early education. “In human children, play usually enhances curiosity, which facilitates memory and learning” [17]. Preschoolers were very anxious in the school as they are provided with toys. The following are the elements that should be considered while choosing a video game for education purpose, (adapted from Funk), Educational or therapeutic objective, type of game, required level and nature of involvement, information and rules, the role of luck, difficulty, competition, duration, participation age and characteristics, number of players, facilitator’s role, and settings [18]. Keeping all these points and implementing the learning through play in the early period of education will yield fruitful result in adult life.

Conflict of interest

“The authors declare no conflict of interest.”

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References

- [1] Early Childhood care and Education – Unicef [Internet]. 2012. Available from: https://www.unicef.org/End_Decade_Note_-_Education_for_All_new.pdf [Accessed: 2020-12-29]
- [2] Fran C. Blumberg, Kirby Deater-Deckard, Sandra L. Calvert, Rachel M. Flynn, C. Shawn Green, David Arnold, Patricia J. Brooks. The digital game as a context for children's cognitive development: Research recommendations and policy considerations. 2019;32:1-33. DOI: <https://doi.org/10.1002/sop2.3>
- [3] Katrina Ferrara, Kathy Hirsh Pasek, Nora S. Newcombe, Roberta Minchick Golinkoff, Wendy Shallcross Lam. Block talk: Spatial language during block play: Mind, brain, and education. 2011; 5(3): 143-151. DOI: 10.1111/j.1751-228X.2011.01122.x
- [4] Lynn Okagaki, Peter A. Frensch. Effects of video game playing on measures of spatial performance: Gender effects in late adolescence. *Journal of Applied developmental psychology*. 1994; 15: 33-58.
- [5] Juliane M. von der Heiden, Beate Braun, Kai W. Muller, Boris Egloff. The association between video gaming and psychological functioning. *Frontiers in psychology*. 2019; 10: 1-11. <https://doi.org/10.3389/fpsyg.2019.01731>
- [6] Tobias Nef, Alvin Chesham, Narayan Schutz, Angela Amira Botros, Tim Vanbellingen, Jean-Marc Burgunder, Julia Mullner, Rene Martin Muri, Prabitha Urwyler. Development and evaluation of Maze-like puzzle games to access cognitive and motor function in aging and neurodegenerative disease. *Frontiers in aging neuroscience*. 2020; 12: 1-15. <https://doi.org/10.3389/fnagi.2020.00087>
- [7] Javier Melero, Davinia Hernandez-Leo. A model for the design of puzzle-based games including virtual and physical objects. *Educational technology and society*. 2014; 17(3): 192-207.
- [8] Jiguo Xue, Chunyong Li, Cheng Quan, Yiming Lu, Jingwei Yue, Chenggang Zhang. Uncovering the cognitive processes underlying mental rotation: an eye-movement study. *Scientific reports*; 2017; 7: 1-12. <https://doi.org/10.1038/s41598-017-10683-6>
- [9] Roslinda Rosli, Teo Wei Lin. Children early mathematics development based on a free play activity. *Creative education*. 2018; 9: 1174-1185. <https://doi.org/10.4236/ce.2018.97087>
- [10] Elisabet Suades-Gonzalez, Joan Forn, Raquel Garcia-Esteban, Monica Lopez-Vincente, Mikel Esnaola, Mar Alvarez-Pedrerol, Jordi Julvez, Alejandro Cacaes, Xavier Basagana, Anna Lopez-Sala, Jordi Sunyer. A longitudinal study on attention development in primary school children with or without Teacher-Reported symptoms of ADHD. *Frontiers in psychology*. 2017; 8: 1-10. <https://doi.org/10.3389/fpsyg.2017.00655>
- [11] Joyce M. Alexander, Kathy E. Johnson, Mary E. Leibnam, Ken Kelley. The development of conceptual interests in young children. *Cognitive development*. 2008; 23: 324-334. doi:10.1016/j.cogdev.2007.11.004
- [12] Yulia Kovas, Gabrielle, Garon-Carrier, Michel Boivin, Stephen A. Petrill, Robert Plomin et al. Why children differ in motivation to learn: insights from over 13,000 twins from 6 countries. 2015; 80: 51-63. *Personality and individual difference*. 2015doi: 10.1016/j.paid.2015.02.006
- [13] Femke E. Stad, Karl H. Wiedl, Bart Vogelaar, Merel Bakker, Wilma C. M. Resing. The role of cognitive flexibility

in young children's potential for learning under dynamic testing condition. 2019; 34: 123-146.

[14] Ian Spence and Jing Feng. Video games and spatial cognition. Review of general psychology. 2010; 14: 92-104. <https://doi.org/10.1037/a0019491>

[15] Susan Main, John O'Rourke, Julia Morris, Hellen Dunjey. Focus on the journey, not the destination: digital games and students with disability. Issues in Educational research. 2016; 26(2): 315-331

[16] Marta Rodriguez, Jimmenez, Francesca Pulina, Lanfranchi. Video games and intellectual disabilities: a literature review. Life span and disability. 2015; 18(2): 147-165.

[17] Michael Yogman, Andrew Garner, Jeffery Hutchinson, Kathy Hirsh-Pasek, Roberta Michnick. The power of play: A pediatric role in enhancing development in young children. American academy of pediatrics. 2018; 142(3): 1-33. <https://doi.org/10.1542/peds.2018-2058>

[18] Mark Griffiths. The educational value of video games. Education and health. 2002; 20(3): 47-51.