



Increasing Children's Character Overt Behaviours by Neuropedagogy-Based Play

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ABSTRACT: The research aims to improve the character of children aged 4-6 years by implementing the way the individual interacts with the environment. Qualitative research methods were used in this study, where researchers investigated the open behavior of children aged 4-6 years during neuropedagogy-based play, as well as the open behavior of preschool teachers' professional characters in managing play. The participants in this research were 20 children aged 4-6 years and 4 teachers who were chosen deliberately. The results of the study revealed that all the children's overt character behaviors improved after participating in neuropedagogy-based play. There was not a single child who was classified as having open early behavior. On the other hand, preschool teachers consistently demonstrate the implications of their professional behavior. Based on research findings, it is proven that neuro-pedagogy-based play is beneficial for preschool children and teachers. Extrapolated from this interpretation, curriculum designers and teaching practices are informed that neuro pedagogy-based play can strengthen children's character, this is necessary in preparing future generations who can overcome all challenges in the future.

Keywords: neuropedagogy-based play, open character behavior, children aged 4-6 years

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1 INTRODUCTION

Indonesia as a large country is predicted to get a demographic bonus in 2030, where most of the Indonesia's population in that year will be people of productive age or 70% (Empirical Based Study, Ministry of Health, 2013). In line with the findings of this research, the real world, especially the Partnership for 21st Century Skills (2007), emphasizes that success in the digital world also depends on positive character, critical thinking abilities, problem solving, and skills. communication and collaboration. The rational reasons that have been stated previously challenge all parties involved in preparing the next generation to carry out various planned actions to prepare a quality young generation. Therefore, all efforts to empower early childhood, especially early childhood education, must facilitate children's growth and development needs, such as creating play experiences for children, to build positive character and other dimensions of development.

Children's play can be done in the form of indoor play and out play, where children experience various games that can develop their character. Apart from that, playing can be done individually or in groups with various toys or without toys (Henniger, 2013). In playing, children experience many things, where these experiences stimulate the brain's nerves. The human brain is a system consisting of approximately 100 billion neurons or neuron cells that transmit signals to each other through approximately 1,000 trillion synaptic connections (Voytek, 2013). The brain continually makes more connections based on the way the individual interacts with the environment (Bonomo 2017). In line with the nature of neurons, they are also called nerve cells, which are cells that carry electrical impulses. Therefore, neurons are the basic unit of the nervous system. The outer layer of nervous tissue is referred to as the cerebral cortex. It is divided into two cortices, left and right, and five lobes frontal, parietal, occipital, and two temporal. Each brain lobe has its own function and functions integrative in activating human abilities which includes human character.

Brain-based games are one of the environments that children need to improve brain connections, and this can be done by implementing neuropedagogy-based games. It is a type of game that emphasizes various activities to strengthen neuron connections through pedagogical practices. However, until now, there is still little research that states its findings about brain-based games through neuropedagogy-based games. Therefore, the aim of this research is to determine the role of neuropedagogy-based games in improving early childhood abilities, which includes improving children's character.

2 THEORETICAL STUDY

2.1 *Play Character and Children*

Play is a concept that is usually used to make children learn about themselves and their environment. Play for children is usually intrinsically motivated, and is an activity undertaken for their own benefit and enjoyment, rather than for results. Children usually

feel joy when playing and immerse themselves in sustainable activities for some time. Plays have a role in developing life competencies that shape human personal character. Through play, children can experience and create the world with its conditions and values (White, 2012). Through play, children could utilize their social skills, creative thinking skills, and negotiation skills as well as communication skills, and language during play activities. In other words, young children design their character development.

Researchers in the fields of education, psychology, and neuroscience have accumulated significant evidence regarding the need for play in children's lives. It cannot be denied that playing is fun and of course fun is the biggest attraction for children (White, 2012). In line with this, when children engage in play, they also develop critical thinking, social-emotional abilities, and physical skills (Jamaris & Edwita, 2015) that contribute to good brain development. Through play, children also learn to regulate their behavior, lay the foundations of life skills and more, learn science and mathematics, figure out how to negotiate complex social relationships, build a creative problem-solving repertoire, and much more. Researchers in the fields of education, psychology, and neuroscience have accumulated significant evidence regarding the need for play in children's lives. It cannot be denied that playing is fun and of course fun is the biggest attraction for children (White, 2012). However, when children engage in play, they also develop critical thinking, social-emotional abilities, and physical skills (Jamaris & Edwita, 2015) that contribute to good brain development through play, children also learn to regulate their behavior, basic skills, and much more, such as learning science and mathematics, figuring out complex negotiations in social relationships, building a creative problem-solving repertoire, and much more. Furthermore, everything contributes to the development of a child's character.

Character reflects human moral qualities that can be observed from humans' overt moral behavior. Human moral development occurs when an individual's selfish desires are replaced by values that become important socializing agents in a person's life. Therefore, when someone is said to be a human being of good character, it is implied that he has superior moral qualities, moral values, and moral reasoning abilities. Correspondingly, a moral person understands right or wrong and deliberately, predictably, and habitually behaves well. Therefore, character can be viewed as open moral behavior that involves judgmental competence to evaluate and respond to all types of behavior and its consequences based on ethical values and social values.

Children aged 4-6 years are in the golden period. This implies that they are in rapid development. According to Freud's psychosexual theory, child development occurs in a series of stages that focus on different areas of bodily pleasure. At each stage, children face conflict, which plays an important role in their development. At this stage, moral competence exists in children, and they use it to resolve conflicts that occur in line with the process of assimilation and accommodation in cognitive development (Martin, 2017; Soldz, 1988). Children's moral development in kindergarten and early elementary school is at the conventional stage where they internalize morality through cognitive processes

that are influenced by reward and punishment. Therefore, moral development already exists before the age of 7 years (Baibert & Hasselhorn, 2016) which is called heteronomous morality. At this stage, children think that justice and rules are prohibited from being changed.

In line with the previous rational considerations, it is important to improve the character of children aged 4-6 years by increasing their developmental task abilities, which include moral development tasks. Therefore, children need to be taught how to behave with good moral behavior. They can learn it through observation and modeling (Bandura, 1997). By observing the actions of others, including parents, teachers, and peers, children develop new skills and acquire new information, including moral behavior. Additionally, observation plays an important role in learning. However, these observations do not necessarily have to be direct observations of the model. Conversely, children can also learn by listening to verbal instructions about how to perform a behavior, as well as through observing both real and fictional characters who display that behavior in books or films, as well as other educational media.

Character is shown by moral values. Moral values include respect, responsibility, honesty, justice, tolerance, prudence, self-discipline, helpfulness, compassion, cooperation, courage, and democracy (Lickona, 1996). Parents have a big influence on a child's character. Schools, like teachers, are also responsible for developing children's character through their behavior which functions as a child's moral model. Therefore, kindergarten teachers have an important role in developing kindergarten moral values that reflect good character. Based on the rational description previously explained, character development consists of three dimensions, as follows: understanding of applicable rules and values, open behavior shown in certain conditions that require moral action, and feelings that arise after the moral action is carried out (Santrock, 1996). Therefore, character development is an unintentional action and is carried out continuously. Moreover, character development goes hand in hand with the ability to control oneself (Budiartiti & Jamaris, 2018). Character skills are influenced by a person's way of thinking and feeling which can be seen in the ability to control behavior and feelings (Jamaris & Hartati, 2017). All of this is reflected in the form of respect, responsibility, honesty, justice, tolerance, prudence, self-discipline, helpfulness, compassion, cooperation, courage, democracy, and communication. Furthermore, character competence is influenced by neurological maturation involving the frontal lobe, parietal lobe, occipital lobe, and temporal lobe (Jamaris, 2016).

2.2 *Brain, Human Development and Neuropedagogy*

The brain contains many neurons, also called nerve cells, cells that carry electrical impulses. Neurons are the basic unit (function and structure) of the nervous system. The human brain is a system consisting of approximately 100 billion neurons (neuron cells) that transmit signals to each other through approximately 1,000 trillion synaptic connections (Voytek, 2013). This "brain-computer" is ultimately responsible for the learning process and outcomes. The outer layer of nervous tissue is referred to as the

cerebral cortex. It is divided into two cortices, left and right, and five lobes: frontal, parietal, occipital, and two temporal (Carter, Aldridge, Pge, & Parker, 2009, Bransford, Brown, and Cocking, 2001, Jamaris & Edwita, 2015).

Lapina and Colombo (2009) and O'Rahilly and Mueller (2008) explain that at birth, a baby's brain is about one third the size of an adult's brain. The brain continues to develop at an incredible rate throughout the first year. The cerebellum triples in size, which appears to be related to the rapid development of motor skills that occurs during this period. In the second year, the most dramatic changes involve the language areas of the brain becoming more interconnected. During the second year, there is a large increase in the rate of myelination, which helps the brain perform more difficult tasks, such as higher-order cognitive abilities, self-awareness, and greater awareness of emotions and attention. Soon, he will use his name, personal pronouns such as "I" and "I." By the age of three years, they have reached 80% of an adult's brain volume. Synaptic density in the prefrontal cortex may peak in the third year, at up to 200 percent of adult density levels. This region also continues to create and strengthen networks with other regions. As a result, complex cognitive abilities are enhanced and consolidated. In this period children have more cognitive flexibility and a better understanding of cause and effect (Carter et al., 2009). In line with the previous description, Jamaris (2013) stated that intellectual development from birth to 4 years of age is the same as intellectual development from 4 to 18 years of age. Intellectual development at the age of 4 – 8 years is greater than intellectual development at the age of 8 – 18 years.

The application of neuroscience and early childhood education is tied together in the form of neuropsychology. Neuropedagogy is a pedagogy to strengthen neuron networks by applying a pedagogical approach. In practice, the neuropedagogical approach is carried out through learning activities. The roots of neuropedagogy are transdisciplinary as seen in Figure 1.

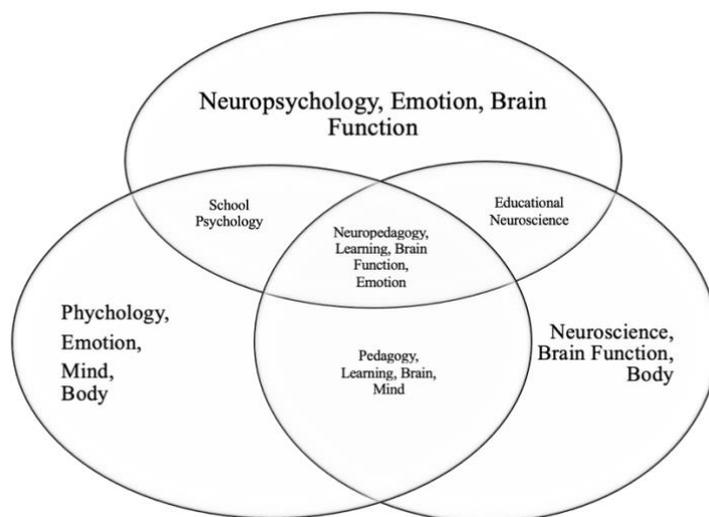


Figure 1. Neuropedagogy Transdisciplinary Crafting (Source: Margaret (2018) modified by Jamaris (2018)

Neuroscience, pedagogy, and other connected discipline crafting can be applied in the form of brain-based learning, for the young children brain-based learning is conducted in the form of brain-based play. The play reflects brain works, which, always to look for pattern of relations among the current information (Maryam, 2013). Brain based play accommodated the learning style of individual students because the learning in brain mind. The adaptability of the brain reinforces the facts that all children could change. It is because the brain continually making more connection based on how the individual interact with environment (Bonomo 2017). In early childhood education instructional activities are conducted through play. Therefore, neuropedagogy based play is another form of based learning which promote the early age development, as well as their character. In line with the root of neuropedagogy which basically as neuroscience and learning connection stated key take ways of neuropedagogy based play is to combine neuroscience and learning. The key takes ways of both combinations, neuroscience and learning are summarized in the following table 1.

Table 1. Key take ways of Neuropedagogy Based Play

Joy	Meaningful	Active Engagement	Iterative	Socially Interactive
Emotions are integral to neural networks responsible for learning.	Making connections between familiar and unfamiliar stimuli guides the brain in making effortful learning easier.	Active and engaged involvement increased brain. activation related to agency, decision making and flow.	Perseverance associated with iterative thinking is linked to reward and memory networks that underpin learn.	Positive care giver child interactions help build the neural foundation for developing healthy social emotional regulation and protecting from learning barriers, such as stress.
Joy associated with increase dopamine of level in the brain's reward system link to enhanced memory, attention, mental shifting, creativity, and motivation	Meaningful experience introduced novel stimuli linking to existing mental framework: processing these stimuli recruit's networks in the brain associated with analogical thinking, memory transfer, metacognition, creating insight, motivation, and reward.	Active engagement active memory encoding and retrieval processes that support learning. Full engagement in an activity allows the brain to exercise networks responsible for executive control skills, such as, pushing out destruction that benefit short term and lifelong learning	With practice, iteration increasingly engages networks related to taking alternative perspectives, flexible thinking, and creativity	Early social interaction promotes plasticity in the brain to help cope with challenges later in life. Social interaction activates brain networks to detecting the mental state of other, which can be critical for teaching and learning interaction

2.3 Analysis of The Research Findings in Neuropedagogy Implementation

Rushton et al., (2019) have reported their study findings about Neuroscience, Play and Early Childhood Education: Connections, Implication and Assessment. The he three of them confirmed that neuroscience is the important component of creating an active, stimulating learning environment, one proposedly designed to active engage of mind of young children to help to strengthen their neurological networks. Friedman et al., (2016) stated their research finding in the field of neuroscience and cognitive neuropsychology to teachers' education and educational work. The goal of the research combined the knowledge in the field of education and teaching, The research found that learning triggers the growth of neurons in the brain, the pattern, and examples brain flexible and can rewire itself, reputation, memorization, and practice assimilate information in the

memory, reliance on information patterns and examples that exist in memory create meaningful and effective learning. Recent studies which have done by different imaging technique revealed new information that the human brain does not into constant situation. The brain in the fact, is continuously change and adapt renewals contrary to previous ideas. Therefore, neural plasticity which is developed by Diamond is important concept for education (Keles et al.,2005).

3 METHOD

The qualitative research method used in this study, in which, researchers investigate the 4-6 years old overt behaviors in experiencing neuro pedagogy-based play focuses on enhancing their character overt behaviors which consist of responsibility, self-confidence, teamwork, empathy, language, and communication. before and after participating in neuropedagogy-based play. For the need of investigation, field notes in the form of behavioral observation guides are constructed in line with the observation activities, aimed to facilitate researchers to make notes and to have objective information about the children's overt behavior during play. Field note results are matched to quality character assessment, aiming to decide whether the enhancement of their overt behaviors has occurred. The field note records are constructed accumulated and continually analyzed to ensure whether the filed observation records are conscious. Furthermore, the field note records are constructed accumulated, and continually analyzed to ensure whether the filed observation records are consciously conducted. Furthermore, the field records are matched to qualitative assessments which are designed qualitatively based on dimensions of related behaviors.

The overt behaviors of the 4-6-year-old children are in four categories which consist of below average, average, good, and very good. In order, to decide the improvement of the overt behavior for both the teacher and the children, consequently the qualitative assessment categories are given numbers, such as 1 for start to begin, 2 for beginning, 3 for developing, and 4 for consistency. The total score of the overt character behaviors is 24, which is divided into four score categories, as follows: 21-24 = consistent, 17-20 =developing, 13-16 = beginning, and 8 -12 = not observed. Therefore, the field records are matched to qualitative assessment, and followed by descriptive quantitative assessment. The study was conducted in BKB PAUD Hasanah RW. 06, Kelurahan Jati, Pulogadung, Jakarta Timur. There were 20 children aged 4 - 6 years old who participated, and 4 teachers participated in this study. All the teachers are professional and, therefore do not need much help to conduct neuropsychology-based play. They were equipped by teachers' guidance in applying neuropsychology-based learning which was developed by the three researchers who have mentioned previously etc.

4 RESULT AND DISCUSSION

4.1 Result

The research results show that the 4-6 years old children's character improve after participating in the neuropedagogy based play for character enhancement of the children, as showed in Figure 1, 2, 3, and 4.

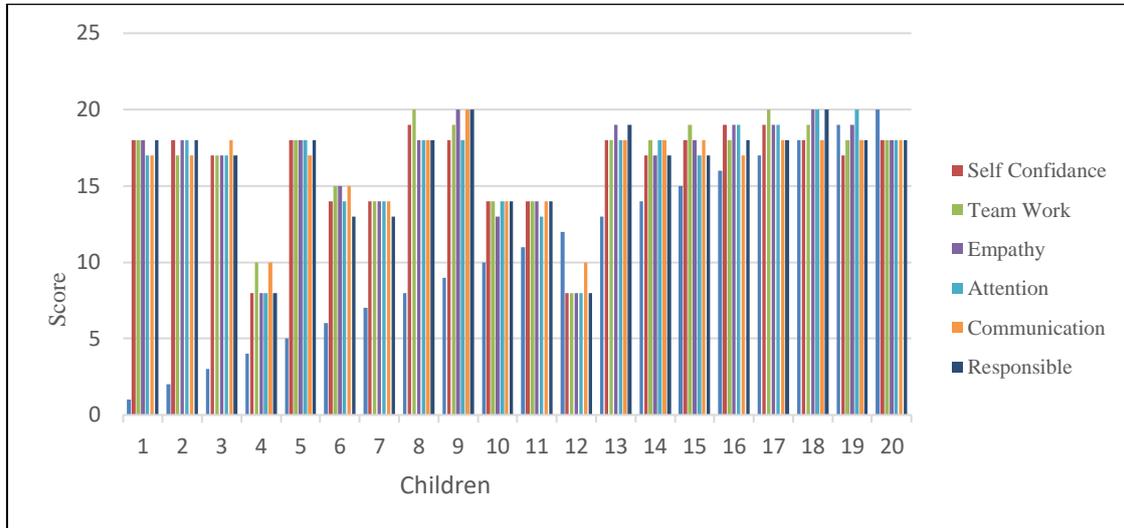


Figure 2. Pre-Assessment Character Behavior of the 4-6 Years Old. N=20

The figure 2 and 3 above show that in the pre assessment character overt behavior of the 4-6 years old children, come out with 6 children show start to begin character overt behaviors. It is because they show most unproved overt character behaviors, which are consisted of ability to regulate self or self-confidence, focus mind on certain activity or attention, work in a team or teamwork, obey other's condition or empathy, socially interact with others or communication, and do require activity or responsibility. None of the children are classified consistent character overt behavior.

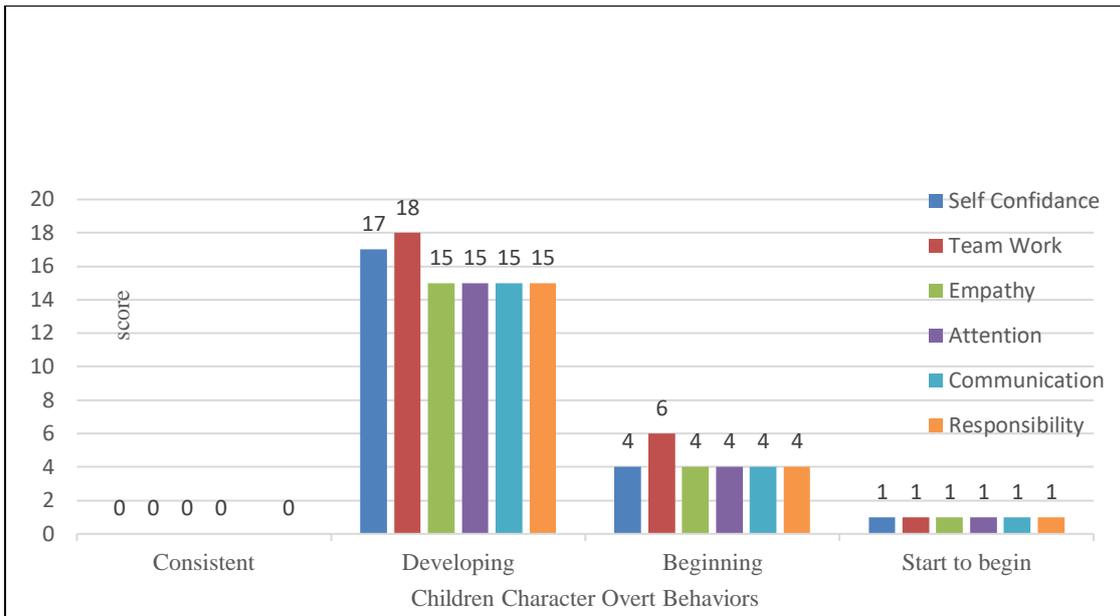


Figure 3. Pre-Assessment Character Behavior of the 4-6 Years Old's Children. N=20

Therefore, their character overt behaviors should be enhanced. As the results, after participating in neuropedagogy based play, none of the children are classified in beginning character overt behaviors development. Two children are classified developing character overt behavior, while eighteen children are classified in consistent character overt behavior as showed in Figure 4 and 5.

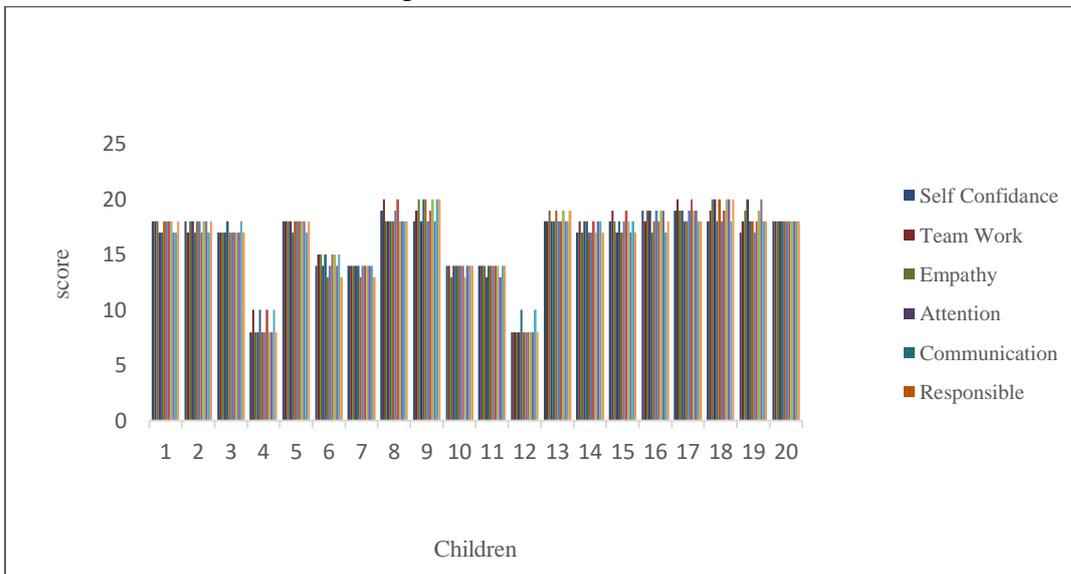


Figure 4. Post Assessment of Character Behavior of the 4-6 Years Old. N=20

In line with performance improvement of character overt behaviors of 4-6 years old children, the preschool teacher's performance who manage the neuropedagogy based play are also improve. Basically, all the teacher's overt behavior in guiding play is very good, because they are professional pre -school teachers.

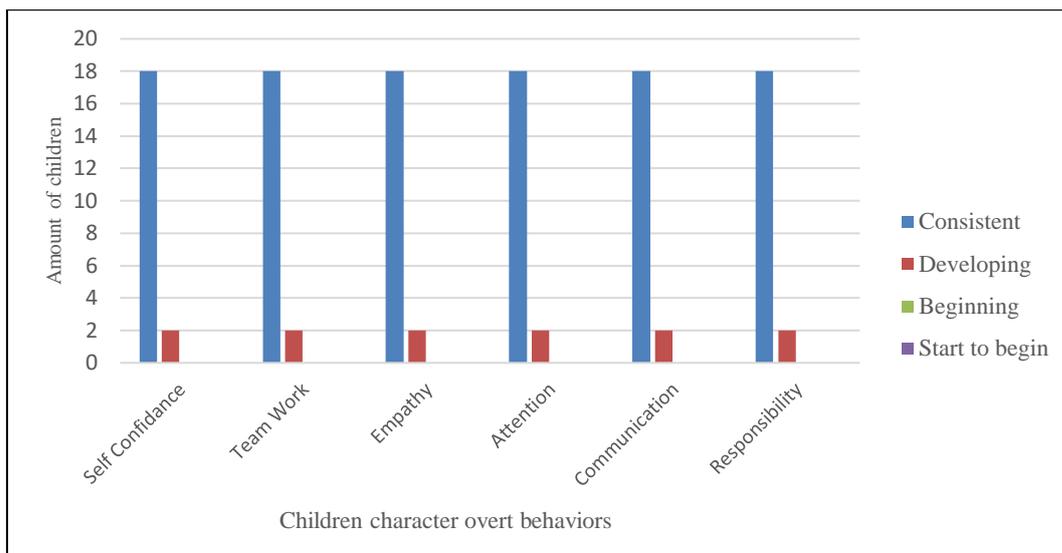


Figure 5. Post Assessment of Character Behavior of the 4-6 Years Old Children n 20

However, they need to make used of them self with neuropedagogy based play, especially related to character behaviors of the 4-6 years old children which emphasized on making the 4-6 years old children play in joy, meaning full, active engagement, iterative and socially interactive. All the teachers can manage and facilitate neuropedagogy based play for the 4-6 years old children, in indoor play or in outdoor play.

Table 2. Pre School-Teachers Statement Ab Practice out Neuropedagogy Based Play Practice

Teacher	Before	After	Proven
Teacher 1	I need to make used with neuropedagogy based play	I have no obstacle to practice neuropedagogy based play, indoor or outdoor play	Yes
Teacher 2	I want to expand my experience and I need to make used myself with neuropedagogy based play	I feel happy to practice neuropedagogy based play and I have no difficulties to manage children play, indoor or outdoor play	Yes
Teacher 3	I have no experience with neuropedagogy based play but have no hesitation to try it in managing children play	I am happy to do neuropedagogy based play with children and I have no difficulties in conducting the children play, in door or outdoor play	Yes
Teacher 4	As the professional preschool teacher, I try to manage children neuropedagogy based play	I have no obstacles to conduct neuropedagogy based play and I happy that the kind of play can improve the children character overt behaviors, indoor or outdoor play	Yes

The researchers also investigate the preschool teachers' behaviors in conducting neuropedagogy based play which consist of their abilities in matching play activities with need of children character enhancement. In line with neuropedagogy based play and character behavior of the 4 – 6 years old children who are participated which consist of responsibility, self-confidence, teamwork, empathy, and communication. All the character overt behaviors of the 4-6 years old children are come out in play activities which colored by combination pf joyful play, meaningful play, active engagement play, iterative play and social interaction play. The table 2 in pervious page shows interview finding before and after the preschool teachers practicing neuropedagogy based play.

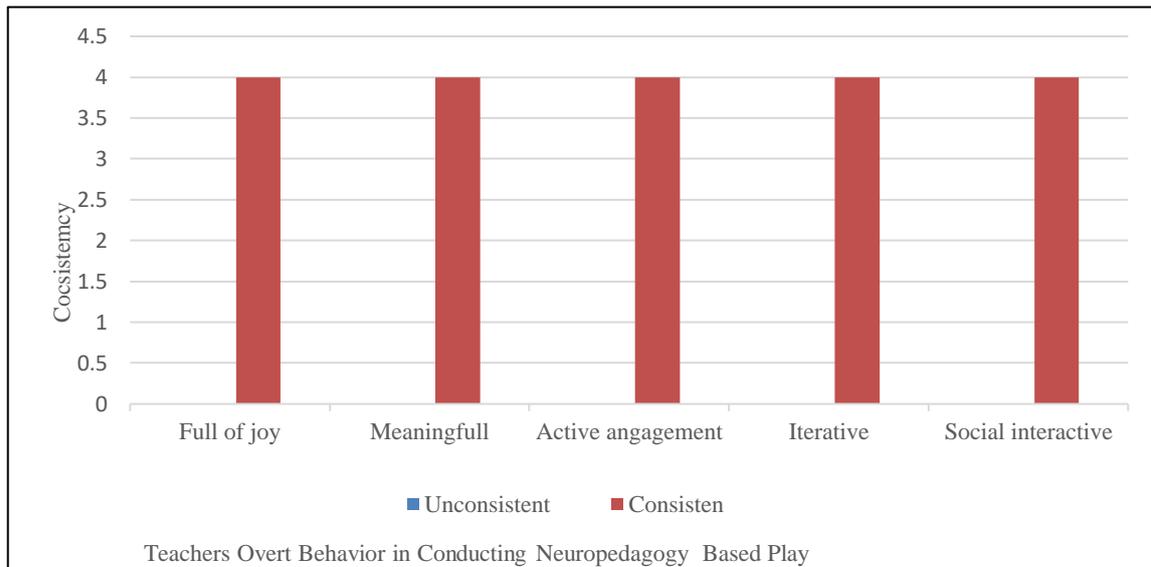


Figure 6. Pre School-Teachers Consistency in Conducting Neuropadagogy Based Play

It is followed by figure 6 which dealt with teachers' overt behaviors in conducting Neuropadagogy based play, as shown in the following figure 6. The chart proves the preschool teacher's statement about their ability in practicing neuropedagogy based play, as shown in table 3. All the preschool teachers show their consistency in making play, joyful play, meaningful play, active engagement, iterative play, and social play, and consistently show their professional overt behaviors, as shown in Figure 6 and 7.

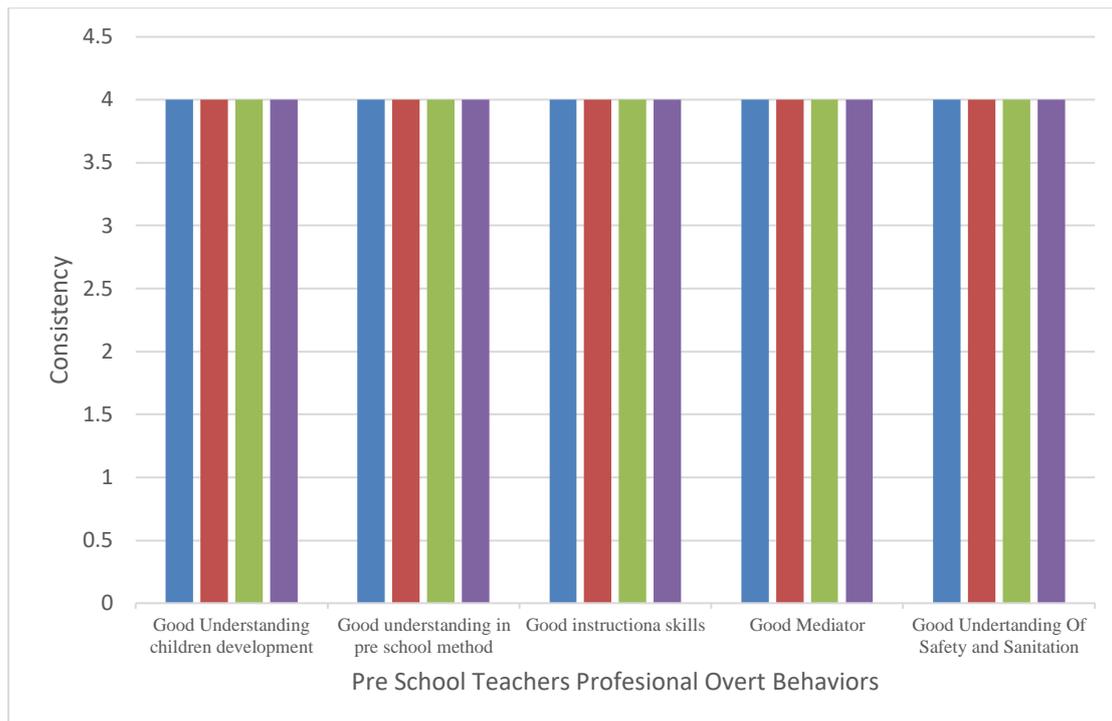


Figure 7. Pre School-Teachers Consistency Professional Overt Behaviors

4.2 Discussion

The results of this research have resulted in breakthroughs in the field of neuropedagogy, especially research that explores the relationship between neuroscience, pedagogy, and children's play to improve the character of children aged 4-6 years. Open behavior of important character, which is needed in the 21st century, is first developed through play. which will be very important for children in their future success. Therefore, the benefits of play serve the child's overall growth and development needs. Piaget believed that children were scientists, driven to carry out everyday experiments that would reveal the nature of their world (Henniger, 2013).

The joyful play played by children is related to emotions which are an integral part of the neural network responsible for learning and are associated with increased levels of dopamine in the brain's reward system which is linked to improved memory, attention, mental changes, creativity, and motivation. Happiness is associated with increased dopamine levels in the brain's reward system which is linked to improved memory, attention, mental changes, creativity, and motivation. As well as making the game meaningful. Meaningful play along with making connections between familiar and unfamiliar stimuli guides the brain in making learning efforts easier. Meaningful experiences introduce new stimuli that are connected to existing mental frameworks: processing these stimuli recruits' networks in the brain associated with analogical thinking, memory transfer, metacognition, creating insight, motivation, and reward. Consistent with previous play that children have experienced, they are active and engaged in engagement that increases brain activation related to agency, decision making, and flow. Active engagement involves memory encoding and retrieval processes that support

learning. Full engagement in activities allows the brain to train networks responsible for executive control skills, such as driving destruction that benefits short-term and lifelong learning, where children who engage in repetitive persistence associated with repetitive thinking are associated with networks of reward and memory that underlies learning. Iterative ness increasingly involves networks related to taking alternative perspectives, flexible thinking, and creativity. These types of play activities also involve positive caregiver-child interactions to help build the neural foundation for developing healthy social-emotional regulation and protect against barriers to learning, such as stress. Early social interactions encourage plasticity in the brain to help overcome challenges later in life. Social interactions activate brain networks to detect other people's mental states, which is important for teaching and learning interactions. Guided play also falls on a continuum based on how many adults, involved preschool teachers set up the environment and participate in the play. Preschool teachers' roles in play vary depending on their educational goals and the child's developmental level.

Based on research findings, it is proven that neuropedagogy-based games lead to a new paradigm in early childhood pedagogy. Extrapolated from this interpretation is an informed curriculum and teaching that education and character education can be strengths-based and personalized to promote. academic achievement, especially in character education. Especially in preparing future generations who can overcome all challenges in the 21st century which is characterized by rapid technological developments, such as the Industrial Revolution 4.0.

Previous research conducted by several researchers mostly discussed the relationship between neuroscience and multiple intelligences. Among these researchers was Shearer (2018) who investigated 500 scientific reports investigating the proposition that general intelligence and multiple intelligences could be integrated based on a common and unique neural system. Furthermore, Chojak (2018) explains neuropedagogy as a scientific discipline, in which it is stated that there is an interdisciplinary description of the theoretical basis for the development of the research field. Jamaris (2016) presented the results of his research on empowering logical-mathematical intelligence in an inclusive group of children aged 4-6 years through a multisensory learning approach. His research found that children's logic and mathematics can be improved through a multisensory learning approach.

The curriculum dictates that students should engage in problem-based learning and work in small groups. They recommended that future character education include moral issues and social differences among students. In their statement, the three researchers never paid attention to the role of neuropedagogy in character education. Dick and Carey (1985) explained systematic teaching design, where they explained the process and procedures for teaching design. However, they do not relate it to neuroscience and neuropsychology. In line with them, further outlined the results of their research on building the teaching and learning capacity of online nurse educators, where they emphasized that three elements of technical pedagogical content knowledge are

important. However, they did not rely on their study of the role of neuropedagogy to improve the teaching and learning abilities of online nurse educators.

5 CONCLUSION

Character is important in every education. Therefore, character education must be emphasized in every educational problem. Considering that character education must start from an early age, therefore teachers in kindergarten have the responsibility to implement character education. In line with the rapid development of the brain, early childhood education must pay attention to improving character by implementing neuropedagogy-based games. Therefore, early childhood teachers and their parents must increase their knowledge and skills to create a neuropedagogical game-like environment that children need to improve their open behavioral characteristics. Based on the previous description regarding the results of previous research regarding neuroscience, educational technology, and neuropedagogy, it is known that only a few studies emphasize neuropedagogical games to improve the character of children aged 4-6 years. Therefore, it can be said that neuropedagogy-based play research is a breakthrough in the field of neuropedagogy. Apart from that, the benefits of playing for early childhood character education can also be used to prepare the nation's next generation of quality.

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