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Piaget's Cognitive Developmental Theory: Critical Review

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Abstract

In the last century, Jean Piaget proposed one of the most famous theories regarding cognitive development in children. Piaget proposed four cognitive developmental stages for children, including sensorimotor, preoperational, concrete operational, and the formal operational stage. Although Piaget's theories have had a great impact on developmental psychology, his notions have not been fully accepted without critique. Piaget's theory has some shortcomings, including overestimating the ability of adolescence and underestimating infant's capacity. Piaget also neglected cultural and social interaction factors in the development of children's cognition and thinking ability. Moreover, in terms of the methodological approach, Piaget's theory had some ethical and bias problems as he studied his own children. However, Piaget contributions, particularly in regards to the process of education among children and transferring cognition into psychology, have had a significant effect on the science of child development.

Keywords: Cognitive Development, Sensorimotor, Preoperational, Concrete Operational, Formal Operational and Child Development

Introduction

Swiss psychologist Jean Piaget (1986-1980) spent around five decades determining the cognitive development of children (Passer & Smith, 2009). During his studies, he attempted to obtain the answer to some key questions such as: "Why does a child talk, and who is she talking to?" and "Why does she ask so many questions?" "Why children in the same age commit the same error?" (Passer & Smith, 2009; Butler-Bowdon, 2007).

To understand cognitive development, Piaget applied structured observation (Shaughnessy, Zechmeister, & Zechmeister, 2012). During the observations, he wrote down everything about the participant's actions (Butler-Bowdon, 2007). After many years of hard work, he finally publicised his ideas and proposed four global cognitive developmental stages for children, including sensorimotor, preoperational, concrete operational, and the formal operational stage (Bernstein, Clarke-stewart, & Roy, 2008; Martin, Carlson, & Buskist, 2010). Although Piaget's contributions have had a great influence to progress developmental psychology (Oates & Grayson, 2004), his works have not fully accepted due to several methodological issues (Lourenço & Machado, 1996). The aim of the current paper is to demonstrate the key aspects of Piaget's cognitive development theory and evaluate Piaget's idea based on later studies.

Cognitive development stages

Piaget suggested that all children journey through the sensorimotor, preoperational, concrete operations, and formal operations stages of development (Moreno, 2010). During the process of moving through one stage to the next, children's cognitive ability change qualitatively (Sigelman & Rider, 2012). Piaget also believed that cognitive development is a continuous process and all children, even in different environmental context and culture diversity around the world, have the same sequence of cognitive development (Hockenbury & Hockenbury, 2011).

The first stage of cognitive development is the *sensorimotor stage*, which starts from birth until two years old (Kasschau, 2003). Infants at this age seek to understand objects by using sensor activity (Moreno, 2010). This stage, characterized by object permanence and deferred imitation (Bremner, 2010).

Object permanence means that "objects remain in the environment even when they cannot be seen or perceived by other senses" (Moreno, 2010). In Piaget's theory, infants in the first 8 months have a lack of object permanence; which means that they cannot understand hidden objects (Hockenbury & et al., 2011). As infants deal with objects physically in this period (Cacioppo & Freberg, 2013), if they do not see them, they believe these objects do not exist (Martin, Carlson, & Buskist, 2010; Hockenbury et al., 2011).

Based on Piaget's theory during the sensorimotor stage, three essential developments occur. Firstly, by 18 months, children can express limited vocabulary, and by two years, they can express short and meaningful sentences (Cacioppo et al., 2013). Secondly, children at the end of the sensorimotor stage develop their capacity to imitate others, which Piaget called "deferred imitation" (Martin et al., 2010). *Deferred imitation* is "the ability to reproduce a modeled activity that has been witnessed at some point in the past" (Shaffer & Kipp, 2010). Finally, by the end of this stage, children imagine and represent symbols relatively (Martin et al., 2010).

New views of the infant's cognitive capabilities

Studies have demonstrated that many cognitive capabilities among infants emerge earlier than in Piaget's theory (Bauer, Larkina, & Deocampo, 2011). Infants have innate knowledge about the external world, and their learning ability is faster than Piaget believed (Spelke & Newport, 1998).

With respects of object permanence, Baillargeon (1987) pointed out that infants in their early age search to find objects earlier than Piaget proposed. And infants under the first age have cognitive ability to understand that hidden objects are not out of sight (Baillargeon, 1995; Hespos & Baillargeon, 2001; Shinskey & Munakata, 2005; Baillargeon, Li, Gertner, & Wu, 2011).

According to Piaget, deferred imitation appears among children between 18 to 24 months (Piaget, 1962). However, Meltzoff (1995) indicates that infants have the ability to imitate different types of action earlier than Piaget suggested (Meltzoff, 1995). Recently, studies found that even infants at six weeks could imitate other's facial expression (Berk, 2006; Lamb, Bornstein, & Teti, 2002). In addition, 6 month-old infants after one day delay (Barr, Dowden, & Hayne, 1996; Collie & Hayne, 1999), 9 months-old infants after a 1-day delay (Meltzoff, 1988) and 14 months-old infants after 7 days delay showed referred imitation (Meltzoff, 1988).

Developmental psychologists (e.g., Meltzoff, 1988; Wynn, 1992; Meltzoff, 1995) demonstrated that an infant's mental representations develop earlier than Piaget recommended. Physical reasoning is an innate ability that assists infants to think about physical objects and interact with them (Baillargeon et al., 2012).

The second stage of cognitive development in Piaget's theory is the *preoperational stage*. This stage starts from 2 years to 7 years old (Cacioppo et al., 2013). During this stage, an infant's symbolic ability develops such as using images and words as symbols to understand the physical world (Bjorklund & Blasi, 2012). Children

between 2 and 4 years old can draw a picture (Santrock, 2011). However, they do not have the ability to think logically (Ciccarelli et al., 2012).

According to Piaget, the first limitation of the preoperational stage is *animism* (Santrock, 2011). Animism is the ability to distinguish between animate and inanimate objects (Shaffer et al., 2010). Children in this stage believe that everything around them is alive (Bernstein et al., 2008). For example, Santa Claus is not a real person, but because children usually see him on TV and pictures; they believe that he is alive (Ciccarelli et al., 2012). Even children in this stage believe that inanimate object is alive, and they say "that tree pushed the leaf off, and it fell down" (Santrock, 2011).

However, Backscheider, Shatz, & Gelman (1993) carried out an experimental study which gave contrasting findings to Piaget's notion about animism. They pointed out that a preoperational child can distinguish between inanimate and animate objects. For example, they asked three and four-year-old children how the healing process happens after injuring plants, animals, and artifacts (Backscheider et al., 1993). The result of their study demonstrated that children at four years old understood that artifacts are fixed by individuals and others will be cured by means of regrowth (Backscheider et al., 1993).

According to Piaget's theory, another limitation of the preoperational stage is *egocentrism* (Santrock, 2011). Egocentrism refers to the child's inability to differentiate between their perspective and others (Kesselring & Müller, 2011). For example, when children stand in front of the TV, they believe that others behind him/her still can see the TV screen. Piaget believed that children are highly egocentric until a later age (Comer et al., 2011). Although few studies supported Piaget's idea that a young child is egocentric, most experiments have shown that child can take others perspective earlier than Piaget suggested (Comer et al., 2011).

Therefore, Piaget's thought of egocentrism has been revised critically (Newcombe & Huttenlocher, 1992). In a very early study, Liben (1978) pointed out that only three years old children are egocentric. Newcombe et al., (1992) supported Liben's idea, and they showed that 4 years old could take other's perspective, and their mental states differ from others (Doherty, 2008). Also, it was found that even 2 years old can distinguish between their peers and adults, which when they speak with adults, use longer sentences (Martin et al., 2010). It means that preschool children are not as egocentric as Piaget thought (Flavell, 1999).

In Piaget's idea, children during the preoperational stage have conservational difficulty (Kesselring et al., 2011). **Conservation** refers to the ability to recognize that something remains the same amount even if its shape change (Franzoi, 2011). Children who do not have conservation ability have a limited mental capacity to understand the change of shapes (Franzoi, 2011).

In contrast, studies have shown that preoperational children have the ability of conservation (Gelman, 1972; Gelman & Baillargeon, 1983). Preschool children are able to do conservation tasks if the tasks are appropriate to their level of thinking and understanding (Berk, 2006). After manipulating the complexity of conservational tasks, researchers reported that Piaget was not correct (Bidell & Fischer, 1992). For example, in his experimental study, Gelman (1972) manipulated the complexity of tasks to judge conservational ability among young children. Finally, he found that even 3 years old children can perform conservation tasks successfully (Gelman, 1972). The difficulty to perform the conservational tasks correctly related to displaying complex tasks by Piaget and preschool children more capable than Piaget theorized (Gelman, 1972).

According to Piaget, the third stage of cognitive development among children is the *concrete operational stage*. It is between the age of 7 years until 11 years old (Franzoi, 2011). Piaget suggested that children during this period are less egocentric; they display the ability to understand concert things (Hockenbury et al., 2011); and they can solve complex problems (Bjorklund, 2012).

In this stage, children's conservation principles develop which they can understand such things as half a liter of water has the same amount in a taller or wider glass (Shaffer et al., 2010). Furthermore, at around 8 years, old children start to solve problems (Lightfoot, Cole, & Cole, 2009).

Moreover, *classification* is another significant characteristic of the concrete operational stage. Piaget suggested that children during this stage can classify objects into different types such as shape, value, and size; children can also consider their associations (King, 2011). When children play with objects, they can understand the difference between strong objects which are fit to play with and weaker object that is not fit to play with (King, 2011). In addition, based on Piaget's notion, children in the concrete operational stage also have the ability to understand the relationship between sets and subsets (Santrock, 2011). For example, children in this stage can understand that one person can be a father, grandfather, and brother at the same time (Santrock, 2011).

In contrast to Piaget notion, children in the concrete operational stage often overestimated (Cacioppo et al., 2013). Recent researchers found that children in this stage cannot understand the relationship between those things that do not exist in the physical world, such as the relationship among numbers as Piaget suggested (Comer et al., 2011).

The final cognitive stage among children is the *formal operational stage*. Piaget proposed that when children approach 11 years, they achieve the final stage of cognitive development (Franzoi, 2011). Piaget believed that during this stage, an individual's thinking and understanding develop significantly (Feldman, 2013). Piaget believed that adolescents in this stage could think logically and deal with abstracts such as math (Pastorino & Doyle-Portillo, 2013).

Does every child reach the formal operational stage?

Although Piaget proposed that all children, without exception, go through the four different types of cognitive development (Bernstein et al., 2008), recent literature demonstrated that not all adolescents approach the formal operational stage (Martin et al., 2010). Since in some societies, the educational process does not focus on critical thinking, which is very essential to reach a formal operational stage (Cole, 1990). Studies showed that only half of the individuals in some societies reach the formal operational stage due to the lack of educational background (Bernstein et al., 2008). Moreover, sometimes individuals can illustrate formal operational skill in just one field, for example, an individual who is a very good an engineer, can think logically about this particular area, but at the same time are very likely to have difficulty thinking logically about poetry (Martin et al., 2010).

It has been found that the ability of formal operational thinking among humans has changed over time (Shaffer et al., 2010). Formal operational competence has been examined among French individuals in the different period between 1967 to 1996 (Shaffer et al., 2010). The result demonstrated that individuals in the current era in terms of thinking logically and solving problems are more capable than individuals who lived three decades ago (Shaffer et al., 2010). Biological psychologists also proposed that adolescents, until the age of 20 years, cannot deal with complex calculation properly due to the limitation of their brain activity (Cacioppo et al., 2013).

Piaget and culture diversity

Some believe that Piaget ignored cultural, educational, and social influence on children's cognitive development. In order to reveal cognitive development stages among children, Piaget did not examine children from diverse societal backgrounds; he examined only children in a western society who had formal education compared with non-western society (Lilienfeld, Lynn, Namy, & Woolf, 2011).

Similarly, the most important aspect of Piaget's theory is the detection of cognitive stages among children was interaction and deal with physical objects (King, 2011). Life pattern and cultural context have been found to play a significant role in cognitive development, however, Piaget ignored this particular area (Franzoi, 2011). For instance, individuals in the nomadic tribe who do not stay in a particular location cannot deal with numbers properly, and they have more difficulty than children in westernized societies in terms of counting objects and conservation principles (Franzoi, 2011). Therefore, cultural influence has been considered an important aspect of cognitive development (Martin et al., 2010). It was found that individuals in Hausa tribe in Nigeria between age 5 to 11 years old failed to understand numbers as conservation tasks because they were not familiar with education and schooling (Martin et al., 2010). Therefore, emerging cognitive stages differ among societies; it's

possible in one society for children to achieve the formal operational stage and in other societies, children remain in the concrete operational stage (Byrnes, 1988).

Moreover, Piaget also underestimated the effects of interaction influence among peers on cognitive development. Piaget did not consider that children living with their families are influenced by their families (Cacioppo et al., 2013). Also, children communicate with their peers outside of the home; this communication can lead to developing a child's thinking to understand the external world (Kail, 2012). In addition, every society has particular activities which have a profound effect on an individual's cognitive development (Rogoff, 1995).

Others believe that Piaget paid too little attention to the impact of social factors on the cognitive process, however, he did not ignore social influence entirely (Kail, 2012). Piaget explored some aspects of the role of interaction on children, proposing that communication with others transforms a child's egocentric thinking to "socialized thinking" (Lourenço & et al., 1996). Piaget also acknowledged that cultural context and social interaction affect cognitive development (Shaffer et al., 2010). However, he did not theorize on how social context affects cognitive development (Shaffer et al., 2010). Psychologists now understand children's thinking and understanding by means of their cultural context (Shaffer et al., 2010). Kitchener (1991) believes that Piaget was not familiar with sociology as a science, therefore, Piaget's sociological thought was limited (Kitchener, 1991).

The Russian psychologist Lev Vygotsky theorized that interaction with others has a great influence on cognitive development (Hockenbury et al., 2011). He argued that children have the capacity to accomplish larger amounts of cognitive improvement through social interaction, Piaget failed to acknowledge this influence (King, 2011). Piaget established his cognitive development theory based on children's dealing with physical objects, however, Vygotsky believed that a child's mind develops when they interact with other people's minds (Bernstein et al., 2008). During this interaction, children use language to ask questions, and others respond to them, this process contributes to the development in the cognitive ability of children (Cacioppo et al., 2013).

Piaget and Methodological issue

In terms of the principles of developmental science, Piaget's theory has some problems. Firstly, regarding the selection of participants; Piaget did not select a great variety of participants to provide a reliable result, mostly he only examined his own children (Lilienfeld et al., 2011). Furthermore, one of the most important aspects in research methodology is to reduce the effect of sampling bias by selecting participants very carefully. Hence, it is not possible to generalize his ideas to children from different cultures or countries around the world.

Secondly, Piaget often utilized the clinical method to collect data. This method is more flexible, so participants are likely to ask different questions (Miller, 2011). However, uniform materials, questions, directions, and techniques to evaluate psychological variables are the spine of experimental psychology (Miller, 2011).

Modern psychologists have been frustrated by Piaget's reports of his experiment. Piaget did not explain the social-economic background of the children, the number of participants, the participant's race or ethnicity, and he did not provide ample detail about his testing measures (Miller, 2011). It is difficult to identify whether Piaget is describing children hypothetically or if he indeed really tested them (Lilienfeld et al., 2011). Moreover, Piaget was poor in the analysis of statistics which he says, "Psychologists over-generalized their methods and arrived at delightful trivialities, particularly when an army of scientists translated their results into mathematical terms" (1918, p. 63 cited in Miller, 2011, 85-86). In addition, "acute observation, especially when made by [a good observer] . . . , surpasses all statistics" (1936/1952, p. 72, cited in Miller, 2012, 85-86). This means statistical summaries were not given by Piaget about his discoveries, and he supplied lengthy specimen protocols interpreted by Piaget of which readers often do not understand the themes of (Miller, 2012).

Conclusion

Swiss psychologist Jean Piaget spent his career determining the cognitive ability among children in their early life until a later age (Krause & Corts, 2012). He proposed four cognitive stages, which he believed every child

goes through consecutively, without skipping a phase (Bernstein et al., 2008). Although Piaget's theory has had a great influence on the child and developmental psychology (Oates et al., 2004), nativism had a different viewpoint in some respects. In terms of the first stage of cognitive development (sensorimotor stage), nativism believed that children are born with some innate knowledge, and they have more capability than Piaget suggested (Baillargeon, 1987). Gelman (1977) believed that Piaget used complex tasks and inadequate strategies to evaluate conservation among children. For example, in one study, Gelman (1972) manipulated the tasks to assess conservational ability among children, and he found a different result which did not support Piaget's result.

Some new developmental psychologists believe that Piaget underestimated an infant's ability in both the sensorimotor and preoperational stage. They also argue that Piaget overestimated formal operational children (Cacioppo et al., 2013). For example, children can do object permanence, understand the conservation, and imitate others earlier than Piaget proposed (Baillargeon, 1987; Gelman, 1972; Meltzoff, 1995).

Social factors have had a significant role in cognitive development among children. Children live with their own parents, and they interact with their peers and teachers; all of these have a great deal of influence on a child's level of thinking and understanding (Cacioppo et al., 2013). Russian psychologist, Lev Vygotsky proposed that children's minds develop in a sociocultural context rather than interactions with a physical object which Piaget suggested (Schacter, Gilbert, & Wegner, 2011). Thus, it is suggested for psychological researchers to account for social factors and cultural contexts in cognitive development studies (Bidell & Fischer, 1992). Vygotsky noticed that cultural tools, such as counting systems and language, have a very strong impact on cognitive development (Bernstein et al., 2008).

Despite all criticisms, Lourenço et al., (1996) claimed that researchers who criticized Piaget had not understood Piaget's major role and contributions. Therefore, Piaget's works have been misinterpreted and criticized in the wrong way, and Piaget had a great deal influence on developmental psychology (Lourenço et al., 1996). Beilin (1992) proclaimed that the influence of Piaget's work on developmental psychology is like that of Shakespeare's influence on English literature (Beilin, 1992). Today, the impact of Piaget's theory has guided psychologists in order to reconceptualize the concept of cognitive development (Lilienfeld et al., 2011). In addition, further researchers have been guided to some important questions which Piaget posed in order to investigate new findings in the area of cognitive development (Shaffer et al., 2010).

Flavell as a famous expert in the field of child development stats that "many of Piaget's contributions have become so much a part of the way we view cognitive development nowadays that they are virtually invisible" (Flavell, 1996: 202). Gelman et al. (1983) also quoted, "it is always easy to examine the past in terms of the present. What is more difficult is to create the future. It will be hard. Very hard, to do as well as Piaget" (Gelman et al., 1983: 220). However, Neo-Piagetian believes Piaget's theory must be revised based on new studies (Santrock, 2011). Psychologists today can use neuroimaging in order to obtain more specific knowledge of cognitive development and stage transition (Cacioppo et al., 2013).

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