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Piaget and Education: A Critique of the Unproblematic Application of Piaget's Theory to Education

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Abstract

Jean Piaget's genetic epistemology has often been applied to education. This research report looks at the interpretation and use of Piaget's ideas to education and argues that most applications of Piaget to education are not in keeping with the nature and object of his genetic epistemology. As such the report suggests number of ways in which Piaget could be used in education without undermining the integrity of his theory.

Key words

Piaget, genetic epistemology, application, education, reflexive abstraction, active methods, constructivism, activity, development, learning.

Declaration

I declare that his research report is my own, unaided work. It is being submitted in partial fulfillment for the degree of Master of Education (Coursework and Research Report) in the University of the Witwatersrand, Johannesburg. It has not been submitted for any degree or examination in any other University.

BMMabitsela

Babalwa Maureen Mabitsela

26 day of FEBRUARY 1999

Dedication

I wish to dedicate this research report to my husband, Tumelo and my two children, Omphile and Itumeleng for their constant support and unfailing understanding.

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I wish to thank my supervisor, Mr Rashad Bagus for all his help, professional competence and sense of quality.

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Introduction

Many researchers and educational practitioners have relied upon Piaget's thinking for educational purposes, and not just in classroom teaching and learning, but also in the training of teachers. In this way, the theory has been treated as a psychological theory that is ready to be applied to education. Despite this tendency, it is important to note that Piaget himself wrote very little about education. Secondly, Piaget never considered himself as an educator or psychologist. In fact, Tamburrini (1982) argues that even with psychological theories, it is not possible to translate their findings into practises that should be carried out in our schools because if we do that, we may end up with practises that may not be regarded as good and sound educational practises. As a result of the foregoing assertions, a number of questions arise. The first question is whether Piaget's theory is really a useful resource in education. If he is a useful resource, the second question is, what contribution can he make to education.

To address the foregoing questions, the purpose of this research report is to show that Piaget's theory can be a very useful resource in thinking about education especially during the time when processes have started to try and reconstruct South African education. Given this stated intention, I will start by reviewing some of the literature in the area of Piaget and education. This review of the literature will try to show that there is a tendency among some researchers to apply Piaget's theory in an unproblematic way to education. I will further show that this unproblematic application is the result of

isolating certain aspects of Piaget's theory and that these aspects are treated as representative of the theory as a whole. Being influenced by my belief that Piaget's theory can be a useful resource in education especially if we look at his overall project, i.e., genetic epistemology, I will consequently provide a detailed exposition of Piaget's genetic epistemology and his theory of psychological development. My first intention with this exposition is to show that Piaget's psychological research was a means to answer the more general epistemological questions about the development of scientific knowledge. Secondly, the exposition will help in contrasting Piaget's genetic epistemology with the interpretations which I believe are a restricted view of Piaget's theory. Lastly, I will try to show how in my understanding genetic epistemology could be used in education.

Part One

Literature Review

Piaget's theory, which is concerned with the explanation of the development of scientific knowledge in people, has been seen by many psychologists to have a great relevance to educational practices. This belief notwithstanding, Groen (1978) argues that initially, Piaget's work was unnoticed in the English speaking world. The main reason for this is related to the fact that at that time American psychology was dominated by behaviorist theories. Unfortunately the behaviorist theories could not provide the American psychologists with the answers to some of the questions they were asking about their education. Groen (1978) contends that there are two reasons which led to the rediscovery of Piaget in the English speaking world. The first reason is that more English translations became available. The second reason is that there was a belief among educators that American education was in a crisis. This belief was provoked by the launching of the Russian satellite, Sputnik in 1957. The main concern raised by this belief was that there was little resemblance between maths and science taught at school and maths and science used by professional mathematicians and scientists. This concern resulted in a search for fresh ideas on curriculum planning. The researchers involved in this quest felt that Piaget's theory could provide the fresh ideas required to change American education.

To facilitate the planning of the new curriculum, a number of conferences were held. Two of these conferences were attended by Piaget's chief collaborator, Barbel Inhelder.

This was the beginning of the process of "the rediscovery of Piaget". The conference which marked the completion of this process of "rediscovery" was attended by Piaget himself in 1964. Despite the claim made by Boyle (1982) that the researchers who were involved in the 1964 conference "were not impressed by the claims of Piaget's theory to provide a basis for educational practise" (p.293), Groen (1978) contends that this was the conference which initiated the tradition of "Piagetian" research by English speakers. Consequently, many books appeared which attempted to establish the relevance of Piaget to education. Groen (ibid) contends that the publications that followed differed markedly from the Genevan tradition. Similarly, Easley (1978) argues that the problem with these publications was the attempt to assimilate Piaget's theory into conventional psychology. This assimilation became evident in so far as Piaget's theory was conceptualised as a theory of learning. In other words, Piaget's theory was viewed as an exclusively psychological theory that could be simplistically and unproblematically applied to education. In the remainder of this literature review I will consequently focus on the simplistic application of Piaget's theory to education as advocated by researchers such Singer and Revenson (1978), Mwamwenda (1995), Biehler and Snowman (1990), Lavatelli (1970), Kohlberg and Mayer (1972), Gage and Berliner (1975) and Woolfolk and McCune – Nicolich (1984). The reason for this focus is predicated on my belief that it is this tradition that has informed most educators and psychologists' views about Piaget. In showing the strong psychological interpretation of what I will call the non-Genevan tradition, I will look at the work of the researchers that have been mentioned already. In doing this, I will look at those aspects of Piaget's theory which the researchers have taken out of the theory and applied directly to education. These aspects

are the stages of development, the teaching of Piaget's experimental tasks, and the implementation of the notion of activity.

Stages of development

Researchers like Mwamwenda (1995), Kohlberg and Mayer (1972) see the aim of education as promoting Piaget's stages of development. For Mwamwenda (1995) this is evident in the fact that he believes that the majority of adolescents in secondary schools have not yet reached the stage of formal operations. To make it possible for these students to reach formal operations, Mwamwenda (1995) contends that the use of a "concrete – oriented approach" to teaching can promote formal operational thought in students. To support this contention, Mwamwenda argues that children at secondary school level are not able to perform successfully at subjects like physics, biology and chemistry if they have not yet attained the stage of formal operations.

In focussing on the stages of development, researchers like Kohlberg and Mayer (1972), Biehler and Snowman (1990) and Woolfolk and McCune –Nicolich (1984) believe that the stages of development can be accelerated. There are different methods which these researchers believe could be used in accelerating the stages of development. For instance Biehler and Snowman (1990) believe that if there is "good quality instruction", this can lead to the acceleration of the stages of development. Kohlberg and Mayer (1972) contends that acceleration is possible if children become exposed to a higher level of thought. Woolfolk and McCune-Nicolich (1984) acknowledge that Piaget does not believe in the acceleration of stages, but they also believe that the acceleration of stages

has a lot to offer to students because the educator focusses on the child's present stage and on opportunities for the child to advance in her development. That is why Woolfolk and McCune-Nicolich (1984) believe that opportunities should be created which would allow students to move to the next stage of development. These researchers believe that in moving a pre-operational child to the stage of concrete operations, children should be encouraged to manipulate objects that can change in shape whilst retaining their mass and this could help children understand conservation which is needed in the stage of concrete operations.

Similarly, Seymour Papert (1980), who even though he does not believe in the unproblematic application of Piaget's theory to education believes that the stages of development can be accelerated. Papert's belief on the acceleration of stages is driven by the fact that he is concerned about the late appearance of the stage of abstract operations in adolescents. For him the acceleration of stages can take place if during their learning of mathematics, children are provided with objects they could use to concretise abstract mathematics and he sees computers as the objects which could be used for this purpose. Papert's use of computers is different from the traditional use according to which the computer is used as a tutor. For Papert the child is the tutor because she is the one who programmes the computer. He therefore believes that if the computer is used in this way this may result in the earlier development of the stage of formal operations.

Lastly, researchers who believe in focussing on Piaget's stages of development also believe that what is taught at school must match the child's level of intellectual

functioning. The reason for this belief is that these researchers argue that the child's stage of development can prevent the occurrence of certain forms of learning. For Woolfolk and McCune-Nicholich (1984) matching can prevent boredom because if content is not matched with practise, the work taught could be too simple for some students, and for others the work could be difficult such that these students will be left behind. They also believe that if matching is done, then disequilibrium is kept "just right" and for them this encourages growth. For the teacher to be able to match the child's stage of development, Woolfolk and McCune-Nicholich (1984) believe that the starting point is to diagnose the child's level of intellectual functioning as this will help determine if the student has the mental operations which the task requires.

The teaching of experimental tasks

The focus on the stages of development has led the proponents of the "non-Genevan tradition" to concentrate on the teaching and training of Piaget's experimental tasks. The purpose of teaching the tasks according to these researchers is to move the child to the next stage of development which is in most cases the stage of concrete operations. Lavatelli (1970) in her early childhood curriculum suggests that children from four to seven years should be trained in class inclusion and seriation as this will enable them to reach the stage of concrete operations. For Mwamwenda (1995) the teaching of conservation tasks is important because this can help reduce or eliminate the time lag which he believes exists in the development of stages between African and Western children. He believes that Western children reach the stages of development much earlier

than African children. He further contends that if children are successful in Piagetian tasks, this is an indication that they will also be successful at school. Also, Singer and Revenson (1978) believe that Piaget's tasks are very useful when children are taught conservation.

There are two ways identified by Denis-Prinzhorn, Kamii and Mounoud (1972) which the researchers who believe in the teaching of tasks contend that the tasks could be used in teaching. The first way is to put aside a certain part of the day to solve Piaget's tasks. Lavatelli (1970) is an example of researchers who believe that tasks could be used in this way. Another way is when the tasks are used in an attempt to teach certain concepts. Denis-Prinzhorn, Kamii and Mounoud (1972) believe that the focus of the researchers in this case is to conceptualise the tasks as teachable content. For instance, in teaching seriation, Lavatelli (1970) suggests that this could be done by asking children to arrange two groups of objects such that they are in one-to-one correspondence. The child could be presented with a set consisting of ten dolls and ten umbrellas. The dolls must vary in height and so should the umbrellas. The child should then be asked to match each doll with a proper umbrella. Once the child has been able to master this, the teacher can go to the next step where she withholds one doll and after the child has finished arranging the nine dolls, she is asked to insert the remaining doll in the correct position. If the child is not able to perform this activity, Lavatelli suggests the teacher should compare the dolls with other neighbouring dolls and then give an explicit verbal rule, "[i]f it is smaller than this one and bigger than this one, then it's got to be in the right place" (Lavatelli, 1970, p.141). As stated earlier, Lavatelli believes that once children are made to go through

these activities, they will make progress in the development towards the stage of concrete operations. The fact that the non-Gevevan researchers see the teaching of tasks as enabling the child to move to the next stage of development also reveals the understanding that these researchers have about the relationship between learning and development. For instance researchers like Kohlberg and Mayer (1972), Mwamwenda (1995), Biehler and Snowman (1990) and Lavatelli (1970) believe that learning comes before development. Kohlberg and Mayer believe that there are two ways in which development takes place. First development occurs naturally and secondly as a result of education.

Activity

The researchers who believe in the unproblematic application of Piaget's theory to education also believe in the importance of action during learning. Lavatelli says:

> If we accept Piaget's theory that knowledge is action upon things and the relation which exists between them, then a major part of the pre-school day should be reserved for free choice of activity (1970,p.47).

In order for the children to be actively engaged, researchers like Mwamwenda (1995), Woolfolk and McCune-Nicolich (1984), Gage and Berliner (1975) and Lavatelli (1970) believe that there must be objects in the child's environment which they can manipulate and as they manipulate them learning takes place. These researchers give examples of objects like blocks, clay, paints, sticks, buttons, sand and many others. Gage and Berliner (1975) believe that objects are very important especially when children are in the preschool. These researchers believe that as the children touch, see and feel things, they

acquire the understanding of concepts more effectively as compared to when they are told about the concepts. This means that Gage and Berliner (1975) attribute children's understanding to experience. Kohlberg and Mayer (1972) also see experience as very crucial during the process of learning. The approach of Lavatelli (1970) to the use of materials is that there must be both structured and unstructured periods. The materials that children use in structured periods may suggest the additional materials that the teacher can provide in unstructured periods. Lavatelli further contends that the role of the teacher during these activities is not to teach but to guide the child. She contends that the teacher should "have confidence in the child's ability to learn on his own" (1970,p.48).

The researchers who see the children's actions as important also believe in the importance of play especially with preschool children. That is why Singer and Revenson (1978) have even provided examples of games which they believe are based on Piagetian principles. For this purpose, Singer and Revenson (1978) suggest that television can be used effectively especially with preschool children. One game which can be played with the child is to ask her to look for things that go together in a television programme and this can help the child learn classification. The child can be asked to find for instance square things, or round things or she could also match colours. Another game is the size game which help the child learn the concepts big, small, more and less. In this case the child can be asked to find something small or big on the programme. These are just but a few of the games which Singer and Revenson have suggested.

In conclusion, I have tried to show how the researchers who belong to the "non-Genevan tradition" have interpreted and used Piaget's theory as an educational resource. I have shown that they have done this by isolating few aspects of Piaget's theory. In the next section, I will therefore provide an exposition of Piaget's theory and try to show that there is more to Piaget's theory than just these few isolated aspects. The intention with this exposition is to show that to view Piaget's theory as an exclusively psychological theory is a misdirected reading of the theory.

Part Two

Piaget's Genetic Epistemology

Introduction

In their use of Piaget's theory as an "educational resource", researchers often adopt interpretations which are not just restricted readings of the theory, but also a misconstrual of his basic ideas. To show the differences between Piaget and his interpreters, this part of my discussion will examine the aims and methods of genetic epistemology and further show how pyschology fits into Piaget's research programme. Specifically, I will show that for Piaget the psychological research was one amongst various research methods he used to uncover the development of knowledge. As a result of his psychological research, Piaget developed a theory of psychological development and I will provide an exposition of this theory. In my exposition of the psychological theory I will include a discussion of the role of biology in his theory and of the "social" in Piaget's explanation of the ontogenetic development of knowledge which I believe has been omitted by many psychologists .

The Aims and Methods of Genetic Epistemology

Piaget's overall project, genetic epistemology, attempts to explain the development of scientific knowledge (Piaget, 1970). In addition to this, Piaget also wanted to investigate the means by which the human mind goes " from a lower level of knowledge to a level that is judged to be higher" (Piaget, 1970,p.13). In Kitchner's terms, therefore, genetic epistemology attempts to uncover the mechanism of the increase of knowledge (Kitchener in Bagus, 1992). To achieve this objective Piaget considered two research

methods (Chapman, 1988). First, he believed that the development of scientific knowledge can be traced historically using the historico-critical method. The problem with the historico-critical method is that the data which this method is able to interrogate is inadequate and it is therefore not possible to reconstruct the origins of knowledge using this method. To resolve this problem, Piaget modified Haeckel's recapitulationist thesis and proposed that there may be a parallel between ontogeny, which is the development of the individual, and phylogeny, which is the development of the species. Given this parallel, Piaget consequently contends that by engaging in ontogenetic research, one can make inferences about phylogenetic development. That is, by engaging in research on the development of cognition in the individual, Piaget believes that we may be able to infer how scientific knowledge more generally emerges and develops. Piaget (1970) further believes that such ontogenetic research needs to take psychology seriously. Thus, with the help of the psychological research, it becomes possible to investigate the "pyschogenesis of the fundamental categories of thought" (Kitchener in Bagus, 1992, p.22) and to uncover the mechanisms of the increase of knowledge. Piaget further contends that if we are able to explicate the mechanisms of the increase of knowledge at the ontogenetic level, we can postulate the same mechanisms as existing at the phylogenetic level. As a result of his psychological research Piaget developed a psychological theory of development and in the next section I will provide an exposition of this theory.

The Psychological Theory of Development

From the exposition of the aims and methods of genetic epistemology it appears that there is a divergence between Piaget and most American psychologists. I therefore think it is necessary to look at how Piaget's thinking evolved. According to Chapman (1988) this can be traced to Piaget's interest in biology. That is, to investigate the development

of cognition, Piaget's starting point is biology. Chapman contends that the reason for starting with biology is that Piaget believes that common principles of organisation exists at all levels of life, i.e. from the evolution of the species in nature to the development of concepts in the mind (ibid). In other words, Piaget believes in a continuity between cognitive processes and biological functioning. His main focus in biology is related to the way in which biological species adapt to their natural environment.

To explain the continuity between cognitive processes and biological functioning, Piaget developed a theory of phenocopy (ibid). According to Chapman, (1988) the general definition of phenocopy is the "replacement" of an exogenous formation by an endogenous formation. For example, in cognition physical knowledge becomes replaced by logico - mathematical knowledge. Barker-Reinecke (1995) believes that this replacement is possible because of the existence of an inner system within the organism that makes it possible for it to sense any perturbations and respond to them. In addition to this, Piaget also believes in the existence of a constructive interaction between the organism and the environment (Chapman, 1988). It is constructive in the sense that it results in the evolution of new forms of knowledge. One must be careful here not to see the environment as being responsible for this evolution, but the interaction of the organism with the environment is such that the organism adapts to the environment. Adaptation is therefore a very important process for Piaget because for any organism to continue to survive, it must adapt to its constantly changing environment.

Notwithstanding Piaget's belief that there are parallels between cognition and biology, Chapman (1988) contends that there are still important differences in the way in which *the exogenous replacement by the endogenous* occur at both biological and cognitive levels. The reason for these differences is that for Piaget cognitive reconstructions do not involve "genetic adaptation" (ibid). The existence of differences in the way in which

the exogenous is replaced by the endogenous at the biological and cognitive levels does not however mean that there are no common principles of organisation. These forms of organisation are characterised by what Piaget calls "self -regulation or "tendency towards equilibrium" (ibid). He says that "every living organisation at every level of evolution, contains auto-regulation and the same thing applies, *a fortiori*, I would say in the field of behaviour" (Piaget in Chapman, 1988, p.267).

In his explanation of ontogenesis Piaget is fundamentally concerned with how the psychological structures are constructed. For Piaget (1964) these structures go through four stages in their development. These stages are sensorimotor, pre-operational, concrete operational and formal operational. The sequence of the stages is universal but the ages at which the stages occur differ. Piaget (1964) identifies four factors which explain the development of the structures. These factors are maturation, experience, social transmission and equilibration.

Maturation the first factor, is seen by Piaget (1964) as a necessary but not sufficient condition for the development of knowledge. There are two reasons given by Piaget for the above assertion. The first reason is that very little is known about the maturation of the nervous system. The second reason is that the ages at which the stages occur differ. The fact that there is a difference in the ages at which the stages occur contradicts the widely held view that Piaget's theory is a maturationist theory. Tamburini (1982) asserts that this misconception of Piaget's theory comes as a result of misunderstanding Piaget's definition of development. Piaget defines development as a "spontaneous process, tied to the whole process of embryogenesis ... it concerns as well the development of the nervous system..."(1964, p.8). Tamburini (1982) further contends that Piaget's emphasis on the spontaneity of development should be understood in terms of his account of development as constructivist in nature.

The second factor, experience, is also seen by Piaget (1964) as a necessary but not sufficient condition for the development of knowledge. Piaget provides two reasons for this assertion. The first reason is that concepts like the conservation of substance which develop at the beginning of concrete operations cannot be accounted for by experience. The second reason is that experience is a concept that has two meanings which are different from each other: the first is physical experience and the second is logical-mathematical experience. Physical knowledge is the knowledge which the child gains through physical experience by acting on objects. For instance, according to Piaget, when a child acts on objects she learns the physical properties of the objects, i.e., she learns for example that the object is black in colour or is heavy. Physical experience leads to a type of abstraction which Piaget calls simple or empirical abstraction according to which the source of knowledge are the objects (De Vries, 1978). With logico - mathematical knowledge, the child manipulates the objects, and introduces certain characteristics into her actions on the objects. She starts to co-ordinate her actions. For example, the child may learn to classify the objects. The source of knowledge now is the actions that are carried out on the objects. Piaget (1964) asserts that once the child has internalised her actions, she can co-ordinate her actions without the help of the objects. Logico- mathematical experience leads to reflexive abstraction (ibid). Piaget believes that the child is not aware of the processes of empirical and reflexive abstraction.. Through the "grasping of consciousness" the child begins to think about her thinking. This is what Piaget calls reflected abstraction (Bagus, 1992).

The two kinds of experience identified by Piaget show that for him knowledge is not just a copy of reality. That is why the idea of an operation is very central to Piaget when he explains the construction of knowledge. Piaget defines an operation as "an interiorised action which modifies an object" (Piaget, 1964). He believes that for the child to know

an object, she must act on it. In addition to being an interiorised action, an operation is a reversible action which ultimately results in the development of logical structures.

Social transmission, the third factor which explain the development of structures is, according to Piaget, also a necessary but not sufficient condition for the development of knowledge. Piaget (1964) contends that for the child to be able to receive information from the external world, she must have a structure into which she can incorporate this information. Without the existence of the structure, the child won't be able to understand the information.

Given that maturation, experience and social transmission are necessary but not sufficient conditions to explain the transition from a "lower level of knowledge to a level that is judged to be higher", what then are the mechanisms that explain this transition? This leads to the fourth factor, equilibration which explains this transition and Piaget (1964) believes that equilibration is the most fundamental factor in the development of knowledge. What happens is that as the child interacts with the environment, a "cognitive need" may arise which can include a problem that one has to solve (Barker-Reinecke, 1995). This need becomes a form of disturbance in the individual. In response to the disturbance, the individual engages in two processes. First she engages in the process of assimilation by which she tries to incorporate whatever is presented to her from the environment into her existing structures. As a result of the process of assimilation, the mental structures change to adapt to the new input by a process called accommodation. These two processes are seen by Piaget as complementary. Through their working the individual is able to reach equilibrium and is able to understand or interact adequately with the external world. Once the constructed knowledge becomes inadequate to explain the external world this gives rise to disequilibrium in the individual. Disequilibrium simply means that the individual's existing knowledge does not "match"

the external the world. One cannot remain in the state of disequilibrium hence Barker-Reinecke (1995) sees disequilibrium as the motivation for constructing more adequate forms of knowledge. For Piaget for instance, disequilibria alone force the subject to go beyond her current state of knowledge (Piaget in Chapman, 1988). The process which helps the individual overcome disequilibrium is equilibration. Moll (1989) sees equilibration as the motor of cognitive growth. There are two things that can happen when disequilibrium is overcome through equilibration. First, the disturbances are overcome leading to the reinstatement of the previous condition. Secondly, when the disturbances are overcome this can lead the individual to a "higher and inherently better level of organisation" and Piaget refers to this as "optimising equilibrium" (Chapman, 1988). When the individual has reached the level of optimising equilibrium, she is able to explain the external world to herself. As time goes by, the optimising equilibrium becomes unstable and consequently the whole process repeats itself. It is in this way that knowledge is constructed by the individual. Equilibration, assimilation and accommodation are therefore the mechanisms responsible for the increase of knowledge. The entire constructive process clearly shows the way in which Piaget views knowing. According to him knowing is not "static" but it is a process (Piaget, 1970). Piaget's view of knowing as a process is also evident in the distinction he makes between operative and figurative aspects of knowledge. With the figurative aspects Piaget refers to the "imitation of states" which according to him is static (ibid). On the other hand the operative aspects deal with the transformation of states. By transformation of states the emphasis is on the mental actions that the subject engages in as she transforms the objects.

A serious criticism that has been directed at Piaget is that he never acknowledged the role of the social in the construction of knowledge (Bryant in Smith (1985) & Bruner in Smith (1996)). The main reason which I believe contributes to this misunderstanding is

that for Piaget (1964) the social is a necessary but not sufficient condition for the construction of knowledge. Smith(1996) contends that Piaget's denial of the social as a sufficient condition does not mean that he denies the essential role that the social plays in the developmental of knowledge.

Piaget identifies two kinds of social relations which influence the development of cognition. These social relations include social exchanges between adults and children and social exchanges between peers. With social relations between adults and children, Piaget acknowledged the fact that children do not just take in whatever is presented to them by adults. Instead, the child reconstructs and transforms this knowledge so that it becomes "an understandable scheme in the child's cognitive reality" (Youniss and Damon, 1996, p.271). Notwithstanding this contention, Piaget has a problem with adult and child social relations because these relations are not relations of equality. Youniss and Damon contends that for Piaget these relations are relations of "unilateral authority" (ibid). Within these social relations there is therefore a tendency for information simply to be transferred from the authority figure to the recipient who is the child. Put differently, the child simply assimilates the information without any accommodation. By contrast, Piaget sees social exchanges between peers as the ideal context for the construction of knowledge. He sees social relations between peers as relationships of co-operation. For the co-operation to take place, children must acquire mutual respect for each other. I must however point out that the development of co-operation is not a smooth and unproblematic process. Youniss and Damon (1996) believe that there will be "moments of disputes" in social relations between peers. The "moments of disputes"

occur because children are egocentric in nature. They always tend to hold to their own points of view without considering other people's views. If co-operation has to take place, children have to attend to the views held by others. There is therefore a greater likelihood of conflict which makes it possible for the child to jointly construct knowledge with peers.

Although the child is involved in social exchanges she does not just assimilate what is communicated to her by her peers but this knowledge is re-constructed internally through the process of internalisation. The process by which the child applies what she has constructed internally to the external world is called externalisation, i.e., the endogenous becomes the exogenous (Marti, 1996). That is why Piaget believes there is a relationship between the processes of externalisation and internalisation. Marti (1996) asserts that internalisation as a key concept in Piaget's theory has received a lot of attention as opposed to externalisation, which is also as important as internalisation. For instance, Piaget believes that there is a relationship between internal and external aspects of knowledge. According to Marti (1996) the foregoing contention contradicts the view held by some people, e.g., Moll (1989) who believe that the direction of development in Piaget's theory is "inside-out". This means that knowledge is constructed internally and this has a bearing on the external as the child tries to relate with people and her environment. For Marti to understand development in Piaget's theory as "inside-out" is a very simplistic view of trying to understand Piaget because development is treated as a unidirectional process. The fact that Piaget believes in an interaction between internal and external aspects of knowledge means that for Piaget the construction of knowledge is "dialectical" in nature.

Internalisation is explained by Piaget as a passage from sensorimotor to representative intelligence (Piaget in Marti, 1996). During the stage of sensorimotor intelligence, for the child to solve a problem, she must carry out actions on objects. At a later stage, the child must be able to internalise her behaviour such that when she is confronted by a problem, she must rely on the use of internal symbols. These symbols represent objects in their absence. The child has then passed from the stage of sensorimotor intelligence to that of representative intelligence. According to Marti the internal aspects of knowledge are not just a copy of the external aspects, but they are a "new level of functioning" (1996, p.61). It is for this reason that Piaget sees the grasp of consciousness as a central feature of the process by which the exogenous knowledge becomes the endogenous knowledge. At the end when one is able to consciously use the internalised information as his own, she is then engaged in the process of externalisation.

As I have indicated earlier on, these two processes, internalisation and externalisation, help uncover the role of social relations in knowledge construction. According to Marti (1996) this is possible if the process of externalisation is "closely linked to semiotic mediation and to social interaction" (p.73). This is an affirmation of Piaget's position cited by Youniss and Damon that the "socialisation of children's schemes takes place at the point of communicative contact ..." (1992,p271). To support this contention, Marti (1996) uses the example of the construction of mathematical knowledge. He argues that children are born into the world that has pre-constructed mathematical knowledge. The child's behaviour in reconstructing this mathematical knowledge to be her own is

regulated by co-operation with peers, the activities of teachers and the child's own activities, hence the importance of the process of internalisation and externalisation.

Conclusion

The above exposition of Piaget's theory has been an attempt to show Piaget's understanding of his research programme, i.e., genetic epistemology, and how psychology fits into this programme. I also tried to uncover aspects in Piaget's theory which are often misunderstood by many psychologists, especially when using the theory as an educational resource. The first aspect is the importance of biology, according to which Piaget believes that biological species should adapt to their environment to survive. In the same way that organisms adapt biologically, they adapt epistemologically and hence the existence of parallels between biology and cognition. The second aspect is the role of the social in the construction of knowledge. Piaget (1970a) believes that in the same way as the organism has to adapt to its environment, the child also has to adapt to "social realities". This adaptation becomes possible to the extent that there is cooperation between peers. I must point out that Piaget's emphasis on these two aspects contradicts the belief that he reduced knowledge development to biological maturation or that he failed to include the social in his explanation of the development of cognition. In the next section I will critically appraise the different interpretations of Piaget's theory when used as an educational resource.

Part Three

A Critical Appraisal of the Use of Piaget's Theory in Education

The use of Piaget's theory in education by researchers such as Mwamwenda (1995), Lavatelli (1970), Singer and Revenson (1978), Woolfolk and McCune-Nicolich (1984), Gage and Berliner (1975) and Biehler and Snowman (1990) raises numerous questions about their understanding of the theory. The major problem with these researchers in my opinion is their tendency to apply Piaget's theory directly to education and in the process these researchers tend to focus on one or two aspects of the theory and then take those aspects to be representative of the theory as a whole. As a result of isolating aspects of the theory, some of these researchers have assimilated Piaget's theory to empiricist's views of knowledge. That is why De Vries (1978) contends that Piaget's work especially when applied to education in an unproblematic way has been reduced to notions that totally contradict his theory. Groen (1978) similarly asserts that "...to take something out in isolation is to bias the theory..." because "...in Piagetian theory, much more than in most psychological theories everything is related to everything else in an extremely complex fashion"(p.267). That is why according to Groen (1978), Piaget does not have a theory that is ready to be applied to education but rather we can talk about the implications that the theory has for education. My main focus in this part of the research report will be to discuss the misconceptions that various researchers have about Piaget's relevance to education. After a presentation of these misconceptions I will critically interrogate the misconceptions on the basis of the theoretical exposition provided in the previous section. The areas of the misconstrual of Piaget's theory that I will concentrate

on are the use of his stages of development; the teaching of experimental tasks; the omission of constructivism; the confusion of development as learning; the misconstrual of the notion of activity; and finally, the failure by these researchers to include Piaget's notion of the social.

The Focus on the Stages of Development in Educational Practise

One aspect which the researchers identified above isolate in Piaget's theory as they attempt to apply the theory to education is the stages of development. These researchers believe that the aim of education is to promote the stages. For instance Kohlberg and Mayer (1972) believe that the goal of education "is the eventual attainment of a higher level or stage of development in adulthood..." (p.454). Kohlberg and Mayer (1972) are not the only researchers who see education as promoting Piagetian stages of development. Mwamwenda (1995) contends that most adolescents at secondary school level have not yet reached the stage of formal operations. He therefore suggests that teachers should use a "concrete – oriented approach" to promote formal operational thought in adolescents. Other researchers who subscribe to this view, e.g., Kohlberg and Mayer (1972), Biehler and Snowman (1990), Papert (1980) also believe that the stages of development can be accelerated. Kohlberg and Mayer (1972) do not use the term "acceleration" but "facilitation". Their explanation of facilitation seems to mean the same thing as acceleration because they believe that the facilitation of stages can be accomplished by exposing children to a higher level of thought. Biehler and Snowman (1990) similarly believe that the acceleration of stages is possible through "good quality

instruction". Papert (1980) similarly contends that the acceleration of stages is possible if children can be provided with adequate objects to think with as they engage in the process of constructing knowledge. Papert's main concern is the late appearance of the stage of abstract operations. He therefore believes that children should be provided with objects to make the abstract concrete and for him a computer can be used for this purpose. That is, the use of a computer as an object to think with may result in the earlier development of formal operations in children.

In their belief that the stages can be accelerated all of the foregoing researchers are undermining a fundamental presupposition of Piagetian theory, viz., that for Piaget (1964) development is a spontaneous process. The acceleration of stages for Piaget is therefore neither possible nor desirable. In fact Piaget refers to the acceleration of stages as an "American question" and Piaget (1971) does not see any advantages in accelerating the child's stages of development.

Researchers like Mwamwenda (1995), Kohlberg and Mayer (1972) who focus on the stages of development also tend to believe that what is being taught must match the child's stage of development because the child's current stage of development restricts her understanding. Almy (1976) contends that the pre-occupation of researchers and educators with matching the stages to what is to be taught shows how Piaget's theory has been assimilated to traditional conceptions of schooling. The focus of the researchers is on what the students should be taught and not on how the students should be taught. Another problem with matching theory and practise, is that according to Smith (1985) it

is very difficult to infer accurately the child's current level of development. The researchers who believe in matching the stages with what is being taught use a variety of means to estimate the child's level of development. One of these ways is to use traditional intelligent tests. According to Thomas (1990) the problem with traditional intelligence tests is that they only determine whether children can give correct answers or not. They do not reveal the thought processes children engage in to arrive at the type of answers that they give. Smith (1985) also suggests that another way of estimating the child's current level of development used by the researchers who believe in matching the stages with content is to infer it from the child's age. The problem with using age as a determinant of the child's level of development is that Piaget (1964) contends that there are differences in the ages at which the stages occur. At times differences occur between individuals who belong to the same culture. Also, when we look at individual development, it is very difficult to estimate the point at which the fundamental characteristic (e.g., abstract thought) of a stage emerges and consequently matching the curriculum to that stage becomes a problem. Piaget (1971) contends that the fundamental characteristic of a stage emerges at the closure of the stage. Piaget refers to the emerging of this characteristic as driven by a feeling of necessity, i.e., the child reaches a point where a certain logical conclusion becomes necessary. By matching what is taught with the child's stage means the curriculum is matched with the final accomplishment of the stage hence the emphasis is on a concrete-oriented approach in teaching. Furthermore, De Vries (1978) contends that concentrating on stages of development is problematic in the sense that the whole theme of constructivism which deals with how the structures develop is missed.

When researchers like Mwamwenda (1995), Kohlberg and Mayer (1972) focus only on the outcome of development rather than looking at the intricate developmental processes within a stage, they fail to recognise the problem of time lags within a stage which Piaget sees as an important problem in the theory of stages. Piaget (1971) believes that within stages certain aspects of thought may be developed whilst others related to them may be underdeveloped. The fact that there is differential development within stages is proof enough that for Piaget development is not just a function of maturation but also of the world. The problem of time lags is related to Piaget's idea of horizontal décalages. According to Thomas (1990) horizontal décalages show that when concepts develop they do not just appear as fully formed concepts. Thomas gives an example about the development of the concept of conservation. He asserts that this concept first appears in the form of conservation of matter followed by weight and then volume and it may take a long time before the concept is fully developed. If the teacher wants to match the content of her teaching to the child's level of development she is faced with a problem of what exactly does she match. Smith (1985) contends that Piaget himself cautions against taking the stages of development too literally. Piaget says that "... [t]here is no reason why teaching should be moulded to what we have found in the stage theory" (Piaget in Smith, 1985, p.185).

Lastly, even though some researchers see the stages of development as representative of Piaget's theory, Thomas (1990) asserts that this is but a small part of Piaget's theory and this is supported by the fact that Piaget himself wrote very little about the stages. Thomas (1990) further asserts that the fact that Piaget wrote very little about the stages

may be an indication that he did not have much interest in the stages. I therefore believe that to focus too closely on the stages of development is to do an injustice to Piaget's theory.

Teaching of Experimental Tasks

Another area where there is an attempt to apply Piaget's theory directly to education is the teaching of his experimental tasks which is referred to as "training studies". This misconstrual of Piaget's theory emanates from the problem of viewing development as the aim of education. The principal goal of teaching the experimental tasks is to enable children to reach for example the stage of concrete operations. Mwamwenda (1995) gives two reasons why he believes it is important to teach conservation tasks. First, he asserts that there is a gap in the occurrence of stages between African and Western children. The Western children reach the stages much earlier than African children. For Mwamwenda the teaching of conservation tasks to those who are lagging behind may help reduce or even eliminate the time lag. Mwamwenda also believes that the ability of children to perform in Piagetian tasks is a determining factor of how they will perform at school. If a child is successful in Piagetian tasks, that shows the child will also be successful at school. It seems there is a mismatch in what Piaget intended with the experimental tasks and the way some researchers use the tasks. For Piaget the tasks provide the researcher a means to infer the nature of the child's current levels and forms of reasoning. By contrast, some researchers, e.g., Singer and Revenson, (1978),

Lavatelli (1970), Mwamwenda (1995) have used the tasks to teach children how to reason.

As an illustration of the attempt to use the tasks Singer and Revenson (1978) contends that tasks could be used in the teaching of conservation. These researchers believe that by teaching children conservation, children can learn how to count. Specifically, Singer and Revenson believe that in teaching children conservation the educator may even tell children that "ten objects divided into sets of five and five are numerically equivalent to ten objects divided into sets of two and eight" (1978,p.118). They also believe that learning takes place as children look and touch objects. In other words learning takes place through experience. Once more Piaget's theory is reduced to an empiricist theory. For Piaget the purpose of investigating conservation is different from Singer and Revenson. Piaget's purpose is to uncover the transition mechanisms which leads to more complex forms of reasoning. By contrast, Singer and Revenson appear to be saying that these mechanisms do not yet exist in children and by teaching conservation the mechanisms will eventually develop. The difference in Piaget and Singer and Revenson is also evident in the fact that for Piaget the construction of conservation is the function of autoregulation and not as a result of teaching. One other problem with Singer and Revenson is that as they teach children to conserve, they also structure children's activities. The same criticism also applies to Lavatelli (1970) although she believes that her programme of early childhood curriculum is a "Piaget programme". In trying to apply Piaget directly to education, Lavatelli (1970) seems to be contradicting herself because as much as she believes that the teacher must trust the child to learn on her own,

she also believes that the teacher has to structure the child's activities. De Vries (1978) gives four examples of the ways in which Lavatelli believes the te er can structure the child's activities. The examples are that the teacher have to ask leading questions, give a verbal rule, demonstrate to the child the actions she should perform and to provide the visual material for children who cannot conserve. By contrast Williams and Kamii (1986) believe that it is very important not to tell children how to solve problems. They provide an example of a five year old who was asked to put the correct number of napkins during the setting of the main table. As there were four members of the family, there would be four plates and four napkins. At first the child started by making four trips to the cupboard and in each trip he took out one napkin. As time went on, he decided to count the plates and come up with the number of napkins matching the plates. William and Kamii believe that if the child was told what to do, she could have done it correctly but mindlessly.

In the foregoing discussion, I have indicated that in the teaching of experimental tasks, the researchers believe that learning takes place through experience. However, Piaget (1964) identifies two types of experience, i.e., physical experience and logico-mathematical experience. For those researchers who believe in learning as taking place through touching and seeing, the focus is only on physical experience. The problem with focusing only on the physical properties of objects is that the source of knowledge is external to the child and the child is merely "recording" this external information. By contrast Piaget believes that for knowledge to be constructed the child must interact with the objects such that she is able to transform the objects. Also for Kohlberg and Mayer

(1972) it appears that development is exclusively dependent on experience. The problem with Kohlberg and Mayer is that they do not even make reference to the type of experience they are talking about. They also do not provide an explanation of how they think experience promotes development. Lastly, one major problem with "experience" for Piaget (1964) is that experience is a necessary but not sufficient condition for the construction of knowledge. Therefore to view development as dependent exclusively upon experience is misleading.

Denis-Prinzhorn, Kamii and Mounoud (1972) identified two ways in which some educators have used Piaget's tasks for teaching. The first way in which Piaget's tasks are used is that in some schools a certain part of the day is set aside to solve Piagetian tasks. This will be explored later when I deal with the misconstrual of the notion of activity. The second way is that the tasks have been used in a laboratory setting to teach certain concepts. The purpose of the latter research is that the researchers are struggling to answer the question of whether it is possible to teach Piaget's tasks. The focus of the researcher in this regard are the correct answers that children are able to give. As soon as the researcher's focus is on correct answers, this means that the researcher's view of teaching is based on the stimulus – response (S-R) psychology. According to Voneche and Bovet (1982) the status that Piaget gives to the errors that children make is based on the fact that children do not just respond to the environment but they act on the environment and in the process they commit errors. In Piagetian psychology errors are important because they are informative about the children's cognitive processes. By contrast the S-R psychologists believe that errors prevent children form finishing the

tasks given to them. De Vries (1978) contends that the emphasis on the correct answers by the empiricists has led to a view of knowledge as the simple accumulation of facts. De Vries also argues that the emphasis on correct answers is not in keeping with Piaget's beliefs. She contends that

> [c]hildren do not simply accumulate ideas which are correct from the adult point of view, but that they construct their knowledge by assimilations which often result in a long series of "wrong" ideas (1978,p.82).

As a result of emphasising correct answers, once more researchers such as Lavatelli (1970) end up contradicting themselves. Another area of contradiction in Lavatelli's work concerns the wrong answers that children give. On the one hand Lavatelli insists that teachers should "not correct the wrong answers" that children give (1970, p.2) but De Vries (1978) argues that in Lavatelli's Teacher's Guide, she has provided procedures for what teachers have to do in getting the children to correct themselves. These guidelines were discussed earlier.

From the foregoing discussion about the teaching of experimental tasks, there are certain conclusions that can be drawn. First, it appears that for some researchers, e.g., Lavatelli (1970) the issue of training studies is to improve performance on Piagetian tasks. According to Groen (1978) the improvement of performance on Piagetian tasks is not important. Instead, Denis – Prinzhorn, Kamii and Mounoud (1972) believe that "...[t]he important thing is the process of thinking and the structure that the process has attained" (p.68). The training studies conducted by Inhelder, Sinclair and Bovet (1974) are relevant in this regard. These researchers contend that the aim of their training studies "was to get a better insight into **the transition mechanisms** which enable

children to attain certain concepts that are essential for scientific thought " (Inhelder, Sinclair and Bovet, 1974 p.242, emphasis added). To the extent that Lavatelli (1970) does not use the task to understand the transition mechanisms she is "barking up the wrong tree" as Groen (1978) puts it. The other problem with teaching conservation tasks according to Groen (1978) is that there is no guarantee that the necessary structures will be constructed. That is why according to Singer and Revenson (1978) there are researchers who have tried to teach conservation but were not successful. This means that even though Singer and Revenson (1978) believe in the teaching of tasks, they also see such teaching as problematic.

Denis-Prinzhorn, Kamii and Mounoud (1972) do not dispute the fact that some Piagetian tasks can be useful in a classroom situation. They contend that the underlying processes of reasoning constructed as a result of engaging children in some of Piaget's tasks should be such that children are able to use these processes of reasoning even in situations that are "beyond Piagetian tasks outside the test situation and outside the classroom" (Denis – Prinzhorn, Kamii and Mounoud 1972,p.69). In other words, the child must be able to generalise what she has learnt even to new situations outside the classroom. The ideal situation for having such progress in development according to Inhelder, Sinclair and Bovet (1972) would be when "the training procedure in some way resembled the kind of situations in which progress takes place outside an experimental set-up" (p.24).

Lastly, I would argue that the teaching of tasks as I have indicated is a misconstrual of Piaget's theory and De Vries (1978) contends that researchers who hold this position

seem to believe that going through all Piagetian tasks will enable the child to move to the next stage of development whereas for Piaget tasks are useful only to the extent that they are able to reveal the transition mechanisms of cognitive development.

Omission of Constructivism

Piaget (1964) has always understood the process of coming to know as an active and constructive process. Beilin (1989) contends that there are two theories which have tried to explain the origins of mind and that Piaget always makes an effort to distance his theory from such explanations. First, the empiricists theories see sensory experience in the world as a source of knowledge. Secondly, the rationalists see knowledge as innate. The contrast between these two accounts and Piaget's constructivism is that for the empiricists and rationalists the subject who comes to know is passive. Beilin (1989) argues that in the empiricist and rationalist' accounts there is no reference to the presence of the instruments of assimilation without which Piaget believes learning cannot take place. The construction of knowledge according to Piaget takes place through a process of self-regulation and that is why the mechanisms of equilibration, assimilation and accommodation are fundamental in Piaget's theory of constructivism.

Given the way in which Piaget understands the process of knowing, I must however indicate that the researchers who believe in the unproblematic application of his theory to education e.g. Mwamwenda (1995), Lavatelli (1970), Singer and Revenson (1978), Woolfolk and McCune-Nicolich (1984), Gage and Berliner (1975) and Biehler and Snowman (1990) have always omitted Piaget's constructivism. Piaget's theory is treated

like an empiricist theory instead of a constructivist theory. According to Almy (1976) and De Vries (1978) the reason why Piaget's theory is treated as an empiricist theory is that at the time when Piaget's theory was rediscovered, people were looking for a theory of learning that could run counter to the behaviourist tradition which was very dominant at the time. Unfortunately, because most people were empiricist in their beliefs Piaget's theory was assimilated into people's old cognitive structures. Consequently, some of Piaget's concepts became distorted or were even changed in the assimilation of his work into American psychology. The focus of this section of my research is to show that people then started to focus on isolated aspects of the theory.

In omitting the notion of constructivism, researchers also failed to recognise the significance of prior knowledge in Piaget's explanation of the development of knowledge. Piaget contends that the child uses prior knowledge when she is confronted by something new and very often assimilation and accommodation will be conditioned by this knowledge. That is why the role of teaching cannot be seen as a mere transferring of facts which the child has to record. Similarly, researchers have also failed to recognise that for Piaget, development of knowledge is an open-ended process, i.e., we cannot tell before the time what the end results of the developmental process will be. To support this contention, Duckworth argues that "children should be allowed to do their own learning" and be given opportunities to take their own decisions (1964, p.2). If learning is approached in this way, it becomes difficult to predict what the outcome of the learning process would be.

In conclusion I want to caution against confusing Piaget's constructivism with Von Glasersfelds's radical constructivism. Ernest (1994) asserts that according to radical constructivism, the focus is on an "[e]volving, adapting, **isolated**, biological organism", (p.9, emphasis added), and it does not have any room for interpersonal communication whereas Piaget (1971a) acknowledges the role of the social in the construction of knowledge. Another problem with radical constructivism is the view of the world that is depicted in this paradigm according to which we can never know the external world. Because no-one can know the external world, the implication is that we cannot claim that constructed knowledge has a relationship with the external world. By contrast, Piaget believes that constructed knowledge has a relationship with the external world. For instance, one is at the state of equilibrium if the constructed knowledge "matches" the external world. For Piaget therefore the social is a necessary factor in the development of knowledge.

Misconstrual of the Notion of Activity

As Piaget's theory is a constructivist theory, he believes that knowledge is constructed by the individual as she interacts with the environment. Piaget therefore emphasises the importance of the individual's activity in the construction knowledge. Piaget says:

> To know an object, to know an event, is not simply to look at it and make a mental copy, or image of it. To know an object is to act on it. To know is to modify, to transform the object, (1964,p.8)

Piaget's emphasis of activity has been understood by some researchers in ways that are not in keeping with what his beliefs. Some educators such as Lavatelli construe activity

as putting aside a few minutes a day for play (Lavatelli, 1970). These researchers also believe in the presence of objects in the child's environment like blocks, sticks, buttons, sand, clay, etc, that children can manipulate because through such manipulation they can learn (Mwamwenda (1995), Woolfolk and McCune – Nicolich (1984) & Gage and Berliner (1975)). Singer and Revenson (1978) have even suggested a few examples of games which children can play and they believe that these games are based on Piagetian principles. Because of the emphasis on the presence of objects, researchers such as Mwamwenda (1995) believe in the use of the "concrete – oriented" approach especially in the teaching of subjects like science. Mwamwenda believes that as children manipulate the objects, they become creative and they also discover things for themselves.

There are a number of problems with the above conception of activity. First, Williams and Kamii (1986) assert that for Piaget activity does not just refer to the physical manipulation of objects but it refers to a "mental action" hence Piaget's reference to an operation. William and Kamii are opposed to the use of the term "manipulation" because for them manipulation is an "external act" which can be mindless. Tamburrini (1982) similarly asserts that it is possible for the child to be engaged in a physical activity without being engaged mentally. The researchers who believe in the simple presence of objects for the children to manipulate seem to be missing the importance of the mental action in the whole exercise. For these researchers what is important is that children must be busy doing something and this does not necessarily refer to activity. Their emphasis therefore is on action which is not the same as activity. That is why for Piaget activity is

not the same as play. De Vries (1978) refers to activity as being "at the core of the constructive process" whose implications are "far beyond the vague justification of play"(p.79).

I believe that Duckworth's (1964) provides us with a more appropriate understanding of Piaget's notion of activity and the importance of this notion in education. She says:

> As far as education is concerned, the chief outcome of this intellectual Development is a plea that children be allowed to do their own learning... Good pedagogy must involve presenting the child with situations in which he himself experiments, in the broadest sense of that term – trying things out to see what happens, manipulating things, manipulating symbols, posing questions and seeking his own answers, reconciling what he finds one time with what he finds at another, comparing his findings with those of other children (Duckworth in Ripple and Rockastle, 1964, p.3).

Misconstrual of Development as Learning

I have already stated that when Piaget's theory was rediscovered by American psychology, the American researchers were in search of a theory which could provide fresh ideas required to change American education. These researchers were in search of a theory of learning. From that time, Piaget's theory was not recognised as a theory of development in which learning assumed a secondary role. Instead, his theory was assimilated into conventional psychology and consequently conceptualised as a theory of learning. For this reason the emphasis of most researchers such as Lavatelli (1970), Mwamwenda (1995), Singer and Revenson (1978) has been to find ways of directly applying the theory to education. The problem of taking Piaget's developmental theory as a theory of learning leads to an even greater problem: the problem of not seeing the

relationship that exists between learning and development. Piaget (1964) draws a distinction between development and learning. According to Tamburrini (1982) the distinction that Piaget draws between development and learning derives from his conception of knowledge. Piaget understands knowledge to be the construction of reality (ibid) and this construction takes place as the child acts on objects.

Piaget (1964) asserts that development and learning are two different problems although there are some researchers, e.g.,Mwamwenda (1995), Biehler and Snowman (1990), Woolfolk and McCune-Nicolich (1984) who do not see the difference. Piaget (1964) defines development as

> a spontaneous process tied to the whole process of embryogenesis... it concerns as well... the development of mental functions. It is a total developmental process... development is a process which concerns the totality of the structure of knowledge. (1964,p.8).

About learning Piaget says:

> learning presents the opposite case. In general learning is provoked by situations ...by an experiment, or by a teacher, with respect to some didactic point or by an external situation. It is provoked in general, as opposed to spontaneous. In addition it is a limited process ... limited to a single problem or to a single structure (ibid).

In other words for Piaget development deals with the general and learning deals with the particular. The relationship that Piaget believes exists between development and learning is that for him development is primary and it accounts for learning. By contrast, some researchers (Kohlberg and Mayer (1972), Mwamwenda (1995), Biehler and Snowman (1990), Lavatelli (1970)) believe that learning is a prerequisite for development. In fact, Kohlberg and Mayer (1972) seem to be confused about how they view the relationship between development and learning. First, they contend that development occurs

naturally and secondly it occurs "as a result of a planned educational programme". This belief notwithstanding, for Piaget (1964) education forms part of the social which he views as a necessary but not sufficient factor for the development of knowledge. Piaget also contends that development comes before learning. What he means by this contention is that for learning to take place, the child must have developed structures which will enable her to assimilate whatever information is presented to her by the teacher. Piaget (1964) is therefore opposed to the traditional Stimulus-Response (S-R) theory of learning. Piaget believes that between the stimulus and the response there is an organism with structures that can assimilate information. The fact that the S-R theory is inadequate in explaining learning is also illustrated by Berlyne in his modification of Hull's conception of the theory (Thomas, 1990). In trying to modify Hull's S-R theory, Berlyne introduces two aspects. The first aspect is what he calls "the transformational responses". These responses are not just repetitions of what is happening in the external world, but they include reversible transformations which according to Thomas (1990) are similar to what Piaget calls "operations". The second aspect is the possibility of internal reinforcements which include the "feeling of surprise, incoherence or coherence". According to Thomas the problem with internal reinforcements is that it is not clear if they are just a copy of the external world or transformations carried out by the subject on the objects. Even though it is not clear as to what is meant by internal reinforcements, what is important is that it seems according to Berlyne that the S-R theory cannot give an adequate explanation of how learning takes place.

Another illustration of the inadequacy of the S-R theory can be seen in the experiments on the acceleration of the development of conservation conducted by Smedlund (in Piaget, 1964). According to Piaget, Smedlund was successful in his study of the conservation of weight as there was external reinforcement in the form of weighing the balls but he experienced problems in the teaching of transitivity. The children who were taught by Smedlund were never able to generalise with certainity with regard to transitivity. There are two reasons that Piaget gives to explain the above results. He mentions that the conservation of weight has both physical and logico-mathematical aspects. He refers to the learning of conservation as the learning of the physical aspect and the learning of transitivity as the learning of the logico-mathematical aspect. For Piaget, the learning of the logico-mathematical structure is only possible through the process of self-regulation because according to William and Kamii (1986) the source of logico-mathematical knowledge is internal.

If the learning of a logical structure is only possible through self-regulation as suggested by Piaget, what does this mean for teaching? According to Piaget (1964) the teaching of logical structure is only possible if the structure you want to teach is supported by simpler structures. Inhelder, Sinclair, and Bovet (1974) concur with Piaget's foregoing assertion. Through their training studies, they were able to accelerate the learning of certain Piagetian concepts. According to Tamburrini (1982) the progress made by each subject was dependent upon the subject's initial level. What this means is that if the child is at an earlier point within the stage in which conservation develops no amount of teaching will bring about conservation. If the child is already close to being a conserver, then teaching

can "accelerate" development. Tamburrini (1982) therefore believes that if there are "appropriate teaching techniques" and the pre-requisite cognitive structures, the structure that the child will learn will be a structure that can lead to generalisation. Piaget (1964) believes that the child will not be able to generalise if learning depends on external reinforcement. The difference between Piaget's conception of learning and learning in terms of the S-R theory is that for Piaget the presence of structures to assimilate knowledge is very important.

In the foregoing discussion I have shown that the terms learning and development cannot be used interchangeably and for Piaget (1964) development and learning are two different problems.

Omission of the Social

In my exposition of Piaget's theory, I mentioned that Piaget has been criticised for not acknowledging the role of the social in the development of knowledge. This criticism is evident in the statement made by Bruner where he says:

> too often, human learning has been depicted in a paradigm of a lone organism pitted against nature ... in the Piagetian model where a lone child struggles single handed to strike some equilibrium between assimilating the world to himself o.· himself to the world (Bruner in Smith, 1996,p.110).

According to Smith (1996) Bruner's contention suggest that for Piaget the child constructs knowledge all by herself without any form of social interaction. As a result of confusing Piaget's constructivism with radical constructivism, Ernest (1994) suggests that the social should be put back into constructivism. Smith contends that this criticism

against Piaget has put many researchers in a dilemma where they have to choose between Piaget and Vygotsky (1978) who is believed by some researchers to have adequately theorised the role of the social in the development of knowledge.

To construe Piaget as having omitted the role of the social is misleading. Mays (1982) asserts that Piaget's theory has sociological roots especially when we consider his account of effective experience, logical, mental and legal thought. Piaget's account of effective experience, logical, mental and legal thought clearly shows how important the role of social interaction is in the development of reason. In fact Smith asserts that for Piaget the issue is not whether the social plays a role in knowledge construction but whether linguistic transmissions are sufficient for the construction of knowledge. Piaget says:

> does the success of such (linguistic) communication depend on the relative quality of the presentation made by the adult himself of what he desires to inculcate in his child, or does it presuppose in the latter the presence of instruments of assimilation whose absence will prevent its comprehension (Papert in Smith, 1985, p.186).

In other words the success of social interaction according to Piaget depends on the presence of instruments of assimilation which the child can use.

Even though Piaget has always been understood to have neglected the role of the social in the construction of knowledge, I think Piaget's theorisation of social relations is one aspect which educational practitioners could have exploited more profitable in education. To give one example of how I think Piaget's notion of the social could be useful for educational purposes, I will focus on the characteristic of egocentrism which Piaget

(1971a) believes is present in young children. Because children are egocentric, Piaget believes that when children are left to work freely, they do not co-ordinate their efforts even if they are working in groups. If a teacher then wants to use group work with young children, it may not succeed. Such knowledge then could help teachers when they consider methods to use when they teach young children. Piaget (1971a) further contends that the attitude of egocentrism can be reduced when the child adapts to social realities. This is how Almy (1976) views the way the social could reduce the attitude of egocentrism in the child,

> as children confront the beliefs of those who see things differently, as they adapt their wishes to others or vice versa in ongoing sociodramatic play, as they contest with each other in structured games, they become less egocentric and better able to take other view points (Almy, 1976,p.94).

Piaget therefore critisizes the methods of the traditional school in this regard. In the traditional conception of schooling, the relationship between the teacher and children is that of unilateral authority where the child accepts everything from the teacher without questioning. Piaget believes that in this type of relationship the egocentric attitude still remains where the child just replaces believing in the self by believing in the figure of authority. The traditional school uses the mechanisms of constraint instead of co-operation. Youniss and Damon (1992) contends that in the relationships of co-operation which are encouraged by the active school, "...children act as partners with other persons to co-construct knowledge" (p.272). For this co-operation to be successful, children have to develop procedures of co-operation. One of these procedures is that children should have mutual respect for each other in the sense that they are able to rescpect each others' views. According to Piaget (1971a) co-operation also encourages a critical attitude of

mind because children do not just accept what others are saying but they are free to question their partners.

From my discussion I have tried to show that researchers have not sufficiently acknowledged Piaget's theorisation of the social, and I believe that Piaget's notion of the social is one (amongst other) aspect which could be useful when Piaget's theory is used for educational purposes.

Conclusion

In this part I have attempted to provide a critical appraisal of the unproblematic application of Piaget's theory to education. I have shown that researchers who believe in applying Piaget directly to education have a tendency to take certain aspects of Piaget's theory (e.g. stages, tasks) and to treat these as representative of the whole theory. The problem that I have highlighted is that when researchers apply Piaget's theory directly to education, they start to see the theory as a theory of learning instead of a theory that investigates the development of knowledge. As a consequence, Piaget's theory is treated like an empiricist theory of knowledge and knowing which is in total contradiction with what he believes. In the next and final section of my report I will suggest ways in which Piaget's theory may be used as an educational resource without undermining its fundamental tenets.

Part Four

Conclusion

In this research report I examined the various ways in which Piaget's theorising about the development of cognition have been interpreted and applied to education. Through a review of some of the extant literature in the area I showed that there is a tendency among some researchers to isolate aspects of the theory and to treat these as representative of the theory as a whole. Specifically, the review of the literature showed that earlier researchers confused development with learning, focused (virtually exclusively) on the stages of development, devoted their efforts to the teaching of Piaget's experimental tasks, and misconstrued the notion of "activity". As a consequence of their restricted foci, I argued that the researchers concerned conceptualised Piaget's theory as a learning theory that could be applied to education in a straightforward and unproblematic way.

To establish what I believe to be a more "appropriate" way of using Piaget's thinking in education I consequently provided a relatively detailed exposition of Piaget's genetic epistemology and his theory of psychological development. In this discussion I showed that for Piaget psychological research was a means to answer the more general epistemological questions about the origin and development of scientific knowledge, and not an end in itself. By contrasting Piaget's genetic epistemology with the restricted readings of his research programme mentioned above, I further showed that the

researchers concerned did not only misconstrue basic aspects of Piaget's theorising but often selected the "less informative" aspects of his theory for use in education.

The foregoing assertions about the inappropriate use of Piaget's thinking in education places a burden on me to show how, in my understanding, genetic epistemology could be used in education without undermining its essential self-understanding. In the remainder of this discussion I consequently look at the implications of Piaget's theorising for educational practice.

As stated before, Piaget's primary concern was to explain the origins and development of (especially) scientific knowledge and to this end he concluded that the act of knowing is an act of construction. This notion of "construction" is at the heart of Piaget's theory and is an important idea which I contend should inform the educational process.

The child's own activities are crucial in the construction of knowledge. It is for this reason that even in education the child's spontaneous activity is important. Piaget believes that "...childhood is thought of as endowed with its genuine form of activity..." (1971a,p.138). He further on suggests that educational practitioners should use methods of teaching which will take cognisance of the child's activity and he refers to these methods as "active methods" of teaching (Piaget, 1973). The implication of the use of active methods is that children have to discover or reconstruct what they have to learn. That is why in the teaching of subjects like science Piaget (1973) contends that children should be encouraged to carry out experiments by themselves. Traditionally, the teacher is the one who carries out experiments with students watching or the students are given

procedures to follow as they carry out the experiments. By contrast, Piaget (1973) believes that the experimental spirit in children is encouraged if they are allowed to go through the stages of the experiment on their own and in the process be allowed to make mistakes. The status that should be given to children's mistakes during learning has already been elaborated in the previous section. Duckworth (1979) believes that Blanchet gives a characterisation of what a good experimental situation should be. Blanchet says that a good experimental situation should "...permit the child to establish plans to reach a distant goal, while leaving him with wide freedom to follow his own routing..." (Blanchet in Duckworth 1979,p.311). Duckworth also contends that the traditional way of teaching by telling children about something does not necessarily mean that they will understand it. That is why the basic principle for the success of education for Piaget is that ""[t]o understand is to discover" (1973, p.20) hence Piaget has even written a book entitled, "To Understand is to Invent". Piaget says:

> The child no longer tends to approach the state of adulthood by receiving reason and the rules of right action ready-made, but by achieving them with his own effort and personal experience (1971,p.138).

What are the implications of the use of active methods for teachers? Piaget mentions the fact that there are fears that the use of these methods will diminish the role of teachers. Challenging this belief Piaget contends that the role of teachers is even more important and meaningful when " ctive methods" are used. The teacher has a responsibility of creating a situation in which the child confronts problems which are useful to her. The teacher is also responsible for stimulating an initiative spirit and research in her students. What is important in the use of active methods is that children should be allowed to engage in activities that will allow for both physical and reflexive abstraction. The

teacher's role as a result of using "active methods should therefore not be underestimated as it makes certain demands on the teacher. One of those demands for instance is that the teacher should have a thorough knowledge and understanding of how the mind of the child develops. Such knowledge of how the childs's mind develops could help the teacher realise that her task is not to transfer information to the child, instead she should encourage the child to discover some of these truths by herself. What Piaget is saying here is that in the same way as the teachers are grounded in the knowledge of their subjects, they also should have knowledge of psychology because psychological knowledge goes along with educational experimentation. Jacob (1982) believes that the teacher will be able to do this if the focus of the teacher is no longer the "products of knowing" but rather "the processes of knowing" (p.275). The teacher must be interested in what happens within the child as learning takes place. That is why when Duckworth (1979) addresses the problem of diagnosing the child's stage of development, she believes that the only diagnosis is to observe the children's actions during their learning. This approach will help the teacher provide the child with the tools she needs as she engages in research.

Given that for Piaget the child's spontaneous activity is important, one question that needs to be addressed is whether Piaget disregards the importance of content when active methods are used. Jacob (1982a) argues that the child's interaction is not "carried out in a vacuum" but the child interacts with content. According to Jacob, Piaget himself recognises the importance of content in the development of intellect. Piaget puts this quite clearly when he says:

> *Generally speaking, since every discipline must include a certain*

> body of acquired facts as well as the possibility of giving rise to numerous research of activities of rediscovery, it is possible to envisage a balance being struck, varying from subject to subject, between the different parts to be played by memorising and free activity (Piaget in Jacob, 1982a,p.244).

The use of active methods also has certain implications for the training that teachers receive. In this regard Piaget argues that a lot of emphasis has always been placed on the fact that teachers have to specialise and that is why even in universities and colleges there are barriers between different fields. A teacher in training does not have the freedom to make a combination of subjects from the different fields. It is for this reason that Piaget (1973) contends that this emphasis on specialisation has even led to compartmentalisation. Piaget further argues that the aim of approaching one's subject from an interdisciplinary point of view is still difficult to achieve because this change has to start with the minds of university and college instructors. Duckworth (1979) asserts that "... all of us, from children to scientists, have difficulty in accepting data that goes against our firmly held beliefs. We have to restructure too much of our intellectual framework to accommodate such surprises" (p.298). For Piaget (1973) the training of teachers should be such that they are able to approach their subjects from an interdisciplinary point of view and this will only be achieved if teachers' training goes along with training in research. Also, to avoid compartmentalisation, this research should be jointly supervised by professors of neighbouring fields. The assumption is that if a teacher is trained in research, she will be able to train her students to be researchers. The idea of the child as a researcher is also echoed by Papert (1980) as he describes the child's activities in the Logo environment. The fact that the child is free to select any

project she wishes to embark on and to choose the route she wants to follow in accomplishing the project is a good illustration of the child as a researcher. Papert says:

> We can give children unprecedented power to invent and carry out exciting projects by providing them with access to computers (Papert in Groen, 1978,p.308).

To involve children in this way in the learning process supports Duckworth's assertion that the most important thing about education is to allow children to know and understand the world in new ways. Children are also allowed to be creative and to take initiatives. This approach also caters for those educators who are interested in the differences between children. To repeat the point that has been made earlier on, if the teacher sees as part of her task training students to be researchers, the view of teaching as transferring knowledge becomes inconceivable.

The foregoing discussion gives an impression that there is something that needs to be done about the teaching profession. Piaget (1973) suggests that there is a need for the teaching profession to be upgraded especially given that teaching is the one profession which is constantly undermined. The upgrading should be such that teaching is taken seriously both at primary and secondary school levels. Piaget (1971a) is critical of the fact that in most institutions of learning, the training of primary school teachers has not been taken as seriously as the training of secondary school teachers. The problem with this attitude is that if teachers are not well equipped for their task at the lower levels of learning, this could cause damage in the children which will have consequences later on in life. Piaget contends that "[t]he younger the child the more difficult it is to teach him and the more pregnant that teaching is with future consequences" (1971a,p.127). One

way of upgrading the teaching profession goes back to the suggestion made earlier that teacher training should include training in research. Piaget suggests that research programmes could be planned yearly during the training such that teachers are exposed to all stages of research. They learn how to collect data and compile reports. Involvement in research could bring back the dignity of the teaching profession so that it could be on the same level as other professions. For the teachers who are already in the profession, Almy (1980) suggests that there is a need for in-service training. This training should encourage active participation by teachers and it should also be geared towards addressing the problems that teachers encounter in their profession. Almy also suggest that the in-service training could give the teachers the support they need in their classrooms as they implement the active methods discussed earlier (ibid). The success of the support that the teachers are given is determined to a large extent by what Almy (1980) refers to as the social climate in which teachers find themselves. For Almy the social climate refers first to the principal who arranges the in-service sessions all by herself with the hope that the teachers will benefit from the sessions. The second meaning of the social climate is that teachers should be involved in the arranging of the training such that they become part of the decision making in the school. The social climate which can yield good results is when teachers become part of the decision making process because they will not see the training as something that is imposed upon them by the authorities but as something which is necessary to help them improve their teaching.

I must however point out that the introduction of active methods in education will not be a process without any obstacles. For instance we have many parties who are stakeholders

in the education of the child like the parents and the government. The question according to Almy (1980) is whether the other parties would really see the value of these methods. To show the resistance that one could meet in the society when active methods are introduced Almy gives an example of an anthropologist who claimed that the society could not tolerate education that teaches children to be logical thinkers (ibid). Apart from these attitudes, other people would argue that before we can implement the active methods, the education policy of the country needs to change such that we have a policy that supports the implementation of these methods. Almy (1980) contends that this is true, but at the same time we cannot wait for change in policies since this can take a long time. What is important is that the principal together with her teachers should come together to look at the possibilities of change within the school. Once they have started to implement the active methods, teachers should be patient since they themselves will also be engaged in the process of learning.

In conclusion, what I have been trying to show in this discussion is that it is possible to use Piaget's theory in education without isolating certain aspects of the theory. What is important is that our practises should be in keeping with his overall project, genetic epistemology. And if we do this we will be able to create individuals who are not just imitators, but individuals who are innovators. In Piaget's words,

> The principal goal of education is to create men who are capable of doing new things, not simply repeating what other generations have done - men who are creative, inventive and discoverers. The second goal of education is to form minds which can be critical, can verify and not accept everything they are offered. The great danger todays of slogan, collective opinions, ready-made trends of thought. We have to be able to resist individually to critisize, to distinguish between what is proven and what is not. So we need pupils who are active, who learn early to find out by themselves (Piaget in Duckworth, 1964,p.5).

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