

THE ROLE OF EDUCATIONAL PSYCHOLOGY IN THE TEACHING AND LEARNING OF SCIENCE

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Abstract

Educational Psychology is the application of psychology and psychological knowledge to the study of development, learning, motivation, instruction, assessment and related issues that influence the interaction of teaching and learning. The paper tries to highlight some of the theories of psychology in education and their various applications and influences on the teaching and learning of science. The paper further concluded that educational psychologists have been instrumental in the provision of techniques that teachers can use to determine how successful students have been in the attainment of new knowledge and skills. The paper therefore recommended that psychologists should provide teachers with information that will assist them in the process of teaching and learning.

The term psychology is derived from two Greek words, namely “Psyche” meaning soul, and “Logos” the study of. The study of psychology commenced at a time when the human soul, spirit or mind were seen as distinct from the body. Psychology overlaps with other sciences that investigate behavior and mental processes. Certain parts of the field share much with biology especially the study of the functions of living organisms and their parts (physiology). Psychology is more connected with psychiatry. Holmes (1986) define psychology as a scientific study of the mind and behavior; it is a multifaceted discipline and includes many subfields of study like human development, sports, health, clinical, cognitive process and social behavior. Holmes (1986) further explained that as an academic and applied discipline, psychology involves the scientific study of mental functions and behavior as it has the immediate goal of understanding individuals and groups by establishing general principles and research in specific areas.

Science on the other hand can simply be defined as a systematic study of nature through the various scientific processes of observing, testing, and verifying. The word science is derived from a Latin word “Scire” which means ‘to know’. From its early

beginning science has developed into one of the greatest and most influential fields of human endeavor that is capable of investigating the various phenomena of life.

The Concept of Educational Psychology

Glover and Ronning (1987) explained that educational psychology is a psychology that involves various aspects of life, for instance the theory of development, individual difference, measurement, learning, motivation and so on. Educational psychology can thus be seen as the application of psychology and psychological methods to the study of development, learning, motivation, instruction, assessment, and issues that are related to teaching and learning. In a nut shell, it can be considered as the application of scientific methods to the study of behavior of people under instructional settings. The areas covered by educational psychologist inevitably overlap with other areas of psychology, for instance child and adolescent psychology, social psychology, psychological testing and educational counseling etc. Educational psychology can be seen as a vital tool that is immeasurable and helps in planning, delivering, and evaluating the learning and teaching process.

Theories of Educational Psychology

The major goal of educational psychology is in understanding the learning and teaching process. Another tool for understanding the teaching and learning process is theory. Stanovich (1992) explained theory as an interrelated set of concepts that is used to explain a body of data and make predictions about the result of future experiments. Theories may have bearings on how facts are interpreted. Some of the famous theories of educational psychology include the following:-

Piagets' Theory Of Learning

Piaget (1940) suggested that people learn through exploration and that learning occurs when the students' exploration uncovers an inconsistency between their current knowledge representation and their experience. There have been several theories over the past years on how to improve students' learning ability. Based on a number of findings. Zakariyya (2012) narrated that "the teaching and learning practices have undergone changes in recent years, as they have been underpinned by shifts in psychological and pedagogical theories."

The cognitive theory of learning states that for learning to take place students actively process information by making efforts to organize, store, and find relationships between information linking new to old knowledge, schema and scripts. The cognitive theory of learning emphasizes the ways in which information is being processed that Cognitive theories emphasized the active and mental process on the part of the student.

Educational Implications of Jean Piagets' Theory of Learning

The following are the main teaching implications drawn from Piagets' theory as identified by Slavin (1994).

- **A Focus on the Process of Children's' Thinking not just its Product:** Instead of simply checking for correct answer, teachers should emphasize the students' understanding and the process they followed in getting the correct answer.
- **Recognition of the Crucial Role of Children's' Involvement in the Learning Activities:** In Piagetian classroom children are encouraged to discover themselves through spontaneous interaction with the environment, rather than the presentation of readymade knowledge.
- **De-emphasizing on Practices that will make the Children to be Adults in their Thinking:** According to Piaget this is referred to the "American Question" which is how do we speed up development? His belief is that trying to speed up and accelerate children's' process through the stages could be worse than no teaching at all.
- **Acceptance of Individual Difference:** Piagets theory asserts that children go through the same developmental stages, however they do so at different rates. Because of this teachers must make special efforts to arrange the classroom activities for individual and group of children rather than for the whole class group.
- **Adaptations of Instruction to the Learners' Developmental Level:** It is important that the content of instruction needs to be consistent with the developmental level of the learner.
- **Teachers main Role in the Facilitation of Learning:** Teachers should provide various experiences that can facilitate learning, for example the use of various teaching techniques like discovery learning will allow opportunities for students to explore and experiment new avenues of learning.
- **Provide the Learners with Different Cognitive Abilities to Work Together:** This will help to encourage less mature students to advance to a higher level of understanding.
- **The Use of Appropriate Teaching Materials:** When concrete proofs or visual aids are used in the teaching and learning situation, they help to facilitate learning by using familiar examples to explain complex ideas.

Constructivism Theory of Learning

The constructivist theory of learning believes that knowledge is not received passively, but it is built up by the cognizing subject. In other words it is not possible to transfer ideas into students' head, rather students have to construct their own meaning from the words they hear or the visual images they see. Although an individual has to construct his own meaning of a new phenomena or idea, the process of construction is always embedded within the social context of which the individual is part. Saunders (1992) stated that "Knowledge is the result of an individual subject constructive ability

not a commodity that somehow resides outside the knower, and can be conveyed or instilled by diligent perception or linguistic communication.

The constructivist view of learning considers learning to be an individual and personal event, hence people construct, re-construct, and deconstruct their own understanding of the knowledge of the world by experiencing things and reflecting on those experiences. For these to occur, students must ask questions, explore and assess what they know. The following principles are based on the work of various constructivist theories of learning.

- Knowledge is constructed in multiple ways, through a variety of tools, resources, experiences and contexts.
- Learning is a process of accommodation, assimilation or rejection to construct new conceptual structures, meaningful representations, or new mental models.
- Learning is both an active and a reflective process.

McInemey and Slavin (1994) decided that the focus of teaching is that of guiding the students, as they build and modify their existing mental models, which denotes a focus on knowledge construction rather than knowledge transmission. They further explained that constructivism as a paradigm of learning is founded on the premise that by reflecting on past experiences one can construct his/her own understanding of the world they live in, generate his/her own rules, and design his/her own mental models which he/she can use to make sense of his/her experience. In another assertion more moderate constructivist claimed that formal instruction is still appropriate but the students should engage in thought oriented activities to allow them to apply and generalize the information and concepts provided in order to construct their own model of knowledge. Constructivism is undoubtedly a major theoretical influence in contemporary science education. Although it began as a theory of learning, it has progressively expanded into becoming a theory of teaching, theory of education, theory of the origin of ideas, and a theory of both personal knowledge and scientific knowledge. Hence it has become an educational version of the grand unified theory.

Application of Constructivism to the Process of Teaching and Learning

- Encourage and accept students autonomy
- Try to use raw data and primary sources in addition to manipulative, interactive and physical materials.
- When assigning task to students, the teacher should use cognitive terminology, such as classify, analyze, predict, and create.
- Build off and use students' responses when making on the spot decisions about teacher behavior, instructional strategies, activities and contents to be taught.
- Search out students understanding and prior experiences about a concept before teaching it to them

- Encourage communication between the teacher and the students and also between fellow students
- Encourage critical thinking and inquiry by asking them thoughtful, open ended questions, and encourage them to ask questions to each other
- Ask follow up questions and seek elaboration after a student's initial response
- Put students in situation that might challenge their previous conception and create contradictions that will encourage discussion.
- Give sometime after posing a question so that students have time to think about their answers and be able to respond thoughtfully
- Provide enough time for students to construct their own meaning when learning something new.

Behaviourism Theory of Learning

This is the science of behavior that focuses on observable behavior only; it is also an approach to psychology that combines the elements of philosophy, and methodology. It emerged in the early twentieth century as a reaction to “mentalist” psychology which has difficulty in making predictions that could be tested using rigorous experimental methods. Behaviorism is primarily concerned with observable and measurable aspects of human behavior. In defining behavior, the behaviorist learning theory emphasized changes in behavior that result from stimulus/response associations made by the learner. Behavior is directed by stimulus that is an individual selects one response instead of another because of prior conditioning and psychological drives existing at the moment of the action (Parkay and Hass, 2000). Behaviorist asserts that the only behaviors worthy of study are those that can be directly observed. Thus it is an action rather than thoughts or emotions. Behaviorist theory does not explain abnormal behavior in terms of the brain or its inner workings; rather it posited that all behaviors are learned habits, and attempts to account on how the habits are learned.

Parkay and Hass (2000) asserted that in assuming that human behavior is learnt, behaviorists also believe that all behaviors can at the same time be unlearned and replaced by new ones; when a particular behavior becomes unacceptable. The key element to this theory of learning is the rewarded response; that is to say the desired response must be rewarded in order for learning to take place. In education, advocates of behaviorism have effectively adopted this system of rewards and punishment in their classrooms by rewarding desired behaviors and punishing inappropriate ones. Rewards vary, but has to be important to the learner in some ways; for example if a teacher wishes to teach the behavior of remaining seated during class period, the successful student reward might be checking the teachers mail box, running errands, or being allowed to go to the library to do some work at the end of the class period. As with all teaching methods, success depends on the given stimulus and response or on association made by one another.

Educational Implications of Behaviorism

Behaviorist techniques have long been employed in education to promote and encourage desirable behaviors and discourage that which is not. Among the methods derived from the behaviorist theory for practical classroom applications are contracts, consequences, reinforcement, extinction and behavior modification.

- **Contracts:** Simple contracts can be effective in helping children to focus on behavior change. The relevant behavior should be identified and the child and counselor should decide the terms of the contract. Behavioral contracts can be used in the school as well as in the home environment.
- **Consequences:** Occur immediately after a behavior it may be positive or negative or unexpected, immediate or long term, extrinsic or intrinsic, symbolic, emotional, or interpersonal, or even unconscious. Consequences occur after a target behavior has occurred and positive or negative reinforcement may be given.
- **Extinction:** Extinction decreases the probability of a response by contingent withdrawal of a previously reinforce stimulus for example a student develop a habit of saying the punctuation marks when reading aloud, classmates reinforce the behavior by laughing, the teacher tells the students not to laugh thus extinguishing the behavior.

Influence of Constructivism to Science Education

Constructivism influences has extended beyond just the research and scholarly community. It has an impact on the science education curricular documents and beyond. Below are some of its influences:-

- **Use of Available Content Materials:** Most traditional designer's base their final curricular on available content material as this design practice is constructive for instructors and students, and does not provide enough flexibility or adaptability. In order to remedy this, education designers should create less restrictive course goals and should not focus excessively on course materials. This encourages students to seek out their own materials and provide flexibility for instructors, so as to adapt curricular to different student groups and academic situations.
- **Materials over Simplification:** Johnson (1997) reported that another common design error that the traditional designers make is over simplification of the material. The idea behind this is to make the material easier to teach and to learn, however it tends to stripe away most of the materials that can stimulate critical thinking in students. Instead of simplifying materials education designers should challenge instructors to devise more efficient discussion methods. Efficient discussions allow students to reach many goals and conclusions by themselves, which otherwise will not have able to reach.
- **Involvement of Instructors:** Instructors should be closely involved with the course design process, because faulty executions can ruin even the best plans, for example instructors and designers should perform progress monitoring tasks continuously throughout the project cycle not only once in the beginning. This constant

monitoring provides up to date feedback and allows designers and instructors to modify education systems and correct problems before they become too severe.

- **Students' Prior Knowledge:** The curriculum of the constructivist advocates for learner's prior knowledge, and in a nut shell constructivist calls for elimination of a standardized curriculum; instead it promotes the usage of "Hands on Curricular" on problem solving.

Influence of Behaviorism to Science Learning

The usage of behaviorism theory in the classroom can be rewarding for both students and teachers. Parkay and Hass (2000) explained that behavioral change occurs for a reason, for example:-

- Students work for things that bring them positive feelings and approval from people they admire.
- Students change behaviors to satisfy the desires they have learned to value.
- Students generally avoid un-pleasant behaviors and develop habitual behaviors from those that are repeated often.

Conclusion

In the constructivist frame work the main focus is to stoke rather than control, therefore the role of design experts should be to encourage student centered learning approach rather than passive learning in order to encourage the acquisition of skills, creativity and interest that can extend even beyond the classroom. While in the behaviorism frame work, the entire rationale of behavior modification is that most behaviors are learned. If a behavior can be learned, then they can also be un-learned or re-learned. Therefore a behavior that goes unrewarded will be extinguished, as ignoring undesirable behavior consistently can lead to its total elimination. In this regard teachers should be encouraged to employ the behaviorist technique in the process of teaching and learning, in order to promote and encourage desirable behaviors and discourage those that are not desirable even beyond the classroom environment.

Recommendation

Neither of the theories of learning is exclusively right or wrong because none of them has all the answers therefore curriculum planners and teachers must find a midpoint that is a way by which the best aspects of all the theories can be combined together in order to provide the best learning environment and technique.

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