Pedagogy of Constructivism and Computer Programmed Instruction in Teaching and Learning Processes

Dr. Adu F.O And Adu E.I (M.Ed)
Postgraduate School College Of Education Ikere Ekiti
Curriculum Studies Department, Center For Educational Technology College Of Education Ikere Ekiti

Abstract: *This paper focused at the pedagogy of constructivism and computer programmed instruction, and explained their meaning and concept as learner-centered and individualised way of teaching and learning processes respectively, aimed at putting learners in the fore of instruction delivery. Using content analysis the constructivist and computer programmed instruction approach to instruction was viewed as a means to minimize the teacher-centered manner to instruction in which the teacher controls the whole instructional processes. Relevant conclusion was made as constructivism and computer programmed instruction pedagogy is becoming increasingly popular in education, therefore it was recommended that this pedagogy be the main focus in the course of instruction delivery.*
Keywords: *Pedagogy, Constructivism, Computer Programmed Instruction, Teaching, and Learning.*

I. Introduction

Pedagogy is the method and practice of teaching, especially as an academic subject or theoretical concept (Collins, 2012). Constructivism is a student centered philosophy that emphasis active participation of student in teaching and learning processes rather than just being passive, as Thomas & Donald (2009) asserted that the first constructivist theory was from an Italian philosopher Giambattista vico in the early eighteenth century whose idea was that epistemic agents can know nothing but the cognitive structures they themselves have put together; and to know means to know how to make. Duffy & Cunningham (1996) that knowledge is a construction by individuals and students can set aside the desire for objectivity to reality; which means the creation of self-image from one of finding to one of making. In order for students to be able to use programmed instruction as a method of individualized form of learning they should be able to use their manipulative intelligence that they possess to bring something out of nothing based on how they feel and what they knew; so Duffy & Cunningham (1996) asserted that students construct their own reality or at least interpret it based upon their perceptions of experiences, as an individual's knowledge is a function of one's prior experiences, mental structures, and beliefs that are utilized to interpret objects and events.

Constructivism is focused at making the course of instruction acquisition students own personal property, through provision of problems and presentation of immediate solutions to it; thus Thomas & Donald (2009) asserted that students serves as ownership of learning activities while teachers design problem based learning modules, and using student query as a mechanism for defining learner centered philosophy. This constructivist theory is a practical approach to learning by students; as Duffy & Cunningham (1996) asserted that pragmatists believes that knowledge is not a matter of getting it right but rather acquiring habits of action for coping with reality; thus students should try to seek viability, and explanations to problems they encounter through improved account of specific events or experiences and interweaving their explanations; thus weaving a web of understanding on their own.

Meaning and Concept of Constructivism

Constructivism is a learning process whereby learners work individually or in small groups to explore, investigate and solve authentic problems and become actively engaged in seeking knowledge and information, rather than being passive recipients(Ken, 2003). In this process, the learners must play an active part in their learning process and be autonomous learners who are actively engaged in constructing new meaning within the context of their current knowledge, experiences and social environments. Learners become successful in constructing knowledge through solving problems that are realistic, and usually work in collaboration with others.

This constructivist learning approach has its foundations in cognitive learning psychology (Jonassen, Peck & Wilson, 1999), and its roots in theories by Dewey (1896), Piaget (1952), Bruner (1985), Vygotsky (1978) and Papert (1980). Generally, constructivist learning places emphasis on the learners and proposes that learning is affected by their context, their beliefs and their attitudes. Learners are encouraged to find their own solutions and to build upon their prior knowledge and experiences. In a constructivist learning environment, students learn by fitting new information together with what they already know and actively construct their own

understanding. In doing so, they gain a deeper understanding of the event and thereby constructing their own knowledge and solutions to the problems (Duffy & Jonassen, 1991; Jonassen, 1994).

Constructivist learning is categorised mainly into cognitive constructivism and social constructivism. Cognitive constructivism is based upon the works of psychologist Piaget (1952) and later, in educational computing, of Papert (1980). It described a theory of development whereby learners build their own knowledge by constructing mental models, or schemas, based on their own experiences. These schemas are then developed, modified and made more sophisticated over time.

Cognitive constructivism focuses on the learners' mental construction of knowledge, while social constructivism enlarges that view by placing more emphasis on the social context of the learning environment. Based on the works by Vygotsky (1978), social constructivism emphasises Vygotsky Zone of Proximal Development (ZPD), which argued that learners can, with the help of teachers' or more advanced learners, master concepts and ideas that they cannot understand on their own. He added that whatever learners are able to do in collaboration today, they will be able to do independently tomorrow (Vygotsky, 1987; Hung, 2001). In other words, learners learn by interacting with their more capable peers, teachers and experts in a collaborative learning community.

The constructivist approach to instruction favours a learner-centered learning and the introduction into the design of computer programmed instructional packages had considerably altered the instructional strategy in every day to day teaching and learning activities in the way teachers teach and learners learn (Kachian & Weiser, 1999, Christie, 2007, Johns, 1999, Mat, 2000, Cook & Cook, 1998, Oliver, 2000).

Meaning and Concept of Computer Programmed Instruction

Computer programmed instruction is an instructional strategy in which the learners' are presented many small learning modules or pieces of information in logical sequence(Lee,2004). Skinner, (1954) whose research on mechanism of teaching animals gave rise to modern day programmed instruction, suggested the following principles which were:

(1) Step-by-step,

Subject must be divided into small units of information. When teaching a specific subject care must be taken to provide as many opportunities as possible for reinforcement. Effectiveness depends on frequency of reinforcement or reward which involves dividing up the information to be imparted into small units or doses. Dividing the material into small slices allows effectiveness by increasing the number of reinforcement.

(2) Active participation,

Learners' must participate on each unit of information by means of exercises provided to assimilate it as they only learn through active performance and involvement in instruction.

(3) Success,

Learners' should be given the possibility of succeeding as often as possible. Success leads to further success, thus eliciting each other in the course of instruction. The activity must lead to success, as a positive reinforcement while error and failure must be avoided at all cost to avoid obstacles to learning.

(4) Immediate verification,

Learners' should be able to compare their answers with the correct one before moving on to the next step. The immediate verification that their response was correct provides the motivation to go on.

(5) Logical graded progress,

Learners' should be given modules in a coherent and cohesive manner to avoid ambiguity, thus programmers should remove superficial elements likely to distract learners'.

(6) Individual pace,

Learners' should be allowed to move at their convenience when using programmed instruction. Thus Skinner, (1954) technique of programmed instruction consisted essentially of a unit of information, question and response as cited by Bishop (1986) in his work, which was called linear programming, while Crowder, (1963) technique of programmed instruction consisted of multiple choice questions. His reason for so doing was purely pragmatic, as the multiple choice item was best suited for the diagnostic function it provided, in which the choice of an incorrect alternative can pinpoint a specific deficiency, thereby permitting the learner to be guided to a discussion of why that choice was incorrect and this was called branching or intrinsic programming (Norman, 1973).
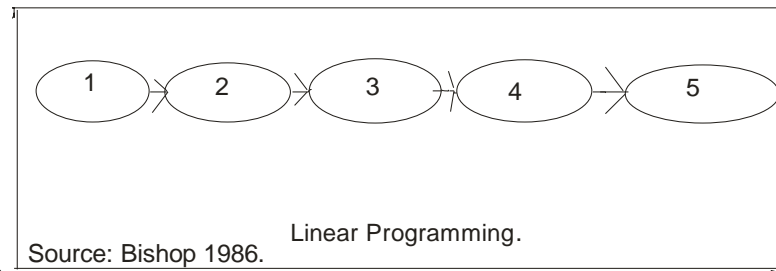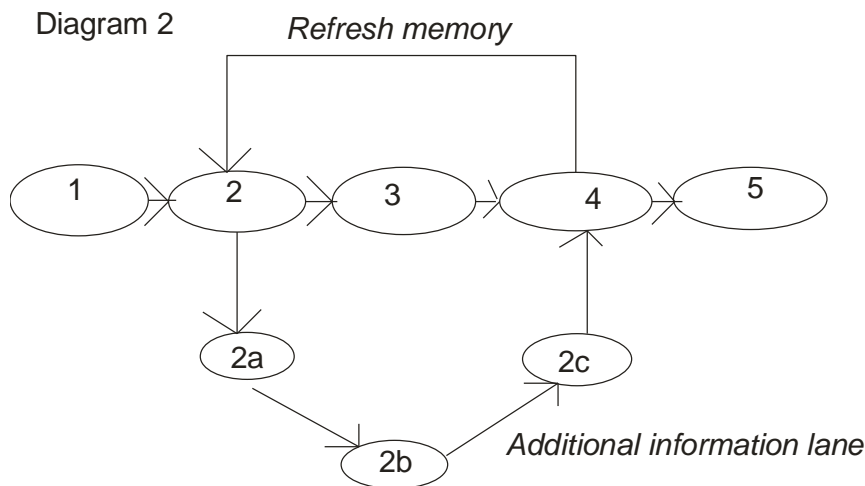
Linear Programming.
Source: Bishop 1986.

Diagram1.

Number one in the diagram above shows the starting of learning process till it gets to number five. It is straight forward and simple way to learn, and does not require any mastery.

Diagram 2

Branching Programming .   Source: Bishop 1986

This diagram above has numbers one to five and additional mastery path of 2a, 2b and 2c to allow further understanding of concepts. This is also called intrinsic programming.

Mathetic technique of programmed instruction is the process of learning from general to specific terms and could be mathematical just like deductive logic (Adegbija, 2009).This is the least popular among all the programmed instruction models, as it is also referred to as retrogressive chaining technique which reverses the order in the teaching of a given process, in which the learner is first given the mastery step of the process and then learns each preceding step (Ajelabi, 2005).

The Pedagogy of Constructivism and Computer Programmed Instruction

Pedagogy is the science or profession of teaching and learning (Encarta, 2010). Therefore, the pedagogy of constructivism and computer programmed instruction is meant to minimize the teacher-centered approach to instruction in which the teacher controls the whole instructional process, and communicates verbally throughout, while the learners remain passive and play little part in teaching and learning processes(Abe, & Adu, 2013). This pedagogy are both focused at giving learners independent ways of learning rather than the solely directed instruction model which was a popular instructional strategy for decades in educational institutions(Adu, 2011).

II. Conclusion And Recommendation

Constructivism and computer programmed instruction pedagogy is becoming increasingly popular in education as a means to motivate learners in their learning and to provide them with many ways to express their ideas and display their information, and it also allows the teachers' the flexibility to present their curriculum in an innovative manner (Ken, 2003). In the constructivist learning mode, the teacher becomes a facilitator, a consultant or guide on the side, helping learners to access, organise and obtain information to provide solutions to the problems. This learning process enables knowledge based learning community to be created whereby learners, peers and teacher share knowledge and assist one another in the acquisition and transfer of knowledge. This complex relationship had been illustrated by Ken, (2003) in creating a conceptual model showing the instructional relationship between the teacher, learners and the role played by computer programmed instruction.

Therefore in constructivist and computer programmed instruction learning environment, learners learning, in particular, the learning process, should be the main focus, not the content, teacher or the computer utilised, which plays only supportive roles.

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