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# HARNESSING COGNITIVE APPRENTICESHIP INSTRUCTIONAL METHOD FOR IMPROVING TEACHING AND LEARNING OF AUTOMOBILE TECHNOLOGY

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## Abstract

*Students performances in the national examinations most especially in the area of automobile technology has been deteriorating. Teachers' instructional techniques and other factors have been identified for these poor performances of students in automobile technology. This paper therefore focuses on harnessing cognitive apprenticeship instructional method for improving teaching and learning of automobile technology. The paper discussed the concept of cognitive apprenticeship, teaching, learning, application of cognitive apprenticeship model in classroom and the need for cognitive apprenticeship in teaching and learning of automobile technology. It is recommended among others that technique should be incorporated in the curriculum of automobile technology so that To-Would be teachers can have prior knowledge of it, all necessary facilities that would make learning effective should be provided by concerned authority and that teachers already in the system should always be sensitized on the effective use of cognitive apprenticeship method of instruction.*

## Introduction

Nigeria's educational system has witnessed a lot of criticisms over the years. This is a result of the fact that students are not learning enough. Student's performances in different school examinations such as senior secondary school examinations and even semester examinations taken at the end of each semester in our tertiary institutions continues to deteriorate, particularly in the area of technology education. A number of factors have been identified for these poor performances of students in technology education. Some of these factors according to Raymond (2006) include learning facilities, school environment, socio-economic background of the students and teachers teaching methods and so on.

For the avoidance of doubt, teacher's instruction technique is a major factor that has been viewed by many to have an over bearing consequences on student's performance. This is because it is the most easily manipulated. Akinsola (2004) pointed out that in spite of government's effort and that of various educational agencies toward improving the quality of technology

education, the methods of teaching in Nigerian schools are devoid of relevant techniques and devices, which result in poor assimilation and understanding of subject matter by students. It is observed that most teachers of technology education continue to engage the conventional methods of teaching, for instance, lecture and discussion methods. As a result of this Raymond (2006) noted that Nigeria cannot achieve its objectives of technology education if teachers continue to rely heavily on these conventional methods of teaching. This according to him is true because these conventional methods will not give room for innovation in the present rapidly changing technology.

From the foregoing, it could be seen that there is need for a diversified instructional approach by technical teachers. Teachers need to revisit their instructional techniques with a view to identifying teaching methods that will aim at improving the quality of teaching and learning and consequently lead to the good performance of students in the area of skill acquisition and school examinations. It is further based on the foregoing that an alternative model of teaching or model of instruction that goes back to the traditional apprenticeship but involves elements of schooling was proposed. This model is called "Cognitive Apprenticeship".

### **Concept of Cognitive Apprenticeship**

Cognitive apprenticeship is an instructional design of learning technique that can be adopted in a classroom switch. It is a model of instruction that goes back to apprenticeship but incorporate elements of schooling. Berryman (1993) pointed out that it involves the students learning through the help and guidance of a teacher or an expert. This guided participation helps the students achieve a task that independently would be too hard or complicated. He further stated that cognitive apprenticeship is structured much like traditional apprenticeship. In traditional apprenticeship the goal or task often to make something tangible that is tangible. In cognitive apprenticeship, the task is to form a process of thinking something that is tangible. In the beginning, the teacher through socialization, model the skill or task at hand for the student. Most times the role of the teacher is to simplify tasks so that they are manageable for the students. This extra help is called scaffolding gradually begins to fade. Fading allows the students to accomplish the task on their own, only asking for help when needed.

Raymond (2006) explained that under cognitive apprenticeship, the teacher describes what they are thinking and doing, why they are doing, and verbalized their self-correction process. Cognitive apprenticeship instruction then continues by the teacher, supporting and coaching students through similar problems, demonstrating the use of scaffolds and explaining the principles and rules that apply to their tasks. The tasks or problems are designed to be increasing complex, and students gain expertise and experience. The ultimate goal therefore for students is to become self-sufficient as they develop competency in their activities. Raymond further stated that in cognitive apprenticeship, the activity is modelled within the

context of real world situation. He noted that the cognitive apprenticeship methods include several other defining characteristics, including increasing complexity and diversity in lesson, sequence and providing a learning environment which promotes not only intrinsic motivation, cooperation but also competition.

Raymond (2006) sees cognitive apprenticeship as a term that focuses on the development of learning and skills beyond the apprehension of subject matter content, for instance trouble shooting procedures and application of diagnostic skill used in work places. Duncan (1996) however maintained that cognitive apprenticeship goes beyond the traditional in that the activity is modelled within the context of real world situations and emphasizes cognitive skills rather than physical skills. He further pointed out the following instructional principles of cognitive apprenticeship as follows:

Content: teach tacit, heuristic knowledge as well as text book knowledge

- Situated learning: teach knowledge and skills in context that reflect the way the knowledge will be useful in real life.
- Modelling and explaining: Show how a process unfolds and tell reasons why it happens that way.
- Coaching and feedback: Observe students as they try to complete tasks and provide hints and helps when needed
- Scaffolding and fading: support learners by performing parts of the task they cannot perform. Gradually reduce the amount of scaffolding, shifting more and more of control to the learner.
- Articulation and reflection: Here students think about and give reasons for their actions thus making their tacit knowledge more explicit, students need opportunities to look back over their effort and analyse their own performance.
- Exploration: encourage students to try out efforts and observe their effect
- Sequence: Proceed in an order to complex, with increasing diversity.

It is believed that programs incorporating these principles would be successful in a variety of academic settings, particularly in basic skill instruction.

## Teaching

According to Okorie (1979), teaching is an attempt to help someone acquire, or change some skills, knowledge idea or appreciation. One of the cardinal objectives of teaching is to assist the learners develop physically, intellectually, emotionally, morally and socially in a manner that he/ she will be able to exploit his/her potential maximally. Thus teaching can influence the acquisition of desirable changes in the behaviour of learners. Teaching can also be described as a guidance of learners through planned activities so that they may acquire meaningful learning from their experiences. It is an interaction process that brings about the desired learning. The process of teaching includes schooling, teaching, training, instructing, indoctrinating,

adapting and initiating ideas. For teaching to be effective, the teachers needs to know how the students grow, learn, think feel and respond to outside influence in their development.

### Learning

Learning is a change in behaviour due to experience. It is a process by which behaviour is initiated, modified or changed. It is the process by which we acquire and retain attitudes, knowledge, and understanding. Skills and capabilities that cannot be attributed to indented behaviour items or physical growth. All these show that learning is a process that is used to accomplish set goals by the learner.

In order to promote learning Oguntonade (1998) stated that the teacher will need to comply with (lie following prerequisites:-

- Specify what is expected of the learners by providing him or her we the objective of teaching.
- Clarify with the leaner what his/her specifications are in order to readjust the content of the following.
- Win the learner's cooperation all through the teaching/learning process.
- Start from where the learners are, that is to say rely on what the learner already knows and use representations he or she is familiar with.
- Put the learner in a situation in which he/she can realize something by him/herself.
- Provide learner with direct access o knowledge by ensuring that he or she has the necessary pedagogical tool at his or her disposal.
- Listen to the learner in order to change his or her ways and behaviour.

From the forgoing, it can be seen that teaching is a process that facilities learning. The teacher is the facilitator and acts as the catalyst by stimulating and encouraging the students to learn. It can further be seen that teaching and learning activities that goes on in the classroom revolve around the teacher and learner. And that the type of relationship that exists between the teacher and learner to a large extent determines whether or not learning will take place.

### Teaching Method

Teaching method refers to be ways and means which a teacher adopts to guide the students through learning activities in order to accomplish the desire goal. There are several teaching methods. These methods according to Akinseinde (1998) are meant for communicating with the students. He further explained that effective teaching takes place when teacher knows which method to use in a particular situation to meet specific goal. And for the purpose of this paper, application of cognitive

apprenticeship instructional model in teaching and learning of automobile technology will be examined.

### **Application of Cognitive Apprenticeship Model on Practical Determination of the Gear Box and Rear Axle Ratios of a Vehicle without Dismantling any of these Components**

It is a well known fact that teachers and indeed to-be teachers of automobile technology faced difficult challenges in teaching the above task most especially in classroom situation. Consequently, the following steps or procedures are to be adhered to:

- Jack up one rear wheel, wedge front wheels.
- Place the gear lever in the top position.
- Place a chalk mark on the tyre of the raised wheel and chalk mark the ground to correspond with the mark on the tyre.
- Make sure that the ignition is off and engage the starting handle.
- Rotate the engine crank shaft until the rear wheel has made two complete turns, at the same time noting the number of turns of the starting handle.
- The number of turns of the starting handle for two complete turns of the raised rear wheel gives the rear axle ratio. Note that the number of turns of the rear wheel should always be brought to two, because with one wheel raised, the differential is working, and this causes the raised rear wheel to revolve at twice its normal rate.
- To find the various gear box ratios, place the gear lever in 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> gear positions as required and proceed as before. This operation gives the overall gear ratio of each gear, and the various gear box ratios are found by dividing the overall gear box ratio by the rear axle ratio.

In spite of the above procedure, automobile technology teachers can still adopt cognitive apprenticeship model to facilitate teaching and learning of the above task in a classroom situation. Since cognitive apprenticeship model or principle usually commences with modelling guided by the teacher or expert, automobile technology teacher who is in charge with the responsibility of teaching the above task should model the above procedures i.e. under modelling, the teacher demonstrates by performing the entire task with the students watching him/her. The modelling is closely followed by scaffolding. And under scaffolding, students are allowed to perform the task themselves with extra help rendered to students by the teachers, and the teacher gradually decreases the support (scaffolding) provided to the students and shifting more and more of control (fading) to the learners (students) which in turn increases students' autonomy through exploration (i.e. careful investigation of what has been learnt).

Scaffolding and exploration stages are followed by articulation (i.e. careful reconsideration of previous actions). Under articulation, students are allowed to revisit what they have learnt or done and discuss with the teacher

and other students. It should be noted that what the students will be revisiting and analyze under this stage (articulation) is practical determination of the gear box and rear axle ratios in vehicle without dismantling either of the component.

Finally, teacher allows the students to discuss, demonstrate, present and exchange their individual or group task and look back to analyze their own or other's performance and artifacts (i.e. behaviour exhibited by individual learner as a result of what they have examined) through articulation and reflection (i.e. careful thought of the process of reconsidering previous actions that has been learnt) methods. Evidences from literature indicated cognitive apprenticeship instructional model or principle has been applied in other trade areas with positive effects. It is therefore believed that if these principles above are followed it will yield a positive result.

### **The Need for Cognitive Apprenticeship in Automobile Technology**

Having discussed various types of teaching method with some of their advantages and

Limitation inclusive, there is need for a problem - solving orientation to technology education of which automobile technology is an integral part of. This is of course apparent from the difficulty schools in Nigeria are having in achieving substantial learning outcomes. Specifically, Raymond (2006) identified cognitive apprentice instructional method as a viable means of modernizing technology education. This is so because of the benefits of using cognitive apprenticeship instructional technique. He further stressed that gnitive apprenticeships put control over learning in the hands of students and out of the teacher By doing this it improves the student development of cognitive management skills, such as goal setting, strategic planning, monitoring, evaluating and revising. These skills are critical for effective learning in automobile technology.

Another benefit of using the technique is that is that it makes the students to be an active leaner and not passive one. In other words, the need for cognitive apprenticeship method for improving teaching and learning of automobile technology can be expressed as follows:

- Cognitive apprenticeship encourages authentic activity and assessment.
- Cognitive apprenticeship encourages greater levels of retention and transfer.
- Cognitive apprenticeship provides students with authentic tasks, it encourages them to think like and be treated as experts. Collins (1991) further explained that when students are actively engaged in authentic tasks and make discoveries on their own, they are motivated and experience a sense of ownership of their knowledge and task.
- Cognitive apprenticeship facilitate higher order reasoning: In this technique, learners work with teachers and experts who use high

Teachers already in system should be educated by the level thinking processes, they are exposed to these processes through cognitive modelling. Hogan and Trudge (1999) lamented that after receiving initial stages of support from teacher and experts, students actually explore new idea and make discoveries using advanced reasoning processes.

From the foregoing analysis, it is clear that automobile technology teachers could adopt cognitive apprenticeship instructional method to improve learning. For example, in modelling, teacher should perform the giving tasks so that students can observe and build conceptual model. In coaching, teachers should assist students by giving hints and support. In fading, teachers are expected to gradually remove support until students are on their own. In articulation, teachers should try and get students to articulate technology information and troubleshooting procedures. In reflection, teacher should encourage students to compare their own diagnostic skill with that of experts, and in exploration, teacher should provide devices that push students into a mode of troubleshooting on their own. It should be noted that if these are complied with and adopted, it will go along way in improving teaching and learning of automobile technology.

### Conclusion

This paper focused attention on cognitive apprenticeship instructional method and how it can be fully used to improve teaching and learning of automobile technology. Cognitive apprenticeship is a modern learning technique which involves the learning activity being modelled within the context of real world situation. The technique makes the students to become active learner through the help and guidance of the teacher who helps the students to achieve a task that independently would be too hard to complex. Cognitive apprenticeship goes beyond the traditional apprenticeship in that activity emphasizes cognitive skills rather than physical skills only.

### Recommendation

The search for instructional method that will improve teaching and learning in automobile technology has made cognitive apprenticeship technique imperative. To make individual must, especially, technology education teacher to be aware of this technique, the following recommendations should be adhere to:

- This technique should be incorporated in the curriculum of technology teacher education so that would be teachers can have prior knowledge of it.
- Relevance of the cognitive apprenticeship method to the teaching and learning of automobile technology and all other technology education courses should be carried out through seminars conferences and workshop in order that teachers can be fully aware of it.
- All necessary facilities that would make learning more effective should be provided by the concerned authority.

- Teachers already in system should always be educated by the concerned authority on effective use of cognitive apprenticeship method of instruction.

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