Harnessing Cognitive Apprenticeship Instructional Technique In Technology Education For National Development

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Abstract:
In the last four years of the nation's education reform, it is obvious that teachers are central to both the problems of education and their solutions. Teachers' Instructional Methods and other factors have been advanced for poor performance of students in Technology Education. This paper focuses on the need to harness cognitive apprenticeship instructional technique in technology education towards improving teaching and learning so that students may better acquire true expertise and robust problem-solving skills, as well as an improved ability to learn throughout life. Relevant literature has been reviewed and recommendations on the way forward presented.

Introduction:
The education system in Nigeria in the past decade has come under sharp criticisms because of the feeling that students are simply not learning enough. Students' performance in different school examinations continues to deteriorate, particularly in the area of technology education. Several factors have been advanced for poor performance of students in technology education. Some of these factors according to Nwachukwu (2001) include learning facilities, school environment, socio-economic background of students and teachers' methods among others.

Among all the factors responsible for students' poor performance, teachers' instructional techniques have been viewed to have an overbearing consequences on students' performance. This is because it is the most easily manipulated. Akinsola (2004) noted 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 technique and devices, which result in poor assimilation and understanding of the subject matter by students. It is observed that most teachers of technology continue to engage the conventional methods of teaching. For instance, lecture and discussion methods. Nigeria cannot achieve its objectives of technology education if teachers continue to rely heavily on the conventional methods of teaching (Nwachukwu, 2001). This is true because these methods may not give room for innovation in the present rapidly changing technology.

All these points to the fact that there is the need for a diversified instructional approach by technical instructors. 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 national development. It is in the light of the foregoing that an alternative model of instruction that goes back to the traditional

apprenticeship but incorporates elements of schooling was proposed. This model is called "Cognitive Apprenticeship".

Concept of Cognitive Apprenticeship:
Cognitive Apprenticeship is an instructional design or learning technique which can be adopted in a classroom. 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 (Berryman, 1993). Berryman further explained that cognitive Apprenticeship is structured much like traditional apprenticeship. In traditional apprenticeships the goal or task is often to make something tangible. In cognitive apprenticeship, the task is to form a process of thinking, something that is intangible. 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 student. This extra help is called scaffolding. Once the student begins to learn the skill the modeling and scaffolding begins to fade. Fading allows the students to accomplish the task on his own, only asking for help when needed.

The teacher describe what they are thinking and doing, why they are doing what they are doing, and verbalized their self-correction process (Johnson, 1992b). 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 the students gain expertise and experience. The ultimate goal therefore, is for students to become self-sufficient as they develop competency in their activities.
Furthermore, Johnson (1992a) stressed that in cognitive apprenticeship, the activity is modeled within the context of real world situation. He noted that the cognitive apprenticeship method includes 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.

Cognitive apprenticeship as seen by Mc peck (1990) is a term that focuses on the development of learning and skills beyond the apprehension of subject matter content, for instance troubleshooting procedures, and applications of diagnostic skills used in work places. Cognitive apprenticeship (Duncan, 1996) goes beyond the traditional apprenticeship in that the activity is modeled within the context of real world situations and emphasizes cognitive skills rather than physical skills. Additional methods employed beyond the traditional apprenticeship of modeling, coaching and fading, include think-aloud modeling and scaffolding. Borrowing the apprenticeship approach, Collins, Brown and Newman (1989) developed a model that seeks to take the best features from traditional apprenticeships and apply them to modern training conditions. They believed that technology can play a major role in accruing the benefits of traditional apprenticeships. The model of cognitive apprenticeship developed by Collins et al and cited in Wilson & Cole (1991) contains several instructional principles as listed below;

1. Content: Teach tacit, heuristic knowledge as well as textbook knowledge.
2. Situated learning: Teach knowledge and skills in contexts that reflect the way the knowledge will be useful in real life.
3. Modeling and explaining: Show how a process unfolds and tell reasons why it happens that way.

4. Coaching and feedback: Observe students as they try to complete tasks and provide hints and helps when needed.
5. Scaffolding and fading: Support learners by performing parts of the task they can not perform. Gradually reduce the amount of scaffolding, shifting more and more of the control to the learner.
6. Articulation and reflection: Have students think about and give reasons for their actions thus making their tacit knowledge more explicit, students need opportunities to look back over their efforts and analyze their own performance.
7. Exploration: Encourage students to try out different strategies and observe their effects.
8. Sequence: proceed in an order from simple 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 skills instruction.

Comparison between Cognitive Apprenticeship and Traditional Apprenticeship:

In ancient times, teaching and learning were accomplished through apprenticeship. Apprenticeship was the vehicle for transmitting the knowledge required for expert practice in different fields. In modern times, apprenticeship has largely been replaced by formal schooling. Although the schooling system has been relatively successful in organizing and conveying large bodies of conceptual and factual knowledge, standard pedagogical practices render key aspects of expertise invisible to students. Hence the cognitive apprenticeship is being sought.

Cognitive apprenticeship is structured much like traditional apprenticeships. Though in traditional apprenticeships the goal or task is often to make something tangible, in cognitive apprenticeship however, the task is to form a process of thinking, something that is intangible (Berryman, 2005).

Johnson (1992) asserted that cognitive apprenticeships uses most of the instructional strategies of traditional apprenticeship but emphasizes cognitive skills rather than physical skills. The traditional apprenticeships have three primary components (modeling, coaching and fading) utilized as the master craftsman models real world activities in a sequence geared to fit the apprenticeship's level of ability. The master models expert behaviour by demonstrating how to do a task while explaining what is being done and why it is being done that way. The apprentice observes the master then copies the actions on a similar task, with the master coaching the apprentice through the task by providing hints and corrections feedback.

In addition to the traditional apprenticeships three primary components of modeling, coaching and fading, cognitive apprenticeships have the instructors verbalize the activity while they are modeling it and verbally coach the student during his completion of the task. This is referred to as "think aloud modeling" (Duncan, 1996).

Furthermore, Collins et al (1989) tabulated the differences between traditional apprenticeship and cognitive apprenticeship as shown in the table below.

Table 1
Difference between Traditional Apprenticeship and Cognitive Apprenticeship.

Traditional Apprenticeship	Cognitive Apprenticeship
i. Simple tasks	Complex tasks
ii. Physical skills and process	Cognitive and metacognitive process.
iii. One-on-one learning in the workplace	learning with several students set in the classroom and laboratory.
iv. Tasks performed by observation	Tasks and process perfumed by reasoning.
v. Learning by doing physical tasks	learning by externalizing through process in diagnosing problems.
vi. Learning from modeling, coaching, and fading of performance	learning from modeling, coaching, fading, articulating, reflecting and exploration of ideas.
vii. Job determined by tasks	learning determined by goals.

The most important differences between traditional apprenticeship and cognitive apprenticeship as put forward by Collins, Brown and Holum (1991) is that in traditional apprenticeship, the process of carrying out a task to be learned is usually easily observable. In cognitive apprenticeship, one need to deliberately bring the thinking to the surface, to make it visible. The teacher's thinking must be made visible to the students and the student's thinking must be made visible to the teacher. It implies that in traditional apprenticeship, the processes of thinking are visible. In schooling, the processes of thinking are often invisible to both students and teachers. Cognitive apprenticeship is a model of instruction that works to make thinking visible.

The Need for Cognitive Apprenticeships in Technology Education:
The need for a problem-solving orientation to technology education is apparent from the difficulty schools in Nigeria are having in achieving substantial learning outcomes. Wilson and Cole (1991) identified cognitive apprenticeship instruction as a viable means of modernizing technical education. This is so because of the benefits of using cognitive apprenticeship instructional technique.
Berryman (1993) asserted that cognitive apprenticeships put the control over learning in the hands of the 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 all critical for effective learning in technology education.

Another benefit of using the technique is that it makes the student to be an "active" learner, not passive one, studies have shown that when students become passive learners they often put little effort, attention or involvement in the learning process.
In other words, they don't learn or retain information; rather passive learning places a premium on reproducing and the students learn by memorization (Brown et al, 1989).
Cognitive Apprenticeship also works in line with the "Zone of Proximal Development" (ZPD). This is the work of Vygotsky, a social psychologist, that refers to the Zone of development that is located in between what a students can successfully do on his/her own and what he will be able to do in future. The concept of ZPD suggests that learning

occurs often when the learner receives appropriate type of assistance from the expert (Shrun and Glisan, 2000). This therefore challenges the student and can also raise the students' sense of self efficiency.

Learning is contextualized through the cognitive apprenticeship approach. Context has proven to be critical for understanding and thus for learning. Contextualizing knowledge also makes for an easier transfer of knowledge and skills. In the same vein, Berryman (2005) noted that it is only in context that most students will learn when, where, and how knowledge applies to other situations. Because learning of these cognitive skills is contextualized, students see the need and purpose for learning, which in turn may also increase motivation. In this regard it becomes obvious that cognitive apprenticeship instructional technique is a model that prepares workers for changing workplaces that are characterized by critical and analytical skills.

From the foregoing, it is clear that teachers of technology education could adopt cognitive apprenticeships instructional technique to improve learning. For instance, in modeling, teachers should perform the given 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 skills with that of experts, and in Exploration, teachers should provide devices that push students into a mode of troubleshooting on their own. If these are adopted, it will go a long way in improving learning in technology education and consequently national development.

Conclusion:

This paper has been concerned with cognitive apprenticeship instructional technique and how it can be used to improve teaching and learning in technology education. Cognitive apprenticeship is a modern learning technique which involves the learning activity being modeled within the context of real world situation. The technique makes the students to become an active learner through the help and guidance of the teacher who helps the students to achieve a task that independently would be too hard or complex. Cognitive apprenticeship goes beyond the traditional apprenticeship in that the activity emphasizes cognitive skills rather than physical skills only. Additional methods employed beyond the traditional apprenticeship of modeling, coaching, and fading include think aloud modeling and scaffolding. The technique has proven to be effective in implementing the conditions that are essential for learning.

Recommendations:

The quest for instructional techniques that will improve teaching and learning in technology education has made cognitive apprenticeship technique imperative. To popularize this technique, the way forward would include;

1. Advocacy of the technique to teachers should be carried out through workshops and conferences in order to educate them on the technique.
2. Cognitive apprenticeship instructional technique should be incorporated in the curriculum of technology teacher education so that pre-service teachers can have knowledge of the technique.
3. Effective learning environment based on advanced-level reasoning and problem-solving skills should be put in place by the government.

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