

Conceptual Analysis and Implications of Students' Individual Differences to Curriculum Implementation in Technical Education

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Abstract

Individual differences refer to the unique ways each human being differs from another human being as expressed in behaviour or perceived in the physical appearance. Three factors of individual differences identified to be closely related to learning/acquisition of skills and performance of tasks. These are personality dimensions, self-efficacy and abilities. These factors individually and collectively have implications to implementation of curriculum in technical education. These implications presents the technical teacher with the challenges of understanding the students and planning instruction with due consideration to the needs, abilities, personalities and other individual differences related characteristics of the students. Among the various ways of coping with individual differences in curriculum implementation are through individualized instruction, the use of ICTs and software as Discrete Educational Software (DES), the use of problem-based or planning production and demonstration (PPD) to supplement classroom / workshop instructions.

Keywords: individual differences, individualized instruction, self-efficacy, intellectual abilities, curriculum implementation, technical education

1. Introduction

The principles of technical education emphasize that effective training should recognise specific aptitude, interest, need, value, habits and abilities of the learners. By recognizing the fact that learners are unique in various human characteristics, it is assumed that these unique characteristics would unavoidably manifest in every learning situation.

Technical education curriculum is equally unique in its characteristics as compared to curricula in other fields of learning disciplines, especially as it provides for job-oriented programme and its primary function is 'learning to do' (i.e. psycho-productive activities). The implementation of technical education curriculum is expected to provide growth opportunity for each individual. needs. In other words, considerations are given to learners individual differences in order to achieve the ultimate goals of the curriculum. It is therefore the intention of this paper to examine individual differences and its challenges to effective implementation of technical education curriculum.

2. Conceptual Analysis of Individual Differences

Since the postulation of trait and factor theory by Parsons in 1909, the psychology of individual differences cannot be alienated from technical education programmes, occupational classifications and characteristics, as well as organizational behaviour. In a very simple term, individual differences refer to the unique ways each human being differs from another human being as expressed in behaviour or perceived in the physical appearance. Individual differences can as well be conceptualized as the personality of the individual.

An individual can be differentiated from another in terms of the following criteria: types/traits, gender, ability, psychic, development aspects, and motivation, attitude, and perception, social and cultural aspects. All these characteristics shape individual's sense of self and so in one way every individual shares the humanness; some individuals share the same gender type or same personality dimensions, they may have the same ability level or share similar socio-economic background, but human uniqueness stems from the dynamic way in which these features combine (Hicks, 2005).

For more understanding of individual differences in technical education, further review of personality construct is necessary. Personality, according to Mischel (1985), is all the relatively stable and distinctive style of thoughts, behaviour and emotional responses that characterise person's ability to adopt to surrounding circumstances. Chrudden and Sherman Jr. (1980) defined personality as a sum total of individual's characteristics. The characteristics which are outside the aptitude-ability areas include more endowing behaviour characteristics as being aggressive, tolerant, nurturing, extroverted and dominant. Personality is equally explained as the unique and relatively stable pattern of behaviour, thoughts, and emotions shown by individuals.

The implication of the forgone definitions is that human person possesses a distinct and unique pattern of traits and characteristics that no other person fully duplicates; and these characteristics are stable over time. These stable behavioural patterns help in the understanding of how people would behave or response to any stimulus in a given situation of human affairs such as teaching and learning.

Furthermore, acquisition of technical knowledge and skills by learners are based on not only "who they are" but also on 'what it takes' to learn. Who they are in terms of their levels of knowledge, skills, abilities and personality. And what it takes in terms of the situation the learners face, or the setting in which the learning takes place. Hence, there is a possibility that a complex interplay exists between students personality (individual differences) and situational factors that could influence the extent to which technical education curriculum is effectively implemented.

Some learners may be better suited than others in a given trade. This ideology is often referred to as person-job-fit; which is formally defined as the extent to which the traits and abilities of individual matches the requirement of the trade or job aspired for (Osipow, 1990). Indeed much evidence indicates that the more closely individuals personality, traits and abilities matches those required by a given trade, the more successful and satisfied the individual tends to be (Caldwell & O'Reilly III, 1990). In other words, technical education is effective to the extent it closely matches the personality, traits and abilities of individual learners in a given trade.

At this juncture therefore, learner's individual differences would be delimited to personality dimensions, self-efficacy and abilities. These three factors are found to be closely related to learning, acquisition of knowledge and skills and task performance in technical education and the world of work.

2.1 Personality Dimensions

These are normally referred to as the big five dimensions of personality. The dimensions underlie many specific traits which according to Costa and McCrea (1992), Greenberg and Baron (2000) and Mullins (2005) are:

Conscientiousness - the extent to which the learner is hardworking, organised, dependable preserving as against being lazy, disorganised and unreliable.

Extroversion/Introversion - the degree to which the learner is gregarious, assertive and sociable versus being reserved, timid and quiet.

Agreeableness - the extent to which the learners is co-operative, warm and agreeable as against being belligerent, cold and disagreeable.

Emotional stability - the degree to which the learners is in-secured, anxious and depressed versus being secure, calm and happy.

Openness to Experience - the extent to which the learner is creative, curious and cultured versus practical and having narrow interest.

2.2 Self-Efficacy

Individual differences based on this personality construct have to do with the individual's belief concerning his or her ability to learn or perform specific tasks successfully. The development of belief about self-efficacy involves two factors which are very cultural to technical skills acquisition and development. These are direct experience or feedback from performing similar tasks or previous learning outcomes and vicarious experience or observations of others performing these tasks (Gist & Mitchel, 1992). With self-efficacy, learners seem to have general expectations about their abilities to mobilize the motivation, cognitive resources and strategies they need to control the events of their learning process.

2.3 Abilities

Abilities have been severally mentioned as a sub-scale of individual differences in theoretical and conceptual contents of the discussion. It is therefore evidenced that individuals differ in their abilities and extent to which they achieve in their cognitive, affective, psycho-productive and perceptual domain of knowledge.

Hence, abilities which are explained as the mental and physical capacities to perform various tasks are many. Despite the many abilities, they tend to fall into one of two different categories, namely: Intellectual abilities which involve the capacity to perform various cognitive tasks; and physical abilities which involve the capacity to perform various physical actions (Eysenk, 1994; Greenberg & Baron, 2000).

2.3.1 Intellectual Abilities

Intellectual abilities are further grouped into:

Cognitive intelligence which is the ability to understand complex ideas, to adapt effectively to learning environment, to learn from experience, to engage in various forms of reasoning and to overcome obstacles by careful thoughts (Neisser, Boodoo, Bouchard, Bykin, Ceci, Halpen, Lochlin, Perloff, Sternberg & Urbina, 1996). Thus, intellectual abilities are those most measured in education generally, and the results, no matter how valid and reliable the instrument might be, cannot be the same for any sample of subjects.

Practical intelligence which is all about the ability to devise effective ways to getting things done. In other words, it is the adeptness of solving the practical problems of everyday life (Galeman, 1998). What really matters in using practical intelligence to solve problems is tacit knowledge. Tacit knowledge is the knowledge of how to get things done. It is far more practical in nature as compared with formal academic knowledge; which often involves memorising definitions, formulae and other technical or guidance information. Tacit knowledge according to Greenberg and Baron (2000) has the following three major characteristics that are much related to the principles of technical education:

- a) Tacit knowledge is action-oriented. It involves knowledge about “knowing how” to do something as opposed to knowing that something is the case.
- b) Tacit knowledge allows individuals to achieve goals they personally value, like acquiring skills in a chosen trade.
- c) Tacit knowledge usually is acquired without direct help from others. This is very necessary in project and other approaches of independent and individualized learning.

Emotional intelligence (EQ) refers to a cluster of abilities relating to the emotional or ‘feeling’ side of life. Among the several components of EQ are the ability to recognise and influence other people emotion, the ability to recognise and regulate one’s own emotion, self-motivation to learn or study hard without easily giving up, and the ability to form effective long-term relationships with others. These components constitute the affective technical competences required from technical students and thereafter in the world of work.

Other intellectual abilities include the ability to quickly recognise similarities and differences in visual stimuli. It is called *perceptual speed* which is very vital in technical trades that involve design and construction. Another intellectual ability in this category is *number aptitude* which is the ability to work with numbers both quickly and accurately. The last one is called *spatial visualization*. It is the ability to imagine how various objects look when related or moved in space. Most technical trades that involve design, construction and production require this ability.

2.3.2 Physical Ability

These refer to the capacity to engage in physical tasks required in psycho-productive aspects of learning. Different trades require different degree of physical abilities which also vary per student. For example the degree of physical abilities required to cut a high carbon steel cannot be the same as those needed to mix concrete or carry out household wiring. And not all the students that may be assigned to these tasks in their respective trades can have the same degree of physical abilities to perform the tasks. However, physical abilities include, and can be measured through:

Strength: The capacity to exert physical force against various objects as in cutting metal or wood.

Flexibility: The capacity to move one’s body in an agile manner as in climbing a ladder or scaffold.

Stamina: The capacity to endure physical activity for prolonged periods as in lying under a motor vehicle, standing in building site, and any other work station.

Speed: The ability to move quickly. Physical abilities are very relevant in technical education because of the emphasis on psycho-productive or manipulative skills.

It is evidenced from the forgoing analysis of individual differences, in terms of personality, self-efficacy and abilities, that challenges abound in the implementation of technical education curriculum. These challenges are most on the teachers as he finds himself in a direct interaction with the learners who must learn within a limited time frame and space.

3. Implications of Students' Individual Differences to Curriculum Implementation in Technical Education

Curriculum implementation in technical education is the classroom/workshop or laboratory efforts of the teacher and the learners to put into operation, the curriculum document within a school setting. It involves the combined tasks of the teacher, the learner and all that are concerned in the education of the learners to translate the curriculum into teaching/ learning activities and experiences (skills and knowledge).

At this level of curriculum process, the teacher reviews the recommended curriculum and arranges the topical content into units of instruction. Consequently, the broad aim and goals of the curriculum area are reduced to specific or instructional objectives for each of the units. The tasks or skills to be taught in each unit are identified and arranged in a prerequisite order for instructional purpose by the teachers. Furthermore, the teacher would need to perform task and instructional analysis by listing the tasks or skills and related information available in each unit. The related information are general, technical and guidance in nature. The nature of this related information will guide the teacher on the kind of instructional materials to select and use (Usoro, 2011).

The teacher is also expected to identify and list the essential element of an occupation, trade or job for instruction purposes. The technique is known as occupational analysis. The analysis according to Usoro (2011) reveals among other things. Manipulative or psychomotor element which are concern and with what the worker must be able to do; and information elements which are concerned with what the walker must know (technical, general and guidance information underlying the practice of the occupation). Usoro emphasized that occupational analysis is an important technique a technical education teachers must master if he is to effectively teach in the workshop. The identification of these elements helps him to plan for demonstrations, prepare visuals, instructional sheets and other aspects of teaching. The basic elements thoroughly learned by an individual become habitual as experience increases. In addition to these responsibilities, the teacher needs to understand the learners based on their individual differences. This understanding would enable him to plan his instructions with due consideration to the needs, abilities, personalities and aspirations among other characteristics of individual students.

4. Coping with Individual Differences

It may rather appear practically impossible for the teacher to cope with individual differences of the learners in the course of curriculum implementation in technical education. This may be due to the fact that the concept of individual differences itself is multifaceted and are variegated proportionally with the number of students the teacher is teaching. The situation is even worst in Nigeria where, in most technical schools and colleges, students outnumber the available facilities in the workshops and laboratories. In the upstream sector of educational system, individual differences are not considered especially when admitting students into technical education programmes. This negligence will eventually compound the teacher's problem of coping with individual differences among students. The adoption and use of individualized instruction approach in technical education can help to cushion the effects of these problems.

Individualized instruction is the process in which the individual student learns on his own, a field of study or a topic broken down into bits (as in task and instructional analysis) according to his interest and ability, using specially prepared programmed books, instructional sheets and electrical or electronic teaching machines. The teacher serves as consultant. By this approach, the student is able to determine and learn the amount of work (information and tasks / skills) he is able to study at a given period at his own pace (National Teachers Institute, 2007).

Individualized instruction is based on the principles of Skinner's operant conditioning. Therefore individualized instruction are characterised by the following principles:

- a) The learner determines his instructional objectives.
- b) The learner specifies what he would want to know at the end of the study.
- c) The instruction is broken down into bits (as in task and instructional analysis) according to the individual learners needs, capabilities and interest.

- d) The learner performs the learning activities either by reading, writing or manipulating the instructional materials in use.
- e) Questions on areas covered are asked at intervals to show the learner whether he understands or not. The teacher attempts to reward and reinforce the learners' efforts.
- f) The individual feedbacks received motivate the learner to learn more.
- g) The learner works at his own pace. He is not held up or pulled forward by other learners.

5. Common Approaches to Individualized Instruction

The most common and contemporary methods or approaches in individual instruction include programmed instruction (PI), computer assisted instruction (CAI), learner controlled instruction (LCI), teaching machine (TM), and personalized system instruction (PSI). These approaches are highly challenging to the implementation of technical education curriculum. Furthermore, these approaches and their attendant challenges can culminate into the use of ICT in classroom instruction, in a manner that will cater for learners' individual differences.

6. Information and Communication Technologies Applications and Individual Differences in Technical Education

Technical education which is characterised by "learning to do" presupposes acquisition of sets of saleable skills for the nation's work force. Therefore the application of ICTs is vital to catering for individual differences. It is worthy of note that individual differences among learners in the training station will manifest significantly in the world of works. This would even become more prominent as the trend in the global industrial community is becoming more information – oriented. Information oriented jobs are characterised by:

- a) Comprehensive, open-ended tasks requiring high responsibility and critical thinking;
- b) Tasks which need little supervision and require active initiative;
- c) Tasks that require creative solution to non-routine situations with deviations handled by the lowest level of specialists;
- d) Continued improvement of performance being as important as computing tasks, and
- e) Integrated work processes and increased ownership of products and process by the individual (Law, Knuth & Bergman, 1992).

Based on the implication of information job orientation to the classroom instructions, the use of software like the Discrete Educational Software (DES) can supplement instruction, introduce topics and also provide means for self-study. Students of differential learning abilities would use DES as tools for learning and re-learning outside the normal classroom instruction schedule.

The use of problem-based learning (PBL) or planning production and demonstration (PPD) approach as suggested by Johannessen (2003) would minimize possible effects of individual differences in equitable learning among technical education students. By this approach, students through learning tasks have to be very active. They can choose to work on their own, based on the pace they can go, but most of the time they work together in small groups. They continually discuss the goals of the assignment with the teacher. They have to document the learning process. In addition to the literature in the text book, they will be guided to relevant resources where they can find more about the subject in terms of internet link (Johannessen, 2003).

In technical education, the organization of a learning process is decisive for how much the student learn. Consequently, it is important to organize the teaching process, as well as classroom/workshop to stimulate learning bearing in mind students' individual differences. No technical teacher can effectively accomplish these tasks when the students' population for a given technical class is not limited to the recommended number which must be accompanied with a corresponding number of functional tools and equipment. Nigeria is yet to come out with a plan to restructure technical education (Technical Schools/Colleges) classrooms that will have ICTs facilities, and to create different kinds of rooms where different kinds of students' activities such as individuals work, group activities, projects, or working individually with computers can take place.

7. Conclusion

It is established that there is a strong interplay among students' personality dimensions, self-efficacy and abilities in the process of implementing technical education curriculum. The teacher's challenges to cater for the learners' individual differences, in this process are enormous. Therefore, the use of ICTs for effective individualized instruction would minimize the effects of individual differences and reduce the teachers' burden in the teaching /

learning processes. But the question is: how is the Nigerian system of education equipped for ICT application in the classroom / workshop to cope with the problem of individual differences?

8. Recommendations

Since the issues and problems of individual differences cannot be eliminated in education and career processes, some measures should be taken to cushion its effects. These may include:

- a) Factors of individual differences should be identified and considered during selection of students into technical education programmes. Placement examination like UTME should be restructured to cater for individual differences.
- b) ICT facilities should be provided in technical school and colleges to facilitate modern individualized instructional approach.
- c) Technical teachers should be given moderate work load so that they can have sufficient time to cater for students' individual differences.
- d) Classrooms and workshops should be restructured to create different kinds of rooms where different kinds of students' activities can take place in accordance with their difference in abilities, personalities and self-efficacy.

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