

# **STUDENTS APPLYING THEIR KNOWLEDGE OF MATERIAL SCIENCE IN PROBLEM-SOLVING: Implications for competence based-learning at the University of Zimbabwe**

**By Peter Kwaira (Department of Technical Education, University  
of Zimbabwe)**



# ABSTRACT



- Study involved serving teachers in second year of a B.Ed degree programme'
- Pre-requisite course: *Principles of Material Science* (PMS).
- Course at the time of study: Machine-shop Practice' (MsP).
- All activities based on the D&T approach, regarding teaching & learning.
- Students required to solve practical-technical problems through hands-on practical activities, supported by relevant ancillary theory.
- Students expected to demonstrate ability to apply knowledge of MS; e.g., in choice of materials and methods of working the materials.
- The problem was therefore to determine the extent to which students applied their knowledge of MS under MsP.
- Data gathered through interviews, observation and document analysis.
- Findings showed students being able to apply their knowledge of MS effectively during problem-solving under MsP; thereby, qualifying their learning as having been outcome-based in nature.

# Introduction and Background to the Problem



- DoTE at UZ involved in teacher professional development since 1987.
- B.Ed.& M.Ed. Programs: Wood Technology, Metal Technology, Building Technology, Technical Graphics, Agriculture and Home Economics.
- Study mainly focused on Wood/Metal Technology.
- UZ, through DoTE, introduced programmes at the request of Government.

# Introduction and Background to the Problem (Continued)



- Ministry of Education, had just adopted a new philosophy in the teaching/learning of technical subjects; marking the advent of D&T as a new concept in the curriculum.
- Since then, D&T has remained as an approach to the teaching/learning of technical subjects in Zimbabwe.
- Move by Government, mainly motivated by the need to keep curriculum abreast of global trends, regarding TE, with specific reference to *curriculum change and innovation*.

# Introduction and Background to the Problem (Continued)



Curricula the world over are changing rapidly, and in Zimbabwe as elsewhere, there has been need to relate teacher education and training to the prevailing politico-socio-economic demands of the curriculum, which now includes D&T within the context of TE.

# Introduction and Background to the Problem (Continued)



Introduction of D&T into the curriculum has meant a shift from the traditional approach to the more progressive problem-solving approach; equated to a move from the '*banking concept of education*' to the '*problem-posing approach*', propounded by Paulo Freire in his famous '*Pedagogy of the Oppressed*' (Freire, 1972).

# The Theoretical Framework and Related Perspectives



From a theoretical perspective, the following issues were pertinent:

- The essence of curriculum change and innovation;
- The link between theory and practice in problem-solving within the context of D&T, and
- Current debate on issues relating to outcome/competence-based learning.

# Main research question

The main research question addressed in this study went as follows: *‘To what extent are students (serving teachers) able to apply their knowledge of Material Science when solving practical problems under Machine-shop Practice?’*

# Sub-questions



- To what extent are the two courses, MS and MsP reflective of each other?
- What aspects of MS do students find being applicable to their activities in MsP?
- To what extent are students able to reflect on their knowledge of specific concepts in MS when solving practical problems? AND,
- In what activities is one able to identify specific cases of students applying their knowledge of MS in solving given practical problems?

# Methodology

1. Participants: 23 serving teachers (16 males and 7 females), under B.Ed. Wood/Metal Technology.
2. Data gathering: interviews; observations and document analysis of course outlines and design folios.
3. Data mainly analysed qualitatively, with the aid of schedules and checklists. In addition, observations of workshop activities were also supported by photographs and video filming.

# Key Results & Findings



- Material Science and Machine-shop Practice, found reflective of each other.
- Aspects of Material Science, found applicable to activities in Machine-shop Practice.
- Evidence of students reflecting on their knowledge of Material Science during problem solving.
- Evidence of students applying their knowledge of MS in problem solving.

# Discussion of Conclusions and their implications

Teachers being able to apply their knowledge of MS in solving practical problems under MsP, had several implication on the issue of outcome-based learning at the University of Zimbabwe, where the subject integration implied between the two subjects proved the relevance of each course to the common purpose of skills development.

# Discussion of Conclusions and their implications (continued)



- Currently, developments in competency-based teacher education (CBTE) present both; possibilities and challenges.
- Besides the need to be clear on the specification of learning strategies or formats, there is still need to provide a clear description of intended learning outcomes (ILOs).

# Discussion of Conclusions and their implications (continued)



The outcome/competency-based learning approach has the potential to yield authentic curricula for various fields (Smith & Dollase, 1999). In this case, such a potential is also likely to be felt in teacher education, where the challenge has been to have teachers coping up with rapid changes in the field of education, particularly now (2016) when our system has undergone a rigorous review process at all levels, in the face of the Zimbabwe Agenda for Sustainable Socio-Economic Transformation (ZIMASSET).

**THANK YOU ALL FOR LISTENING!**