

MULTIMEDIA INSTRUCTION TO ENHANCE LEARNING IN MULTIGRADE EDUCATION IN THE WESTERN CAPE

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Abstract

Children growing up in the rural areas of the Western Cape have limited experience due to the social, economic and cultural isolation that influences their cognitive development. These factors are not considered in the current multi-grade educational context and therefore the quality of teaching and learning is often insufficient. Integrating multimedia instruction in the teaching and learning process is one of the possible solutions to add experience and to enhance learning. This design-based research genre therefore aims to solve this complex problem by going through iterative cycles of design and development.

Introduction

Children growing up in the rural farm areas of the Western Cape have limited experience of the outside world due to the social, economic and cultural isolation in which they live. Each new experience adds to their knowledge and plays a role in shaping a person's view of the community and the society in which they live as well as the world at large. It helps to determine what a person does and how it is done. This isolation influences the social, emotional and cognitive development of the child. Of these influences poverty plays a vital role and stands central to the different types of development that must take place. Inequalities are eminent, even after twenty years of democracy in South Africa.

These factors are not considered in the current practices in multi-grade education where there is more than one grade and several levels in a classroom with only one teacher at any given time. The teaching and learning process is teacher-centred instead of being child-centred. This is due to constraints such as the teachers' time, knowledge, skills, attitude, support and/or training as well as a lack of efficient instructional design and learning materials. The quality of teaching and learning is therefore often insufficient.

The proposed research will be undertaken as part of the research programme of the Centre for Multigrade Education (CMGE).

Literature Review

Quality Education for Rural and Farm Areas

Both the United Nations (2009) and Sedel (2005) agree that children from poor and rural communities are the ones likely to lose out and be disadvantaged in terms of education. Acker and Gasperini (2009) state that the quality of education available in rural areas lags behind the quality of education in urban areas.

Multiple studies on education in South Africa have found inequities and a lack of basic quality education in poor rural and farm areas. Inequality, like that found in these rural and farming areas of South Africa, undermines quality education opportunities (United Nations, 2009). The impact of development on access to quality education for farm children is at best ambiguous. This is supported by the Human Rights Watch Report on South African farm schools (2004). The historical, social and economic conditions on commercial farms are among the poorest in financial resources, physical structure and quality in South Africa (Human Rights Watch, 2004). Children from poor households, rural areas, slums and other disadvantaged groups still face major obstacles in accessing good quality education (Nelson Mandela Foundation, 2005). The teaching, learning and resources in farm schools are inadequate (Department of Education, 2005). There are often large differences in test scores based on socio-economic status, school performance and other variables.

One of the Education for All (EFA) goals is to achieve education quality and learning achievements (Sedel, 2005). Quality and equity are two inseparable objectives that need to be pursued to achieve education for all. The ultimate goal of education is to equip children with the knowledge, skills and opportunities they need to realise their potential and to participate in social and political life. Many education systems are failing to achieve this goal (UNESCO, 2008).

Acker and Gasperini (2009) comment that the improvement of and access to quality education are two of the challenges and are critical foundational aspects of any advance in Education for Rural People. Education will be the yardstick that will differentiate and govern the gap between the rich and the poor (Acker & Gasperini, 2009).

Multigrade Education

Little (2001) and Pridmore (2007) described multi-grade education as a context or situation where teachers are responsible, within the same period, for instruction across two or more curriculum grades, usually in the same classroom.

Success in the multi-grade classroom depends greatly on the ability of the teacher to organize and manage instruction so that cooperation, independence and a motivation to learn become environmental norms (Miller, 1991). The multi-grade teacher has a specific role to play within multi-grade pedagogy (Miller, 1991). This situation is strenuous for the teachers who do not have the necessary

knowledge, skills and attitude to support multi-grade pedagogy. Many teachers in multi-grade environments are either untrained or trained in mono-grade pedagogy (Dugard et al., 2005), have few if any teaching and learning resources, and regard the multi-grade classroom as the poor cousin of the better resourced mono-grade classroom found in large, urban schools, staffed by trained teachers. It is thus essential to train and support the multi-grade teachers on this pedagogy and to change their attitude in order to enhance the quality of this kind of education (Little, 2005).

Little (2004) gives a further analysis of what is needed for quality learning and teaching. It is a function of many factors including: the organisation of learners, the distribution of teachers, the structure and quality of curricula, the quality and quantity of learning and teaching materials, the content and quality of teacher preparation systems, and the structure, content and quality of assessment systems. These are supported by Miller (1991) and Higgins (2007) who states that resources, aids and material for teaching and learning are vital to support multi-grade pedagogy. Nelson et al. (2010) stated that these tools typically function as add-ons to the curriculum rather than as an embedded tool for delivering the curriculum.

Multimedia, Multimedia Instruction and Multimedia Learning

Combining multimedia with the teaching and learning process is one of the possible solutions to giving learners new experiences and enhancing teaching and learning by creating these experiences.

Multimedia may be defined in multiple ways, depending upon one's perspective. Multimedia is an integration or combination of two or more media such as text, graphics, still images, animation, audio and/or video.

Mayer (2009) defines multimedia as the presentation of content that relies on both text and graphics. Neo and Neo (2001) also state that it is the combination of various digital media types, but add that it is combined into an integrated, multi-sensory, interactive presentation to convey a message or information to an audience. The combination adds up to more than the elements by themselves, which is the key quality of multimedia when it comes to learning. In any combinations or permutations of common media formats, the whole should be greater than the sum of the parts (Neo & Neo, 2001).

Multimedia instruction (or multimedia instructional message or multimedia instructional presentation) refers to presentations involving words and pictures that are intended to foster learning (Mayer, 2009). It uses motion, voice and music, text, graphics, video and still images, to enhance learning by stimulating multiple sensory organs simultaneously (Dervan et al., 2006). Mayer and Moreno (1998) focused on the effect of visuals on learning. People learn better from words and pictures than from words alone. Simply adding words to pictures is not an effective way to achieve multimedia learning (Mayer & Moreno, 1998).

Multimedia learning is the common name used to describe the cognitive theory of multimedia learning. The multimedia learning theory draws on several other theories (Mayer & Moreno, 1998):

Paivio's dual coding theory (Clark & Paivio, 1991; Pavio, 1986). This information processing occurs in three general stages. First the verbal and nonverbal information enters our information processing system independently via the two separate systems (Baggett, 1989; Paivio, 1986). Humans possess separate information processing channels for visually and auditory represented material. The visual and verbal explanations must be coordinated in order to enhance learning. Then the information is processed separately but concurrently in working memory. Eventually the information from both channels is integrated and connected to other information already held in long-term memory.

Conditions for the effective use of media. Multimedia learning occurs when learners construct and coordinate multiple representations of the same material. Students are actively learning in multimedia teaching rather than being inculcated (Chen & Zhang, 2010). It is an active process of filtering, selecting, organising, and integrating information based upon prior knowledge (Chun et al., 1998; Mayer, 1997). Humans actively engage in cognitive processing to construct coherent mental representations of their experiences when we apply cognitive processes to the incoming material. The result of this processing is the creation of a mental model of the information presented.

Cognitive load influences learning. This is known as cognitive load theory (Chandler et al., 1990; Chandler & Sweller, 1991). Humans are limited in the amount of information that can be processed in each channel at one time. Children who are listening to any presentation can only hold a few images and a few sounds in working memory at one time. This theory is developed out of several empirical studies of learners, as they interacted with instructional materials. Although there is some individual variability, memory span tests have shown that average memory span is pretty small — from five to seven 'chunks' of information. Chandler and Sweller (1991) began to measure the effects of working memory load, and found that the format of instructional materials has a direct effect on the performance of the learners using those materials. Shank (2005) states that multimedia have the potential to extend the amount and type of information available to learners which can lead to frustration and overload. Many projects do not take these factors into account.

Individual differences in learning with multimedia. Inconsistency between personal cognitive style and instructional method might inhibit learner's transformation of knowledge (Ausburn & Ausburn, 1978; Chun et al., 1998). Using a variety of media to present information caters to more learning styles (Dervan et al., 2006). This principle is more important for low knowledge than high-knowledge learners, and for high-spatial rather than low-spatial learners

(Mayer & Moreno, 1998). Kalkbrenner and Pape (2004) comment that different theories influence the way multimedia learning environments are designed.

The Benefits of Multimedia

There are several benefits in the use of multimedia in learning. Studies that focused on the effectiveness of multimedia education have proven that multimedia learning resources are often more effective than text-only resources, particularly when the learner is introduced to completely new material (Dervan et al., 2006). Mayer and Moreno (1998) states the importance of using multimedia in fostering student learning: “. . . advances in cognitive psychology provide the starting point for such theories . . . one of the most important avenues of cognitive psychology is to understand how technology — such as multimedia — can be used to foster student learning” (p. 1). Cognitive processes, like comprehension and recall, are enhanced by the use of multimedia when it is used properly in conjunction with text-based information (Dervan et al., 2006; Shank, 2005).

Mayer (2009) furthermore states that well-designed multimedia presentations work best for learners who are low rather than high in prior knowledge about subject matter.

Shepard's (n.d.) synthesised studies showed potential benefits of well-designed multimedia, including alternative perspectives, active participation, accelerated learning, retention and application of knowledge, problem-solving and decision-making skills, system understanding, higher-order thinking, autonomy and focus, control over pacing and sequencing of information and access to support information.

In addition to the primarily cognitive effects multimedia can affect emotions and motivation (Astleitner & Wiesner, 2004; Dervan et al., 2006). Motivational and emotional aspects should therefore be considered when designing multimedia and likely correspond to Hede and Hede's (2002) cognitive engagement, motivation, and learner style factors. Dervan et al. (2006) state that having fun during learning will help the brain retains more information. Multimedia teaching enhances students' interest in learning and therefore promotes learners' learning methods and life development (Chen & Zhang, 2010).

Problems, Implications and Challenges

Mayer and Moreno (1998) asked how one can avoid a trail of broken promises concerning the educational benefits of new educational technologies. Shank (2005) wrote that although multimedia can provide opportunities for improved learning, it can also be ineffective when implemented poorly. Sorden (2005) and Shank (2005) also commented on the danger of broken promises. Sorden (2005) cautions that the liberal use of multimedia to add excitement and to hold the learner's attention does not always make for sound instructional design in multimedia delivery and can quickly become counter-productive to learning. This

may happen if visual and auditory components are intended to stimulate and not to educate.

Chen and Zhang (2010) state that teachers act as organisers, researchers, and administrators in the teaching context. Teachers also guide, monitor and evaluate the students' self-learning (Chen & Zhang, 2010). The role of the teacher changes more to the role of a coach who supports the learner during the knowledge constructing process (Kalkbrenner & Pape, 2004).

Research Questions and Aims

The proposed research focuses on the following research question: To what extent can multimedia instruction enhance learning in multi-grade education in the Western Cape? The research questions can be sub-divided into the following questions:

- What are the current situation of teaching and learning in multi-grade education in the Western Cape?
- What are the substantive and procedural characteristics of multimedia instruction to enhance learning in a multi-grade classroom in the Western Cape?
- How practical and efficient is multimedia instruction in enhancing learning in multi-grade education in the Western Cape?

Research Design and Methodology

There are several reasons for choosing design research as a research genre. Design research is relevant for educational practice as it aims to develop research-based solutions for complex problems in educational practice (Nieveen & Van der Akker, 2007). This research aims to solve a complex problem and to advance our knowledge about the principles in multimedia instruction and the processes to design and develop it. This will be done by enhancing the learner's experiences and their cognitive development by including multimedia in the teaching and learning process within the multi-grade education context.

In the greater part of this research the teachers and the learners of the Intermediate phase (Grades 4, 5 and 6; learners ages 10–12) of eight multi-grade schools will be used. These schools are three rural districts in the Western Cape Province, the most south-western province in South Africa, and represent a range of

circumstances and specific contexts found in multi-grade schools within this province.

For this research to be successful it will go through three phases of development (Nieveen & Van der Akker, 2007).

Phase 1: Preliminary Phase

During the preliminary phase a thorough needs and context analyses will be done along with the development of a knowledge base and conceptual framework based on a thorough literature review. The context and the needs refer to all the variables that may impact multimedia instruction in the teaching and learning process. In this case the context and needs refer to the following:

- external environments (outside the classroom)
- internal environment (inside the classroom)
- learners' competence
- teachers' competence
- teaching and learning strategies

The needs and context analysis will be done by questionnaires for the teachers and the learners, focus groups interviews and classroom observations. A teacher interview guide will be used to gather information about the needs of the teachers and their perception of the context.

A context and needs analysis will allow the designer to see what problems they may have to overcome and enable them to develop strategies to deal with these problems.

Phase 2: Design and Prototyping Phase

In the design and prototyping phase, the researcher will go through iterative cycles of design and development based on the results of the first phase.

The multimedia design will be in line with the Curriculum Assessment Policy Statements as well as other design principles. A section of the social science curriculum will be chosen for this design. Social science consists of two parts, history and geography, and it is the ideal platform to expand the learner's experience by exploring the world in which they live and the world around them.

Stage 1: Identify the Substantive and Procedural Design Principles. This stage focuses on identifying the substantive and procedural principles of valid and practical multimedia in order to enhance learning. The methods that will be used include screening with a checklist, focus group interviews and expert appraisal.

Stage 2: Global Design (Version 1). During this stage learning opportunities will be designed and developed where multimedia forms an integrated part of the

learning process. The quality of the design will be measured with a checklist and focus group interviews by experts.

Stage 3: Micro-Evaluation (Version 2). During this stage, the product will be tested, reviewed and modified. The product will be tested with a small group of users from the eight multi-grade schools who will use parts of the intervention outside the normal user setting. The quality of the product will be measured through observation of classroom activities and by interviewing the teachers by experts.

Stage 4: Tryouts (Version 3 and 4). During this stage the product will undergo another round of testing and will again be reviewed and modified, but within the normal user setting. This stage will be divided into two sub-stages. During the first sub-stage the product will be tried out in the eight multi-grade schools after which it will be revised (version 3). In the second sub-stage the improved product version will be tried out in three additional multi-grade schools in the Western Cape after which it will be revised for the final time (version 4). A pre- and post-test will be used to determine all the learners' knowledge and understanding before and after the implementation of the product. Classroom observations, interviews and questionnaires will be used to determine the intended and unintended outcomes in the cognitive, affective and psychomotor domains.

Phase 3: Evaluation Phase

During the final phase the summative and semi-summative evaluation of the process and product will be done by focus group interviews and expert appraisal (Nieveen & Van der Akker, 2007). This will be done to determine:

- the extent that multimedia instruction enhanced learning; and
- the actual practicality and expected efficiency of multimedia instruction in enhancing learning.

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