

Geoscience education in the classroom – a case study of the first Namibian Teachers’ Workshop

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Abstract :- Science teachers play a key role in developing future leaders in science and technology by fuelling the curiosity of students and encouraging further exploration into topics of interest. Thus, it is important that educators are equipped and supported with well-grounded strategies to develop and improve their teaching methods in science education. Multimodal literacy encompasses visual, auditory and tactile communication modes, allowing for multiple forms of representation to create meaning. In science education in particular, the use of different modes of teaching, such as the incorporation of scientific videos, posters, art work and field observations into the curriculum, generates interest and a broader outlook. To equip science teachers with the know-how of introducing multimodal literacy in their classrooms was the aim of a science teachers’ workshop that took place from 3 to 4 October 2023 in Windhoek, hosted by the Geological Survey of Namibia.

Keywords :- Geoscience education, Multimodal literacy

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Introduction

Multimodal media convey meaning through an amalgam of visual, auditory and / or tactile elements to create understanding (Kress, 2010). For example, a poster conveys meaning through a combination of written language, images and spatial design. Each mode has its own specific function in the process of creating understanding, and on its own usually carries only part of the message (Kress, 2010). Thus, multimodal literacy refers to the ability to understand, interpret and create meaning through various communication modes, including but not limited to text, images, videos, sounds, as well as interactive components (University of Montevallo, 2023).

In education, particularly in the sciences, the concept of multimodal literacy takes into account that individuals process infor-

mation in diverse ways, and that effective communication and teaching requires the employment of multiple modes to convey abstract ideas. Thus, empowering science teachers with multimodal literacy skills, that is the know-how to transfer knowledge in various innovative ways other than by means of the traditional textbook, is imperative for improving science education in Namibian classrooms. Diagrams, graphs, equations and tables are examples of representations that are crucial to the way meaning is created and communicated in science (Nielsen and Yeo, 2022). In addition, the introduction of practical activities and interactive elements, such as experiments and role plays, will enhance science teaching and learning.

Importance of Geoscience Education

Geoscience education centres on the study of the earth's physical characteristics, processes and systems, along with natural and human-induced events that influence them (King, 2008). This wide field encompasses disciplines such as geology, oceanography,

meteorology, climatology, environmental science and more. As even young children naturally tend to exhibit curiosity about the physical world surrounding them, everyday occurrences like thunderstorms, as well as rarer events such as the occasional earth tremor,

serve as illustrations in practical earth science education.

The importance of geoscience education is multi-faceted, addressing critical societal challenges (e. g. environmental protection, climate change) and enhancing our understanding of the earth's processes expressed through natural phenomena such as for instance volcanic eruptions and earthquakes. It plays a vital role in promoting environmental consciousness, sustainable development and scientific literacy in general. Also, geoscience education in the classroom contributes to the training of future generations of geoscientists, policy makers, educators and informed citizens in general (King, 2008). Outreach programmes, science fairs, workshops and seminars, among others, are effective platforms to create a basis for understanding scientific concepts, and for developing critical thinking and

problem-solving skills in the young generation, which extends beyond the mere acquisition of scientific knowledge.

Given the accelerating threats posed by climate change, environmental pollution and general ecological damage, there is a need to review mankind's role in the world of today. Not an easy task, this calls for a concerted effort from universities, research institutions, primary and secondary schools and all sectors of society to implement a new model of geoscience education, with a view towards promoting a harmonious coexistence with nature. Central to achieving this objective is the education of individuals from an early age, starting at home and continuing at school. Therefore, investing in the training of capable science teachers must be regarded as an obligation of high importance.

Geoscience Education in Namibia

The Namibian educational system embraces the use of multimodal literacy, with posters, graphs and diagrams displayed in classrooms, as part of existing lesson plans. From the outset, when Namibia gained its independence in 1990, its emphasis has been on assisting students to develop self-reliance and critical thinking (Kangumbu, 2005), including scientific thinking and practices, and to promote problem-solving capabilities (Vivante and Vedder-Weiss, 2022). Therefore, teachers' knowledge of scientific concepts and methods is crucial for students' learning and development (Vivante and Vedder-Weiss, 2022). As teachers are the key agents in implementing changes in the classroom - not only in geoscience education, it is imperative that they are enabled to engage in scientific debate at grassroot level in order to improve their professional competence and subsequently their teaching (Kangumbu, 2005).

Keeping in mind that earth science is not an explicit subject taught in Namibian schools or even part of teachers' training, the likelihood of introducing it formally in the school curriculum or in teachers' instruction in the near future is remote. However, there are other ways in which geoscience can be

brought home to young learners through outreach programmes and public engagement activities. For more than a decade the Geo-Information Division of the Geological Survey of Namibia has engaged in science communication programmes to raise awareness of the importance of geoscience in schools and communities (Mocke and Mhopjeni, 2020) through hands-on-activities, posters, videos and presentations. In as much as diversity in learning practices adds interest to the school curriculum by nurturing pupils' natural curiosity, the Division also recognises the necessity of including teachers in its initiatives to further science education in the classroom.

Accordingly, the Geological Survey of Namibia recently embarked on a geoscience teachers' workshop programme by inviting teachers from around the country to learn about earth science and how to incorporate it into the existing curriculum. This initiative is a collaborative effort with the GEOBUS programme of the University of St Andrews, Scotland, and provides teachers with innovative ways of bringing earth science to their students, such as hands-on activities in the classroom.

2023 Geoscience Teachers' Workshop

This workshop marks a pioneering initiative, as the first in Namibia to focus exclusively on geoscience education - rather than a broader science perspective - for primary and secondary school teachers. The main objective of the two-day workshop was to enhance the teaching of earth science in schools by integrating geoscience principles into existing school curricula, and introducing educators to new communication modes with readily available resources (Table 1). Like many countries globally, Namibia does not have a stand-alone geoscience subject in its school syllabus; how-

ever, elements of geoscience are embedded within traditional subjects such as chemistry, geography, physical science and life science. Apart from explaining the theoretical background, the workshop aimed to present teachers with the practical tools and knowledge needed to creatively teach geoscience concepts within the existing framework. Geoscience-related subjects covered during the workshop encompassed chemistry, physics, environmental science, mathematics and agriculture (Fig. 1).



Figure 1. Theoretical and practical sessions during the Teachers' Geoscience Workshop held at the Geological Survey of Namibia, 3 – 4 October, 2023

The workshop concentrated on the science curriculum for grades 6 to 11 (age 12 – 17), addressing geoscience topics such as plate tectonics, volcanoes (forces, pressure and speed), earthquakes (forces, movement and plate tectonics), earth's structure (including

magma flow), fluvial processes, mining (including mining economics) and the periodic table (highlighting the use of specific elements in communication technologies, i. e. smartphones). Each lesson also contained a practical component, allowing teachers to engage them-

selves in hands-on activities for a better understanding of the benefits of interactive teaching

and learning practices, and the generation of new ideas to bring to their students.

No.	Materials used	Concepts explained
1	Cookies (e. g. chocolate chip cookies), paperclips, chopsticks, tweezers	Mining activities, including economic and environmental aspects
2	Effervescent tablet, water, glue, film canister, stopwatch	Volcanoes, pressure
3	Water, water bucket, food colourant	Plate tectonics
4	Baking flour, food colourant, water	Earthquakes, layering of soil and sediments
5	Boxes, elastic bands, spaghetti, chopsticks	Earthquakes, vibrational forces

Table 1. Experimental materials used in the workshop in explaining geoscientific concepts

Conclusions

The workshop’s aims to promote geoscience education in Namibian primary and secondary schools were realised in so far as most of the twenty-three participating teachers went away inspired, motivated and eager to implement new teaching methods in their classrooms. The participants gained skills and insights on how to incorporate geoscientific concepts into the current curriculum and in-

clude interactive teaching modes in their lessons, in order to enhance both learning results and professional competency in educators. A survey was conducted after the workshop for the purpose of improving future similar exercises and gaining a better understanding of the limitations faced by Namibian school teachers (Figs 2, 3).

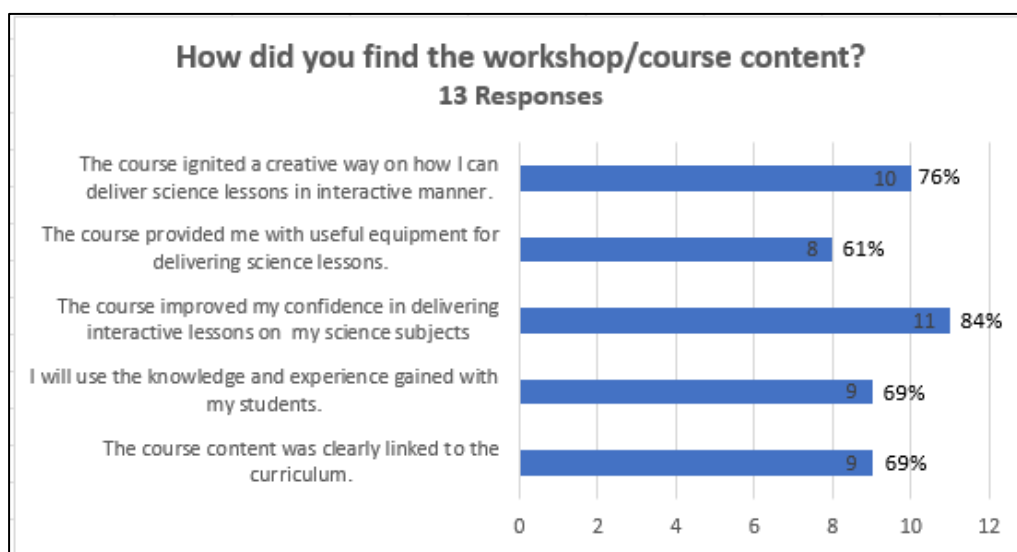


Figure 2. Teacher’s response on workshop content

More than two thirds of the workshop participants found that the subjects covered were in line with the current curriculum and plan to incorporate the knowledge and experience acquired in their lessons, while nearly 85% stated that the workshop had heightened their confidence in teaching science subjects (Fig. 2). Still, despite special emphasis being placed on affordability in all experiments (Table 1), a considerable proportion professed

their inability to obtain the required materials owing to lack of financial resources or standing of the school (Fig. 3).

Other comments and recommendations included the demand for this type of workshop being held on a regular basis to enable more teachers from around Namibia to discover the concept and benefits of multimodal literacy, the suggestion to extend the course to 3 or 4 days in order to cover a wider range of sub-

jects, and a request for greater emphasis being placed on environmental education. The overall success of the workshop can best be expressed by the acknowledgment of several of the participants that it succeeded in turning science from theory into practice, and making

it more plausible to young students (and their teachers). Future plans include a proposal to take the workshop into all Namibian regions in turn, in order to reach more teachers and allow educators from remote rural areas to participate.

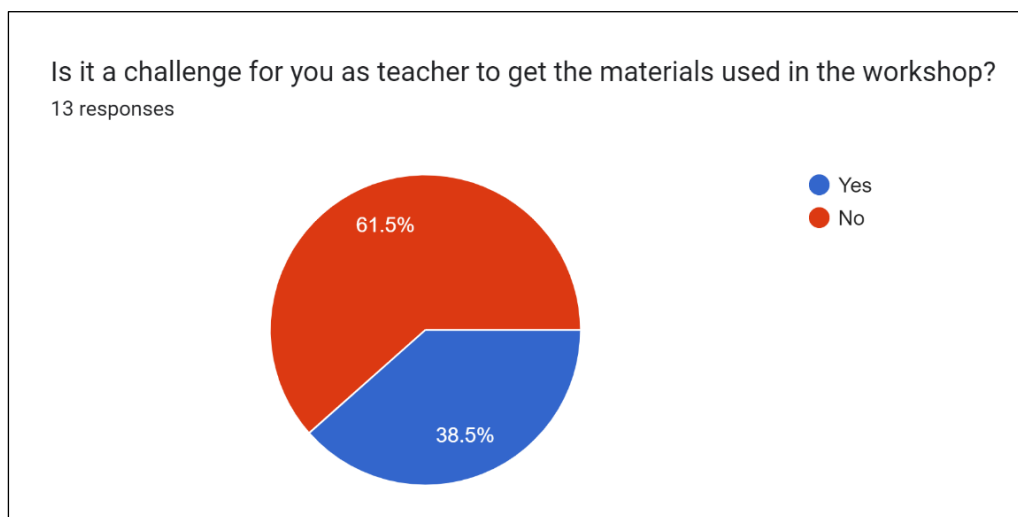


Figure 3. Teachers' response regarding the acquisition of materials used in the workshop

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