SCIENCE TEACHERS' USE OF RESOURCES IN TEACHING SCIENCE IN SECONDARY SCHOOLS

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ABSTRACT

This study explored the use of instructional resources in secondary schools in the teaching of science by teachers. Instructional resources are an essential aspect in science education since they significantly influence learners' comprehension, involvement, and overall learning experience in various ways. Education experts believe that effective learning takes place when learners engage productively with instructional resources, leading to successful knowledge acquisition, and this serves as a premise to conduct this study. The study employed an interpretivist paradigm and a case study design. The socio-cultural theory was used as a lens for this study. According to the socio-cultural theory, learners construct knowledge from their interaction with their surroundings, providing them with experiences they learn from. Purposive convenience sampling was utilised to select three secondary schools from two regions. One science teacher participated from each school. Heads of Science Departments also participated in the study. Classroom observations, individual semi-structured interviews, document analysis and open-ended questionnaires were used for data collection. The thematic approach and content analysis were used to analyse data. The results show that some teachers do not effectively use resources in their teaching because of limited time, large number of learners, lack or inadequacy of resources and limited pedagogical skills. Hence, recommendations from this study seek to improve the provision and use of resources as well as to strengthen professional staff development on effective pedagogical skills.

KEYWORDS: Resources, science teaching, learner engagement, secondary schools.

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INTRODUCTION

According to Umar et al. (2019), instructional resources provide a structure for effective learning when used appropriately. These researchers further stated that this is because resources enhance learners' understanding of concepts. When teachers appropriately use quality instructional materials, they can be confident that their learners are receiving consistent and accurate information. Frimpong (2021) claims that instructional resources make learning more engaging and interesting to learners, keeping them from getting bored. Moreover, Ministry of Education (MoET (2013) points out that the use of digital instructional resources to teach Science, Mathematics and Technology enhances the learning of abstract concepts. Good instructional resources include activities, illustrations, and other elements that capture learners' attention helping them to comprehend and retain the information presented better.

Of concern, however, is that Frimpong (2021) noted that there is a general inadequacy of learning and teaching support materials (LTSMs) in some schools. This implies that the learners who are not well exposed to instructional resources are disadvantaged, considering the benefits of using instructional resources during the teaching and learning process. Dlamini-Nxumalo and Gaigher (2019) also noted that using teaching and learning resources promote interaction during a lesson, making learning more meaningful. Of importance also, is how the teacher uses the resources to enhance learners' understanding of the concepts and skills learnt (Amos et al., 2022). However, it appears that teachers are more confident in teaching science through teacher-centered rather than student-centered inquiry (Kaya et al., 2021). To increase teachers' confidence in enacting inquiry-based instruction, they need to be provided with inquiry experiences, and long-term professional development has been recommended (Chichekian & Shore, 2016).

Teaching resources in this study refers to learners' and teachers' activities, illustrations, print, equipment & chemicals and also digital resources. The results of the Physical Science for Eswatini General Certificate in Secondary Education (EGCSE) in the externally examined class from 2018 - 2022 show that a small percentage of learners who sat for examination qualify to obtain a credit of C in Physical Science which is one of the minimum entry requirements for university entrance to study the Bachelor of Science degree. There are a number of factors that affect learners' performance which include shortage of qualified teachers, shortage of infrastructure, shortage of instructional resources and teachers' use of available resources (MoET, 2012). The learners' performance in Physical Science from 2018 to 2022 is presented in Table 1.

Table 1. Physical science results from 2018 - 2022

Year	A*	A	B	C	D	E	F	G	U	X	Total	Grade C & above	Grade D and below
2018	41	130	698	1416	1477	1808	1097	1193	2362	119	10222	22.35	54.53
2019	144	254	815	1527	1800	1682	1243	1063	2239	183	10767	25.44	53.75
2020	104	308	1020	1582	1828	1773	1051	857	1790	156	10313	29.22	53.41
2021	235	241	1152	1542	1902	1963	1177	793	1681	173	10686	29.66	54.60
2022	94	240	853	1255	1296	1435	827	642	1524	95	8166	29.90	51.43

The classification of the grades is given in Table 2 according to the Examinations Council of Swaziland's (2014) standards.

Table 2. Explanation of symbols according to Examination Council of Swaziland

A*	A	B	C	D	E	G	Below G
Credit				Non-credit			Ungraded

The results presented in Table 2 show that although there is a slight improvement in the performance of Physical Science since 2018, it is still not significant because about 30% of the learners manage to get a C grade or better. This means that a very large number of learners, who sit for EGCSE Physical Science, are rejected in institutions of higher learning in the science programs. Literature on the contrary, has shown that there is a demand for more STEM programs as the world operates in the Fourth Industrial Revolution (4IR). The Fourth Industrial Revolution conceptualizes rapid change to technology, industries, and societal patterns and processes in the 21st century due to increasing interconnectivity and smart automation. With the advent of the 4IR, there is evidence of a shift from the use of print to digital genres to be relevant in meeting the learning needs of the 21st Century learners (Prensky, 2017 as cited in Girón-García & Fortanet-Gómez, 2023). However, it may be a concern if the teachers select and use inappropriate and irrelevant digital tools. Thus, the interest in investigating teachers' use of resources arises because the Physical Science Form 5 results according to the Examination Council of Eswatini (2022) are not impressive; they enable a limited number of learners to enroll at a university. Learners have to get a good credit in physical Science to major in Science. It is of interest to find out if schools have adequate Instructional Resources (IRs) and if they are used appropriately in schools to bring about effective learning that can improve performance. Hence, this study focuses on science teachers' use of instructional resources in teaching science in secondary schools for effective teaching and learning. Literature notes that the use of instructional resources improve learners understanding of concepts, and improve their performance. Thus, this study attempted to answer the following research questions:

1. What kind of teaching and learning resources science teachers use for teaching and learning?
2. How do science teachers use the teaching and learning resources?
3. What challenges do science teachers experience in the use of teaching and learning resources?

REVIEW OF RELATED LITERATURE

A study conducted as part of the European project *FaSMEd*[1] (2013–2016), brought together eight (8) countries to investigate formative assessment (FA) and inquiry approaches in Mathematics and Science education. The focus was on primary science lessons on the topic of "how to prevent the spread of microorganisms". The study explored how teachers implemented FA in primary science classrooms, providing insights into the use of a variety of analogue and digital resources for FA purposes and how these resources can be used to enhance student learning. The findings showed that teachers used the whiteboard to establish learners' prior knowledge at the beginning of lessons and during lessons to gain feedback on the learners' learning process. They also used this resource for peer-to-peer feedback. Furthermore, the findings revealed that smartboards were used by teachers to present tasks and initiate classroom discussions. In addition, task-specific digital resources were used for peer-to-peer feedback, the evaluation of one's own learning, and the initiation of group discussions. Also, the results showed that digital resources were considered challenging by some teachers because of their practicality, citing time and the technical aspects as the main challenge.

Amos et al. (2022) examined the impact of instructional materials in teaching and learning Biology in institutions of higher learning in Central Region of Ghana using a qualitative, case study. Three (3) Biology tutors in three (3) Colleges of Education in the Central Region were selected using purposive sampling. Data was collected using an open-ended interview and the data were analysed using interpretative technique based on the themes developed from the collected data. The findings revealed that instructional materials increase learners' cognitive abilities by enabling them to think critically and by improving their interest in learning. The study also showed that the tutors' pedagogical skills depend on their competencies in the classroom instructions. This is because the use of instructional resources help them in the assessment of the subject by selecting relevant materials for each concept.

Umar et al. (2019) also investigated the effectiveness of the use of instructional materials on teaching and learning in computer science institutions of higher learning. However, instead of using a qualitative case study, a quasi-experimental design was adopted for this study, whereby two groups were formed, that is, a control and an experiment group. Simple random and stratified random sampling were used to select one hundred (100) learners from two (2) colleges. Fifty (50) learners (Experimental group) were taught with instructional materials and another fifty (Control group) were taught without instructional materials. A validated Computer Achievement Test (CAT) was used to collect data. The study showed that leaners who were taught with instructional materials performed a lot better than the learners who were taught without. Also, using instructional materials enhanced learners' understanding of concepts and led to high academic

achievements. Their findings concur with Amos, et al. (2022) who also shared the same sentiment when they also noted that using instructional resources enhance learners' understanding and participation during a lesson.

Okobia (2011), on the other hand, assessed the availability and teachers' use of instructional materials and resources in the implementation of junior secondary school social studies curriculum in Edo State using a quantitative approach. In this study, fifty (50) social studies teachers (specialist and non-specialist) were randomly selected from fifty junior secondary schools in five (5) local government areas. Data was analyzed using t-test for the hypothesis and simple percentages. The results showed that there was a shortage of instructional materials and resources. It was also observed that there was no difference in the use of instructional materials between specialist social studies teachers and non-specialist teachers.

In the same view, a descriptive study by Haloi (2022) explored the availability of teaching and learning materials in the provincialized and private secondary schools of Kamrup District. In addition to this, the research study also examined learners' attitudes towards classroom use of instructional materials. Stratified random sampling was used to select ten provincialized and seven private schools. Again, by adopting simple or unrestricted random sampling technique one hundred and fifty (150) learners from provincialized and one hundred and ten (110) learners from private schools were selected as participants. To collect data, a questionnaire was used. The findings showed that both provincialized and private schools were well equipped with instructional materials. However, the status of the private schools seemed to be better in comparison to the provincialized schools. Furthermore, the study also showed that there was no significant difference between the provincialized and private school learners' attitude towards using instructional materials in class. The findings do not concur with Okabi (2011) who noted that there is a shortage and inaccessibility of teaching and learning materials in secondary schools.

Frimpong (2021) also explored the availability and the role of instructional materials and interaction in ensuring quality early childhood education provision in the Agona East District of the Central Region of Ghana. Data was collected from twelve teachers and twelve head teachers in twelve schools using semi-structured interviews and observations, instead of questionnaires, which were used by Haloi (2022). The findings of the study revealed that there was a shortage and inaccessibility of teaching and learning materials, which hindered learners' active interaction with them, which affects learners' performance. The findings also indicate that participants perceived teaching and learning materials as an important factor in ensuring quality early childhood education. The findings concur with Okobia (2011) who also noted that there is a shortage of instructional materials in most secondary schools. The findings also share the same sentiment with Umar et al. (2019) and Amos et al. (2022) in that instructional materials enhance learners understanding.

Using a case study approach, Staberg et al. (2022) examined how teachers interact with analogue and digital resources in a science lesson in Europe. Two (2) primary school teachers teaching Grade 5 and Grade 7 and learners participated in this study. Data was collected using document analysis, classroom observations, and interviews. Eight analogue and digital resources were identified, which were used to employ five formative assessment strategies. The strategies commonly used related to effective classroom discussions

which provoked evidence of student meaningful learning that portrayed learners as self-directed learners and peer instructors. The teachers' rationale for using the selected resources were mainly connected to their effectiveness, practicality, and relevance.

Muhaimin et al. (2019) explored factors predicting Indonesian science teachers' integration of digital resources in education, especially for teaching activities in rural areas. Data were collected from two hundred and seventeen (217) respondents who were science teachers of senior and junior high schools in one province located in Sumatra, Indonesia. Smart PLS 3.0, was used to analyse the data. In addition, t-test was used to elaborate on the differences regarding the integration of digital resources based on demographic information. Findings from the study show that attitude was the strongest driver predicting intention to use digital resources in education perceived by teachers in rural areas. Other factors (facilitating condition and knowledge and skills) did not affect actual behavior. In addition, the difference test informed that Mean values between participants' teaching experience was significantly different regarding the integration of digital resources of schools in rural areas. No significant differences were reported based on gender and level of school. The technology integration for schools in rural areas is different compared to the schools in cities and urban areas.

Another research conducted by Kapici and Costu (2023), acknowledged the technological advancements that demand changes in classroom teacher practices. This was a comparative study on the use of physical science laboratories by one group of learners exposed to hands-on experimentations and a virtual laboratory by another group that manipulated items digitally. The learners were then assessed by testing for conceptual knowledge and science process skills. The findings indicated that although both groups of learners had acquired the desired knowledge and skills, those exposed to the digital resources performed better than those exposed to the physical resources. The results of this study indicate the importance of resources for science teaching and learning, but places digital resources superior over physical resources. These findings also seem to be in line with Prensky (2017) who claims that learners of this generation are more comfortable manipulating digital resources. These findings also concur with Dlamini-Nxumalo and Gaigher (2019) who explored teachers' use of computer simulations in teaching electrolysis, in that using simulations (instructional resources) improves learners' participation and enhance their performance in the subject.

de Winter and Millar (2023) examined the perceptions of (forty-three) 43 pre-service teachers on practical work in England on the importance of practical work in teaching science. Their findings indicate that they acknowledge the importance of practical work in science teaching, because it makes science meaningful for learners. Nevertheless, the participants suggested that the value of practical work varies with different science topics; in some cases there may be differences in what is observed and the ideas generated by learners from the observations. Hence, this study points out a contrasting perception on the need for equipment and chemicals.

Theoretical framework

Lev Vygotsky's (1978) socio-cultural theory was used as the theoretical framework in this study. According to the socio-cultural theory, learners construct knowledge from their interaction with their surroundings, providing them with experiences they learn from, rather than just passively taking in information provided to them by a teacher. As the learners experience the world and reflect upon those experiences, they build their own representations and incorporate new information into their pre-existing knowledge (schemas). As a result, more interactive activities are encouraged to promote cognitive growth, such as productive discussions, constructive feedback, and collaboration among themselves and their teacher. Teachers are thus encouraged to promote collaborative learning, thoughtful discussions and meaningful learning. The intention of promoting learning is to create purposeful, meaningful learning amongst learners, and the primary role of the teacher being to facilitate learning. This is done by directing the dialogue and confirming contributions in an effort to further motivate the learners. Guided exchanges, comprehensive discussions, and the creation of an engaging community are valuable strategies for cognitive development. This study sets out to explore engagement of teaching and learning resources by the facilitator (teacher) as part of an activity that generates meaningful and fruitful discussions between the novices and the teacher. When well carried out, learners successfully cross the zone of proximal development in science lessons bringing about effective learning.

METHODOLOGY

On research method, an interpretivist paradigm and a multiple case study approach was utilized to investigate the use of instructional resources by teachers in the chemistry curriculum. Purposive convenient sampling was used to select three science teachers in three secondary schools from two regions closer to the researchers. Data were collected using document analysis, observations, and a follow-up semi-structured interview. Document analysis was conducted on the chemistry syllabus Examinations Council of Eswatini (2022) to ascertain the expectations stipulated by the curriculum learning outcomes on the topic taught. The National Science, Mathematics and Technology Education policy was also analysed for postulated approaches for teaching the science in as far as instructional resources are concerned (MoET, 2013). In addition to this, lesson observations were conducted to obtain the actual practice displayed by both teachers and learners during chemistry lessons.

According to Taherdoost (2021), observation is an appropriate technique to evaluate teaching in the classes. He further notes that an observation provides first-hand data gathered through the observation of events, behaviors, interactions and processes. Each teacher was observed three times teaching the same topic of the teacher's choice. After the last observation session, the teachers were subjected to semi-structured interviews to solicit clarifications, explanations on classroom practices in order to obtain deeper understanding of actions that took place in class. The interviews were conducted after all the observation sessions had been completed to avoid influencing teacher classroom practices while the research was in progress. The participants were asked the same questions. Interviews on the other hand give the most direct

and straightforward approach to gathering detailed and rich data, regarding a particular phenomenon (Creswell & Poth, 2018). Finally, Science teachers, one from the department were asked to complete an open-ended questionnaire to assess the availability of teaching materials that might have influenced their use of the different instructional resources. Regarding data analysis, a thematic approach was used to analyze data from the semi-structured interviews, whereby the themes were coded. For the document analysis, a content analysis was used to analyse the data.

The researchers sought permission from the Director of Education and Training in Eswatini to conduct this study in the participating schools. Permission was also sought from the principals of participants. The participants were informed about the details of the study, process and reasons for the study, risks and discomforts that are likely to be encountered during the data collection. Benefits of doing the research were explained and that their participation was on voluntary basis. This means that, the participants were free to withdraw from the research any time they want without prejudice to the participant and rejoining the project (Creswell & Poth, 2018). Anonymity of teachers, learners, and the schools were respected and confidentiality guaranteed.

FINDINGS AND DISCUSSIONS

Three themes emerged from the study namely: teaching resources used by science teachers, how science teachers use teaching and learning resources (teaching methods) and challenges faced by science teachers in their use of teaching resources.

Teaching resources mainly used by science teachers

The findings of the study indicate that some science teachers did use print to a limited extent, in the form of textbooks and rarely used hand-outs. This was noted during class observation as the use of print was minimal since the teachers did not direct the learners to open and read their text books. The learners referred to their textbooks without being instructed to do so. The learners were referred to the textbooks when searching for an answer to the teachers' oral questions, which were predominantly lower-order questions.

From this observation, it can be said that the textbooks were underutilized. However, one teacher indicated that teachers value and use the practical activities found in textbooks when she stated that;

> *"Teachers use books as practical manuals since most of them have detailed practical activities, for example, science around us and the UNESWA Chemistry book. The Biology book we use also has some practical in them even though the SISSES (Strengthening In-service for Secondary Science in Swaziland) workbooks are also used at times for the practical".*

The other reason for using mainly textbooks/print instead of digital resources was because they did not want to disadvantage some of the learners as stated by one of the teachers: *"Some learners don't own smartphones, those that have them can't all have enough data to use Internet".* The teacher further

emphasized that, currently for his school, it is better to use print over digital resources since all learners have access to textbooks since there is a book rental system.

On the other hand, other forms of print such as handouts and worksheets were never used by teachers during this study. The need for worksheets was observed in one lesson as it was noted during class observations that teachers used mainly the chalkboard to write important points and also wrote questions on the chalkboard for learners to answer in their note books. Secondly, the science teachers used the chalkboard to write learners' responses and to draw diagrams to make illustrations. However, they also used the chalkboard to write text and diagrams that were in the textbook. This was noted when the teacher made drawings of the electrolytic cell.

Furthermore, another teacher used science equipment to introduce and demonstrate a concept. Noted was that all the participants in this study carried out a teacher demonstration in at least one of the observed lessons. However, there was no lesson in which the learners were provided with an opportunity to manipulate the equipment and chemicals themselves. When asked why they did not give learners practical work, one of the science teachers said; *"There is a shortage of equipment, so we give learners more practical work when preparing them for examinations*". Responding to the same question another said; "*we also do practical work for some topics although its use depends on the availability of resources, but we try to demonstrate so that learners may at least observe*".

Also noted during the observation was that most of the teachers used the science laboratory for teaching, even if there was no practical work or demonstration to be carried out during the lesson. Probably, this was for easy access to resources that may be needed in case there is need to show them to learners. However, the laboratories were not used solely for teaching science. This was noted during an interview when one of the teachers stated that: "*The science laboratory is also used to hold meetings if a request is made by the administration to do so."* This is an indication that some schools do not have adequate rooms which can be used for other activities.

How science teachers use teaching and learning resources

It was noted in the previous section that although textbooks were available to all learners, they were predominantly under-utilised by teachers during the lessons; teachers did not intentionally direct learners to refer to the textbooks. Although the chalkboard was generally used by the teachers to write on, one teacher asked his learners to write answers on the board. This created an interesting interaction as their peers reacted to what had been written on the board, bringing about peer-critiquing and peer-coaching. This made the class more alive as learners appeared more interested in contributing towards what their peers wrote on the board that they were when the teacher was writing.

On the issue of use of science equipment, most of the teachers demonstrated the practical activities to the learners due to inadequate resources and time. The demonstrations were dominated by teacher talk and lower-order questions. The excerpt illustrates: *"For some topics, it is not easy to get perishables that are enough for all the learners to do the practical work themselves, so I resort to demonstrations".* The teacher also stated that:

> *"It is not easy to prepare for a practical activity because I have a lot of other classes I teach. It would have been better if there was a lab technician to help me with preparing for the practical activities for the learners".*

Worth noting was that during the teacher demonstrations, not all the learners could clearly observe what was taking place due to the large class size. This was the case in one of the classes observed. However, the teacher may have split the class into smaller groups, but the challenge would be the time it would take to repeat the demonstration for the groups.

Challenges faced by science teachers in their use of teaching and learning resources

Responding to the challenges faced by science teachers are, one of the science teachers stated that:

> *"The challenges include the large number of learners, not having adequate time to prepare and check if a practical will produce the expected results and time limitations".*

Two challenges emerge from this statement. These are: large class size and time constraints. Another teacher stated that;

> "*No matter how much I may wish to conduct practical activities for a lesson, if not all the equipment is available for the activity, I am not able to let learners do it. The only time the school provides us with funds is when we need to buy materials for practical examinations. As a result, we then add a few other materials we need that are not part of the practical examination".*

This is an indication that inadequacy of the resources was a third challenge that emerged as a constraint to effective use of teaching and learning resources.

On the class size, another one of the teachers expressed how difficult it was to supervise and monitor a large group of learners while they carry out a practical activity. This was noted when he stated that;

> "*Whenever I give learners practical work, the groups become too large. This becomes a challenge for me to effectively support each group and some of the learners do not participate".*

Picking up some issues that have been mentioned prior, which include teachers' under-utilization of textbooks; teacher-centeredness; asking of mainly lower-order questions; and not ensuring that all learners obtain an opportunity to clearly observe processes during teacher demonstrations; the researchers noted that teachers with stronger pedagogical skills might have handled the environment in a more effective way. Hence, an additional challenge brought forth from the class observation was teachers' limited pedagogical skill.

One of the teachers highlighted the need for professional development as he still regarded practical work as a means to reinforce what he had taught through mainly teacher-talk and lower-order questioning that did not promote reasoning in learners. This was evident when the teacher stated that: *"I will teach them first, give them written work/classwork and then they will do practical work later so that they understand what they have learnt".*

This indicates limitations of pedagogical skills since the teachers still used the 'teacher talk', while learners listened to his approach to teaching. Learners' practical work and teacher or learner demonstrations were regarded as a way of confirming what had already been taught. This signified the need to strengthen teachers' professional development. No use of digital resources was observed. This was noted when one head of department responded to the question of digital teaching resources used by the science teachers in the department. She stated that:

> "*Not all departments have WIFI and the science department is one of the departments which does not have its own projector, hence science teachers use mainly textbooks".*

Another teacher stated that they only used digital resources that required data during the time of COVID-19, when the school provided them with data. Since they no longer had access to data and WIFI, they did not use them. When asked about the use of off-line digital tools such as downloaded videos, the teacher stated that data is still required to download the videos that are later used off-line and in addition to that, the equipment for using those tools were not available. For instance, one school had a data projector shared by all the departments but there was no laptop. Effective use of instructional resources mainly depends on availability of the resources and also the teachers' pedagogical skills.

Findings of this study revealed that inadequacy of resources is one of the reasons teachers find it difficult to fruitfully implement socio cultural theory of manipulating the learners' environment in such a way that they can interact meaningfully with both the equipment and with each other. Learners' cognitive abilities would be more activated when they practically carry out the hands-on activities themselves and they would be able to

create their own meaning of the concepts to be learnt than when they watch the teacher carry out the activities on their behalf. In that way, they can have more meaningful discussion about the processes, and effective learning can take place. This claim is in line with that of Amos *et al.* (2022) who argue that exposing learners to instructional resources increases their interest in the subject and promotes critical thinking. Amos *et al.* (2022) also concurs with Umar *et al*. (2019) and further claims that engaging learners with the resources improves their performance.

In addition to the above claim, Amos *et al*. (2022) also purported that teachers' pedagogical skills play a significant role in bringing about effective learning. This argument goes along with the researchers' concern that there might be need to strengthen participants' pedagogical skills to bring about meaningful learning in science in schools.

On another note, all the science teachers seemed to predominantly use the chalkboard, probably because all the science laboratories were installed with chalkboards. They used the chalkboards mainly to write the learners' responses when the teachers asked questions in the beginning of the lesson and also to write down the main points during the lessons. The findings concur with the European project (2013-2016) which noted that the science teachers used the whiteboard mainly to establish learners' pre-knowledge at the beginning of lessons and during lessons to gain feedback on the learners' learning process. The writing on chalkboard and/or whiteboard by science teachers usually occurs during class discussions when there is interaction among the learners and also between the learners and the teacher. The domination of teacher-talk and asking of lower-order questions was not in line with socio cultural theory since the teacher took the centre-stage instead of being a facilitator in the class. The Sociocultural theory supports engagement of learners during lessons as it stipulates that learners should not be passive, but they have to take part in class discussions to enable them to construct knowledge. The role of the teacher is to create scaffolding during his/her facilitation so that learners can easily engage in the discussion and the teacher may include higher-order questions in his/her interaction with learners.

Of concern though is that, the way the resources are also used is guided by factors that do not relate to meaningful learning but is influenced by time, class size. In which case, the use of teaching materials may compromise its purpose of enhancing teaching and learning as alluded by Rocha *et al*. (2023); Staberg *et al*. (2022); Frimpong (2021) and Umar *et al.* (2019). de Winter and Millar (2023) emphasize the importance of practical work for meaningful learning because it allows learners to manipulate and engage during learning. However, the findings indicate that the use of practical work is limited because of large class sizes and time constraints. Shortage of funds is flagged as another reason. This finding concurs that there are problems of low stock level for the number of learners in many classes (Swaziland Government, 2012). Hence, the science teachers tend to do demonstrations instead of letting student do practical work. Not exposing the learners to practical work deprives them of developing their manipulative skills, limits interaction and performance.

The sociocultural theory promotes interactive activities to enhance understanding and promote cognitive growth. This can be achieved through productive discussions, constructive feedback, and collaboration among learners themselves and also with their teacher. Hence, teachers are encouraged to promote collaborative learning, interactive discussions to achieve meaningful learning. The role of the teacher being to facilitate learning. Dlamini-Nxumalo and Gaigher (2019) noted that using digital resources, computer simulations enhance understanding of abstract science concepts. In the same view, Kapici and Costu (2023) also concur with Dlamini-Nxumalo and Gaigher when they highlighted the importance of resources for science teaching and learning, emphasizing that digital resources are much preferable over physical resources. Of concern is that the findings show that digital resources are hardly used because of unavailability of WIFI and shortage of relevant tools such as projectors in schools.

This concern concurs with that many secondary schools in Eswatini have science laboratories and ICT laboratories, though availability of equipment and internet connection are limited (Swaziland Government, 2012). This limits learners' interrogation with content especially because learners of this generation are more comfortable manipulating digital resources (Prensky, 2017). Of note also is the concern raised in the findings that an appreciable number of the learners do not have access to personal digital gadgets they may use privately, and that their domestic socioeconomic status is not strong enough for them to access internet connectivity. Nevertheless, Prensky notes that digital resources increase learners' motivation and engagement in the subject.

CONCLUSION

This study concluded that resources are inadequate in some schools, particularly perishables. This results in over-reliance on teacher demonstrations instead of providing learners with opportunities to carry out hands-on practical activities. It also revealed that there is under-utilisation of print resources and excessive use of chalkboard even where worksheets may be used. Nevertheless, there was acknowledgement of practical activities in some of the textbooks used. Large classes, including teachers' workload also deprive learners an exposure to learning resources. Despite having been exposed to the use of digital resources during the advent of COVID-19, it seems that some schools have ceased using digital tools to teach Chemistry. Over-arching all the findings, was noting that implementation of appropriate pedagogical skills may have enhanced effective learning through strengthening learner interaction with instructional resources and with their peers.

Following the findings of this study, it is recommended that science teachers should be provided with adequate instructional resources of all forms (including digital ones) and that professional development of teachers should be strengthened to sharpen their skills on improved pedagogical skills. Worth considering is brainstorming on possible approaches to address the unfavorable science teacher-to-learners ratio in order to enhance effective learning. The teaching loads for science teachers should be minimized considering that

teachers need to plan and prepare learners' practical work since there are no laboratory technicians in schools.

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