https://doi.org/10.34142/2709-7986.2026.31.1.08

TEACHERS' COMPETENCE IN USING DIGITAL VISUALISATION LEARNING MATERIALS FOR TEACHING READING COMPREHENSION IN PRIMARY SCHOOLS: CASE OF MOROGORO MUNICIPALITY COUNCIL, TANZANIA

КОМПЕТЕНТНІСТЬ ВЧИТЕЛІВ У ВИКОРИСТАННІ МАТЕРІАЛІВ ЦИФРОВОЇ ВІЗУАЛІЗАЦІЇ ДЛЯ НАВЧАННЯ РОЗУМІННЯ ПРОЧИТАНОГО У ПОЧАТКОВИХ ШКОЛАХ: ПРИКЛАД МУНІЦИПАЛЬНОЇ РАДИ МОРОГОРО, ТАНЗАНІЯ

Received: February 16, 2026 **Accepted:** March 23, 2026 **Published**: April 15, 2026

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How to Cite this Article (APA Style):
Kavishe, A., Matalu, K., & Mwakasege, A. (2026). Teachers' competence in using digital visualisation learning materials for teaching reading comprehension in primary schools: Case of Morogoro Municipality Council, Tanzania. *Educational Challenges, 31*(1), 108–120. https://doi.org/10.34142/2709-7986.2026.31.1.08

ABSTRACT

Purpose. *This study focused on assessing teachers' pedagogical competence in using Digital Visualisation Learning (DVL) materials during Reading Comprehension instruction in primary schools. Specifically, the study seeks information on teachers' knowledge and skills in integrating DVL materials into English language reading comprehension instruction in primary schools. The study also examines factors affecting the use of digital visualisation in classroom situations.*

Methodology*. Anchored in the European Digital Competence Education Model, the study employed survey questionnaires, observations, and interviews as primary methods of data collection from respondents. The study adopted a mixed-methods approach within a case study research design, focusing on ten selected schools in Morogoro Municipality, Tanzania. One hundred and ten respondents were involved, including ten (10) primary school head teachers and one hundred (100) primary school English language teachers. Regression coefficients were used to analyse quantitative data, while qualitative data was analysed thematically.*

Results*. The findings show that teachers had low competence in using DVL materials in teaching reading comprehension in primary schools. The low competence is caused by a negative attitude, and low self-efficacy, limited access to technological resources, inadequate professional training and a lack of institutional and government support. The lack of teachers' competence indicates that in-service training is essential on bringing teachers' competence to improve teachers' competence in using digital visualisation in classrooms.*

Conclusion. *The study concludes that the availability of proper digital teaching and learning resources and teachers' positive attitude, should be prioritised to influence teachers' knowledge and skills on using DVL materials in primary schools teaching and learning. It is recommended in this study*

Мета*. Це дослідження зосереджено на оцінці педагогічної компетентності вчителів у використанні матеріалів цифрової візуалізації (DVL) під час навчання розуміння прочитаного у початкових школах. Зокрема, дослідження спрямоване на пошук інформації про знання та навички вчителів щодо інтеграції матеріалів цифрової візуалізації при навчанні розуміння прочитаного англійською мовою у початкових школах. У дослідженні також розглядаються фактори, що впливають на використання цифрової візуалізації в ситуаціях в класі.*

Методологія*. Спираючись на Європейську модель освіти з цифрової компетентності, дослідження використовувало анкети, спостереження та інтерв'ю як основні методи збору даних від респондентів. У дослідженні було використано змішаний метод у межах дизайну тематичного дослідження, зосередившись на десяти обраних школах муніципалітету Морогоро, Танзанія. У дослідженні взяли участь сто десять респондентів, включаючи десять (10) директорів початкових шкіл та сто (100) вчителів англійської мови початкових шкіл. Коефіцієнти регресії використовувалися для аналізу кількісних даних, тоді як якісні дані аналізувалися за допомогою тематичного аналізу.*

Результати. *Результати дослідження свідчать, що вчителі мають низький рівень компетентності у використанні матеріалів цифрової візуалізації (DVL) під час навчання розуміння прочитаного в початковій школі. Це зумовлено негативним ставленням, низькою самооцінкою ефективності, обмеженим доступом до технологічних ресурсів, недостатньою професійною підготовкою та браком інституційної й державної підтримки. Отримані дані підтверджують необхідність підвищення кваліфікації вчителів для ефективного використання цифрової візуалізації в освітньому процесі.*

Висновок*. Дослідження дійшло висновку, що наявність належних цифрових навчальних ресурсів та позитивне ставлення вчителів мають бути пріоритетними для впливу на знання та навички вчителів щодо використання матеріалів цифрової візуалізації у викладанні в початкових школах. У цьому*

that the government and private sectors should invest in education and provide financial support for teachers' trainings about the use of digital tools in their everyday teaching and learning for global competitiveness. This study will further develop an intervention for upgrading teachers on how to integrate DVL materials in teaching English language subjects in Tanzania.

Keywords: *digital literacy, ICT integration, multimedia tools, pedagogical skills, professional development, teacher training.*

дослідженні рекомендується, щоб уряд та приватні сектори інвестували в освіту та надавали фінансову підтримку для навчання вчителів використанню цифрових інструментів у їхньому повсякденному викладанні для глобальної конкурентоспроможності. Це дослідження буде подальшою розробкою покращення підвищення кваліфікації вчителів щодо інтеграції матеріалів цифрової візуалізації у викладання англійської мови в Танзанії.

Ключові слова: *цифрова грамотність, інтеграція інформаційно-комунікаційних технологій, мультимедійні інструменти, педагогічні навички, професійний розвиток, підготовка вчителів.*

INTRODUCTION

Integrating Digital Visualisation Lesson (DVL) materials is not only used in education matters but also as a pedagogical tool in the teaching and learning process (Kumar et al. 2022). The National Educational Curriculum and various studies have insisted on integrating DVL materials, such as facilitating the availability of teaching and learning materials, and simplifying the lesson. The major challenge is teachers' competence to integrate DVL during the teaching and learning process (United Republic of Tanzania, 2019).

The integration of Digital Visualisation Lesson (DVL) materials extends beyond general educational purposes and serves as an essential pedagogical tool in the teaching and learning process (Kumar et al., 2022). The National Education Curriculum, alongside various scholarly studies, emphasises the incorporation of DVL materials to enhance the availability of instructional resources and to simplify lesson delivery. However, a major challenge lies in teachers' competence to effectively integrate DVL materials into classroom instruction (United Republic of Tanzania, 2019).

The use of DVL materials has been world widely emphasized because the material supports both teachers and students during teaching and learning of reading comprehension in the English language subject in primary schools (Fidelis et al., 2021). For example, a study conducted by Draper (2010) found that using DVL materials influences teachers in the teaching process and increases students' active participation in teaching and learning reading comprehension.

Another study conducted by the United Nations Organisation for Educational, Scientific, and Culture (2018) also reported that DVL materials support help teachers' preparation, knowledge, and skills while using in the teaching process. Furthermore, a study conducted by Kumar et al. (2022) shows that DVL materials improve teachers' knowledge, skills, and motivate them to use while teaching reading comprehension in primary schools. The evidence from literature insists that DVL materials are essential tools for enhancing reading comprehension in primary school level.

Moreover, teachers' competence is also insisted in reading comprehension instructions in the teaching and learning process. For example, a study conducted by Timotheou et al. (2023) reported that teachers have low competence in using technological tools in teaching and learning. Also, a study conducted by Many-Ikan et al. (2011) found that teachers have low competence in using the whiteboard in teaching and learning.

In Tanzanian context, the situation is almost similar to other countries as reported by various researchers. For example, a study conducted by Kalinga and Ndibalema (2023)

found that a lack of training on how to use technology affects teachers' competence in using technology in the teaching and learning process. This implies that lack of training and low experience in using technology are among the factors that affect teachers' competence in using DVL materials in the process of teaching reading comprehension in primary schools.

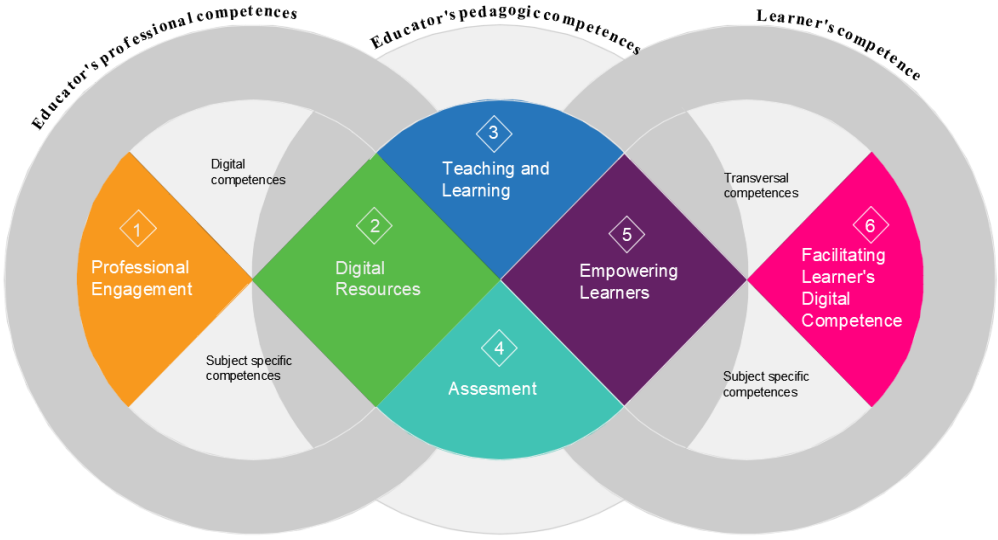
Initiatives have been taken in various countries. For example, a study conducted in China by Zhang, Liu & Zhou (2014) reported that competence standards for teachers were used to evaluate and measure the development of teachers' ICT competence. UNESCO (2018) established a digital competence standard for teachers on how to integrate digital tools in the class. Likewise, the United Republic of Tanzania (2019) reported that teachers need to be trained on the knowledge and skills of the currently occurring technological transformation in teaching and learning. This shows that there is a high demand of teachers training on integrating technology in classroom situations. This was also supported by the findings of Ndibalema (2022), who found that teachers have low competence in using technologies due to the lack of training.

Research also shows that there is a high demand for digital materials in the learning process. For example, a study conducted in Zanzibar by Hamad et al. (2023) found that teachers have low competence in integrating digital lesson contents due to a lack of appropriate digital materials in teaching descriptive writing in ordinary secondary schools. Thus, this study focused on assessing teachers' competence and factors affecting them in using DVL materials in teaching reading comprehension in Morogoro Municipality primary schools. It is expected that this study will contribute to teachers' awareness and readiness in using DVL materials in teaching and learning reading comprehension in primary schools.

The European Digital Competence Education Model identified by UNESCO, 2018 was employed in this study, whose main tenets focus on determining the role of educators in distinguishing the six areas in which 22 digital competences are expressed, Figure 1.

Figure 1

The European Digital Competence Education Model identified by UNESCO.



The Competences include professional engagement, digital resources, pedagogy (teaching and learning), curriculum and assessment, empowering learning, and facilitating learners' competence. The areas 2-4 focus on pedagogical competence for educators. In this study, the primary school teachers were considered educators who

were tested against prepared tools for measuring teachers' awareness and competence in using DVL materials.

This model has been selected to guide this study because it insists issues to be determined on assessing standard of teachers' pedagogical competence when using DVL materials in teaching and learning. In this study primary school teachers acted as educators; therefore, the researchers prepared a tool for measuring teachers' pedagogical competence on using DVL materials in teaching reading comprehension in primary schools.

Through this model researchers related it to this study as follow: First, model was helpful to measure teachers' digital competency (on organising) DVL materials in teaching reading comprehension. Second, this model is used to determine teachers' pedagogical competence (strategies and styles) in teaching and learning reading comprehension. Third, this model is used to measure teachers' ability on assessing (quiz, test and homework's) related to reading comprehension via digital way. Forth, this model was used to examine primary school teachers' ability on searching digital materials related to reading comprehension in online process. However, application of European Digital Competence Education Model in third world countries like Tanzania had challenges due to lack of funds on training teachers to integrate it in teaching and learning process.

Purpose. This study focused on assessing teachers' pedagogical competence in using Digital Visualisation Learning (DVL) materials during Reading Comprehension instruction in primary schools. Specifically, the study seeks information on teachers' knowledge and skills in integrating DVL materials into English language reading comprehension instruction in primary schools. The study also examines factors affecting the use of digital visualisation in classroom situations.

METHODOLOGY

The study employed a mixed-methods research approach to assess teachers' pedagogical competence in using DVL materials in teaching reading comprehension in primary schools. This approach was used to obtain both numerical and narrative data from respondents because the mixture adds value and authenticity to the information collected from respondents. A case study research design was used to get in-depth information from the respondents (Creswell & Creswell, 2018). The sample involved one hundred and ten (110) respondents from ten primary schools, which was obtained through a simple random sampling procedure to get one hundred teachers (ten from each selected school).

The purposive sampling procedure was used to select ten (10) schools from which ten head teachers were obtained. The study used an interview and a survey method to collect data from respondents. The interview was used to obtain in-depth information from the participants. Specifically, face-to-face interview was used for personal interaction, allowing for a comprehensive exploration of the research topic and the collection of rich qualitative data. The time range for each interview session was 45 to 60 minutes.

During the interview, the researcher recorded the information in the notebook, and the audio information was recorded in the digital tape recorder using an Android smartphone. The interview helps the interviewer and respondents to take part in formalised dialogues and allows the interviewer to shadow the interview guide correctly, and also digress if needed. The interview was managed using the interview guide. Furthermore, the interview guide was prepared in English and conducted in English language.

The survey method was used to seek perceptions, feeling and ideas from respondents about integrating DVL materials in teaching reading comprehension in primary schools. To ensure validity and of the data reduce bias, this study employed two research methods for data collection that provided sufficient information bias. Reliability was obtained through conducting a pilot study of the instruments, establishing a relation with research participants, and providing clarification on the completed research instruments (questionnaires). The test-rest technique of the research instruments was used to test the relevance and trustworthiness of the instruments. The reliability analysis using Cronbach's Alpha Coefficient was used to assess the reliability of questionnaire items before conducting further analysis (Cohen, et al, 2011).

The data obtained through interview was analysed in a thematic way by considering themes and sub-themes through six steps proposed by Braun and Clarke (2012). The first step involved familiarization with data, transcribing the data, translating, and reading, and re-reading data. The second step was establishing initial codes. The third step required assembling relevant codes into the themes in which they belong. The fourth stage was revising the theme and sub-themes, which also involved the modification of themes. The fifth step was naming and defining themes.

Lastly, the sixth step was writing up the report. Before going to the field for data collection, the researcher obtained ethical research clearance letters from various authorities such as the University of Dodoma through the post-graduate office of the Vice Chancellor, specifically the directorate of research, publication, and consultancy. Research clearance letters was also obtained from the Morogoro Regional Administrative Secretary (RAS) and the District Executive Director (DED) from Morogoro municipality.

RESULTS

In the contemporary primary education landscape, digital visualisation learning (DVL) materials such as interactive images, animated graphics, videos, infographics, and multimedia texts hold considerable promise for strengthening reading comprehension among young learners by rendering abstract textual content more concrete, supporting vocabulary development, enabling mental imagery, facilitating inferences, and boosting active engagement in diverse classroom environments.

This study investigates teachers' competence in using digital visualisation learning materials for teaching reading comprehension in primary schools within Morogoro Municipality Council, with the primary finding being teachers' low competence in integrating these materials, driven by contributing factors including negative attitudes and low self-efficacy toward technology, limited access to technological resources, inadequate professional training, and lack of institutional and government support; emphasizing the critical requirement for focused interventions in teacher capacity development, infrastructure provision, and ongoing support to enable effective DVL utilization and foster enhanced reading outcomes alongside educational equity.

Teachers' Low Competence in Integrating the DVL Materials in Teaching Reading Comprehension in Primary Schools

This section presents the results of the assessment of teachers' pedagogical competence on using the Play Cast digital visualisation tool in enhancing reading comprehension, with particular emphasis on professional engagement, teaching and learning, and digital skills. Regression coefficients analysis was used to determine the extent to which each predictor variable, such as professional engagement, teaching and learning, and digital skills**.** Specifically, it allowed us to quantify how changes in each

predictor are associated with changes in the predicted pedagogical competence score (B values) and to assess the statistical significance of these relationships (p-values). Table 1 illustrates the findings.

Table 1

Regression Coefficients of teachers' pedagogical competence on using DVL materials in teaching primary schools

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
1 (Constant)	1.783	.240		7.426	.000
Pedagogical competence	.041	.040	.105	1.031	.305
Professional engagement	-.247	.037	-.711	-6.651	.000
Teaching and learning	.054	.033	.140	1.621	.108
Digital skills	-.009	.041	-.019	-.220	.826

Note. Dependent Variable: Teacher's competence using digital visualisation tool.

With reference to the SPSS outputs presented in Table 1 above, the multiple regression equation ($Y = \beta0 + \beta1X1 + \beta2X2 + \beta3X3 + \beta4X4 + \epsilon$) became: X1-Pedagogical competence, X2-Professional engagement, X3-Teaching and learning, and X4-Digital skills

$Y = 1.783 + 0.041X1 + -0.247X2 + 0.054X3 + -0.009X4 + 0.240$

The findings from the regression equation indicate that teachers' pedagogical competence using DVL material was predicted to be 1.783 when all predictor variables (Pedagogical Competence, Professional Engagement, Teaching and Learning, and Digital Skills) were zero. The analysis revealed that Professional Engagement ($\beta = -0.247$, $p < 0.001$) was the only significant predictor, showing a negative relationship. This means that an increase in Professional Engagement was associated with a decrease in teachers' competence in digital visualization in this dataset.

Pedagogical Competence ($\beta = 0.041$, $p = 0.305$), Teaching and Learning ($\beta = 0.054$, $p = 0.108$), and Digital Skills ($\beta = -0.009$, $p = 0.826$) did not have statistically significant effects, suggesting they do not meaningfully predict teachers' competence in this model. Generally, the results indicate that competence in digital visualization is primarily influenced by factors other than general pedagogical skills, teaching practices, or digital skills; and the negative effect of Professional Engagement highlights the need to explore potential underlying causes, such as workload, focus on non-digital tasks, or insufficient training.

Furthermore, during the interview, the informants identified four major sub-themes, namely negative attitude and low self-efficacy, limited access to technological resources, inadequate training and professional development, as well as a lack of institutional and government support.

Negative Attitude and Low Self-efficacy

It was found from interviews that on the one hand, some teachers have a negative attitude towards using DVL materials during teaching because they lack awareness about using digital technological tools in teaching and learning. One head teacher said:

> *In my side, using technology in primary school level is a challenge because many teachers do not use technology. I think using DVL materials for us is still a challenge. Last, I can say that using DVL is not a good method in primary schools* (Head teacher, School A, Interview, January 2026).

The statement above shows that a negative attitude is among the factors that affect teachers' competence in integrating the DVL materials in the classroom situation. However, the findings of this study specifically revealed that negative attitude is a barrier to teachers' competence on using DVL materials in teaching reading comprehension in primary schools.

On the other hand, other teachers showed positive attitude in using DVL materials in teaching reading comprehension in primary schools. Head teacher form school C explained:

> *I think, using technological tools in teaching and learning increases participation and interaction between teachers and students. But we lack confidence and experience to integrate it in the classroom* (Head teacher, School B, Interview, January 2026)

The above quote shows that using technological tools is important to enhance teaching and learning.

Limited access to technological resources

In the second sub-theme, it was found that limited access to technological resources was among the factors that affect teachers' competence in using digital technological tools in teaching and learning. One head teacher from school D said:

> *In fact, in our school, we have two projectors and three computers. Some teachers like to integrate technology, but technological infrastructure remains a major barrier in enhancing teachers' pedagogical competence in primary schools* (Head teacher, School B, Interview, January 2026).

The statement above reveals that limited accessibility of technological tools affects teachers on using technology in teaching primary schools.

Inadequate professional Training

During the interviews, the informants explained that the lack of sufficient training on how to use technological tools affects teachers' competence in using DVL materials for teaching and learning. One head teacher from school F claimed:

> *On my side, I have attended one seminar about ICT, but I have a low ability to integrate during teaching and learning. Also, there are a few teachers who attended training and seminars about the integration of ICT in the classroom situation* (Head teacher, School C, Interview, January 2026)

The quotation above reveals that, without sustainable professional development (PD), teachers cannot integrate technology into the classroom.

Lack of Institutional and Government Support

During the interviews, the informants said that some primary schools lack government support and therefore they lack resources and training about digital technology. One head teacher commented:

> *Mmmh... we receive a few funds that are used to identify ICT tools in our school. Also, some NGOs such as VODACOM and YAS gave computers and printers, but*

> *they did not arrange any seminar about how to integrate ICT in teaching and learning* (Head teacher, School D, Interview, January 2026)

The quotation above shows that the lack of support from the government and private sectors on the use of technological tools in primary schools is a barrier that hinders teachers' knowledge and confidence to use technology in the teaching and learning process.

DISCUSSION

The findings from first sub-theme about negative attitude and low self-efficacy. The findings of this study concur with the study conducted by Joseph (2021) that teachers' negative attitude affects using ICT during the teaching and learning process. Also, results relate to study conducted in Indonesia by Katemba (2020) found that teachers have negative perception implementing technologies in language teaching and learning. Furthermore, the study conducted by Tiwari et al. (2022) provided similar results that teachers' attitude is essential for influencing them to use technological tools in teaching and learning.

However, findings of this study relate to the findings of the study conducted in Namibia by Shilongo (2023), which revealed that the lack of technological resources is among the factors that affect teachers' competence in using digital technology in teaching and learning. Moreover, the findings of the study conducted by Mushimiyimana et al. (2025) showed various factors that affect the use of the ICT in education, such as a lack of resources and low competence in using it. The findings show that the lack of technological resources, such as projectors and computer affect teachers' competence because they lack confidence in using them in their daily teaching activities. This implies that lack of technological resources affects teachers' competence to integrate DVL materials in primary schools (Kwambaza, 2024) while teaching reading comprehension.

Moreover, findings from second sub-theme about limited access to technological resources. This study relates to the study conducted by Masterson (2020), which reported that ICT facilitates teaching and learning, and makes the lesson easily understood. Furthermore, the study conducted by Kasuga (2016) provides similar findings that using ICT influences a learner-centered approach, motivates learners and increases active participation during the lesson presentation. Similarly, study conducted by Huang, Helgevold, and Lang (2021) stressed digital technologies, online learning and lesson study.

Also, study conducted by Ghomi and Redecker (2019) which insisted development and evaluation of a self-assessment instrument for teachers' digital competence. The focus was to show way how teachers needed to be competence on assessing students through digital manner. It was further revealed in this study that a few teachers who used DVL materials in their lessons were well understood and their lessons were enjoyable to the students. This implies that the positive attitude of teachers towards the use of DVL materials is essential to make them interested in engaging them during teaching and learning reading comprehension in primary schools.

Furthermore, findings from third sub-theme about inadequate professional training. The study concurs with Tanzania's National Framework for Teachers Continuous Professional Development (TCPD), which insists that teachers update their competence in order to cope with the global changes (United Republic of Tanzania, 2020). Also, results were related to the study conducted by Fallon (2020) who insisted digital literacy to digital competence for teachers. The study focused teachers framework on how to use digital tools in teaching and learning. Similar results were obtained in the study conducted by

Valverde-Berrocoso et al. (2021), which revealed that some teachers have low competence in using technology in teaching and learning.

Moreover, the study supports the ICT competence standard for teachers. The purpose is to insist on how teachers integrate technological tools in their daily teaching (United Republic of Tanzania..., 2015). However, the findings of this study go further show that the lack of professional development about technology affects their ability to integrate in teaching and learning reading comprehension in primary schools. This indicates that the lack of PD on integrating DVL materials is a barrier for primary school teachers. This is because teachers lack special or professional training on to use digital tools in teaching and learning reading comprehension.

In addition to that, finding of forth sub-theme about lack of institutional and government support. The findings of this study support the National curriculum framework for basic teachers in Tanzania, which insist teachers (Omollo et al., 2024) be competent in using technological tools in their teaching and learning process (United Republic of Tanzania, 2019). However, this study found that the policy of ICT was identified using digital technological tools in teaching and learning, but it is theoretically rather than actual practice.

In the similar vein, study conducted by Ilomäki and Lakkala (2018) insisted digital technology and practices for school improvement, the study also developed innovative digital school model. Moreover, study by Manyengo (2021) who insisted digitalization in teaching and education in the United Republic of Tanzania. Therefore, the study concludes that the availability of policy together with its actual implementation is essential for enhancing teachers' competence and confidence to use DVL materials in teaching and learning reading comprehension in primary schools.

CONCLUSIONS

The study concludes that in-service training about teachers' competence is essential for improving their competence in using DVL materials in the classroom. The study further concludes that the availability of proper digital teaching and learning resources, together with teachers' positive attitude, is important to influence teachers' knowledge and skills on the use of DVL materials in the primary schools' teaching and learning process.

It is recommended in this study that the government and private sectors should invest in education and provide financial support for teachers' training to use digital tools in their everyday teaching and learning for competitiveness in the global market economy. The study also recommends that further studies should be conducted focusing on the interventions to upgrade teachers on how to integrate DVL materials in teaching English language subject in Tanzania.

ACKNOWLEDGEMENTS

This paper draws partly on data collected as part of ongoing PhD studies in 2025. The author gratefully acknowledges the District Executive Director (DED) of Morogoro Municipal Council for granting permission and facilitating access to conduct the study in the selected primary schools. Special thanks are extended to all teachers, school administrators, and pupils who volunteered as participants and contributed their time and insights to the research.

No additional contributors provided technical assistance, writing support, or other material help that requires specific acknowledgment beyond general participation. There was no external financial or material support received for this study.

CONFLICT OF INTERESTS

The authors declare that there are no conflicts of interest related to the publication of this paper.

FUNDING

The authors declare that no specific financial support was received for the conduct or publication of this study.

ARTIFICIAL INTELLIGENCE STATEMENT

No artificial intelligence tools were used in the preparation of this manuscript.

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