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Teacher Pedagogical Beliefs and Resistance to the Effective Implementation of Video-Based Multimedia in the Physics Classroom

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Abstract. This research aimed at investigating the influence of teachers' beliefs and the reasons behind their resistance to the effective integration of video-based multimedia (VBM) in physics classrooms. An explanatory research design following a pragmatic worldview was used in this study to investigate teachers' pedagogical beliefs and to examine the causes of their resistance to integrating VBM in the physics classroom. A purposive sampling method was used to select 47 physics teachers. Participants in this study were aged between 26 and 56 years old with an average teaching experience of 8.1 years. A questionnaire (Cronbach alpha = 0.85) was distributed to participants, followed by one-to-one interviews with randomly selected senior five physics teachers. Participants witnessed the effectiveness of using VBM in teaching physics. However, they still resisted incorporating it into teaching. Results revealed that the link between teachers' beliefs and their resistance to incorporating VBM in the teaching and learning of physics is quite strong. An investigation of how to address the factors that impede the effective incorporation of VBM in teaching and learning is highly recommended.

Keywords: physics education; teacher beliefs; teacher resistance; video-based multimedia

1. Introduction

Modern education is aimed at preparing competent and competitive citizens (Lewin, 2015). In the 21st century, it seems that information and communication technology (ICT) is an asset to be used to achieve this objective in a world that increasingly demands technological skills (Berrett et al., 2012). Integration of ICT in education refers to the incorporation of digital technological equipment that can serve as educational tools, such as computers, digital video cameras, projectors, CD-ROM drives, DVD players, software, etc. (Borko et al., 2008; Inan & Lowther, 2010; Kay, 2012). Integration of ICT in education means the harmonious cohesion between ICT and pedagogical teaching methodology to improve the relevance and quality of education (Tondeur et al., 2016). In this regard, many African countries have responded positively to the incorporation of ICT in teaching (Mukhwana et al., 2020). The increase of ICT tools in schools has allowed the spread of ICT multimedia into many schools, in that way increasing video-based multimedia (VBM) use in the classroom (Kettle, 2020).

In the Rwandan context, researchers have witnessed the usefulness of VBM in teaching sciences such as physics (Ndihokubwayo et al., 2020). In addition, the issue of inaccessibility to ICT tools in Rwandan secondary schools has been alleviated because the Government of Rwanda initiated a project to distribute more than 100 laptops per school countrywide (Rwanda. Ministry of Education [MINEDUC], 2016). Similarly, the new curriculum for secondary schools in Rwanda advocates for the use of technology in science education which can be concretized by the utilization of animations and simulations (Rwanda Education Board [REB], 2015). Moreover, the effect of the Covid-19 pandemic has stressed the need for integrating multimedia such as VBM in education.

In December 2019, the first case of Covid-19 was signaled in China, later escalating rapidly all over the world and resulting in a pandemic (World Health Organization [WHO], 2020). Many countries set procedures in place to fight against the spread of Covid-19 (UNESCO, 2020; WHO, 2021). Measures to control Covid-19 transmission resulted in school closure in many countries worldwide (Mugiraneza, 2021). The decision to close schools affected students in more than 186 countries worldwide (UNICEF, 2020). After schools reopened, great measures for remedial education systems were necessary. For instance, in Rwanda, education policymakers launched the Education Covid-19 Response Plan (Mugiraneza, 2021; Rwanda. MINEDUC, 2020). The objectives of the plan included, among other objectives, developing the use of ICT and enhancing the way multimedia is used in education (Mugiraneza, 2021; Rwanda. MINEDUC, 2020). Other priorities emphasized by the plan are virtual learning, the use of multimedia and digital tools, teacher training, and online assessment approaches (Mugiraneza, 2021; Rwanda. MINEDUC, 2020).

Conversely, teachers still resist integrating technology-related methodology in science education, and in certain schools, usage of multimedia for pedagogical teaching in physics classrooms is poor or even nonexistent (Rwanda. MINEDUC, 2020). This provides evidence for the need to examine physics teachers' pedagogical beliefs about teaching and learning using multimedia and to investigate the reasons behind their resistance to incorporating it into teaching. Consequently, this research sought to investigate issues related to the effective integration of VBM through the lens of teachers as the agents of change in the education setting and the reasons for teachers' resistance to incorporating VBM in teaching and learning.

2. Literature Review

In order to synthesize the literature within the field of VBM in education with a focus on teachers' pedagogical beliefs, we grouped our literature into three main parts. We first discuss the literature that explores VBM and subsequently the literature that looks at teachers' educational beliefs about teaching using VBM and their resistance towards integration of VBM, respectively.

2.1 Video-Based Multimedia in Teaching and Learning Science

Technology has become one of the fundamental elements of modern society. Many countries consider the integration of ICT in science education to enhance education and research (Berrett et al., 2012). The effective utilization of ICT in science education is no longer limited to administration issues only but also to teaching and learning (Becta, 2004). Researchers have reported that in teaching and learning science using ICTs, ICT-based multimedia is the effective methodology (Kay, 2012). Ndihokubwayo et al. (2020) reported that among the ICT-based multimedia, videos are effective and cheaper in teaching sciences such as physics which require laboratory observation. Video refers to moving pictures accompanied by sound and digital videos, providing a lot of information in a short period of time and showing real-life objects (Hu, 2016). In science education, videos are used to support verbal explanations of concepts to engage students in knowledge construction and meaningful learning (Kay, 2012).

The use of VBM in science education has been found to hold several advantages. These include solutions to mechanical work of rewriting, modern and innovative teaching methods, saving time, student motivation, class management, and raising academic achievement and retention (Antoiniette & Giorgetti, 2006; Kay, 2012; Kettle, 2020). Moreover, researchers have reported the effectiveness of VBM in science, technology, engineering, and mathematics (STEM) education (Kunnath & Kriet, 2018).

2.2 Teachers' Pedagogical Beliefs about Video-Based Multimedia in Science Education

The Stanford Encyclopedia of Philosophy (2019) defined *belief* as psychological understanding, attitude that something is the case, or that some proposition about the world is true. Pedagogical belief refers to the understanding, shreds of evidence, or schemes about teaching that teachers believe are supposed to be real. Teachers' educational beliefs act like a filter through which new information is screened for relevance and meaning (Ertmer, 2005). Teachers' beliefs have been categorized into two main groups: teacher-centered and learner-centered beliefs (Deng et al., 2014). Teachers may, however, have and adhere to both teacher- and learner-centered pedagogical beliefs (Lim & Chan, 2007; Tondeur et al., 2016).

In the teacher-centered view, the teacher acts as a specialist, managing the teaching-learning activities and serving as an educational expert. Conversely, in the learner-centered view, the teacher works as a guide, with learners cooperating and getting involved with knowledge construction (Davidson & Major, 2014; Deng et al., 2014). The learner-centered belief stems from the theory of constructivism, where learners actively get involved with knowledge construction and the teacher acts as facilitator (Teo et al., 2008). Researchers have revealed that to ensure that learners better navigate the global environment in which they now live and must work in tomorrow, the learner-centered method is the effective approach (Antoiniette & Giorgetti, 2006). Moreover, studies have revealed that to better prepare the 21st century learners, who are digital natives, incorporating technology in education could be an effective answer (Becta, 2004).

Teaching and learning using VBM have been suggested as an active and learner-centered methodology where students can choose words and images, bring them together into the logical verbal and visual model, and integrate them into whole conceptual structures (Borko et al., 2008; Mayer, 2005). Such methodology can positively reshape teaching practices, create and maintain a positive teaching and learning climate, and improve students' learning when suitable measures are taken into account (Kunnath & Kriet, 2018).

2.3 Teachers' Resistance to Integrating Video-Based Multimedia in Teaching

Teachers as agents of change in education play a crucial role in their educational choices concerning when and how to integrate a new approach such as VBM within their classroom activities (Kim et al., 2013). Previous studies have revealed that incorporating a new approach such as VBM into teaching and learning requires changes and that teachers manage changes in different ways (Tondeur et al., 2016). Howard and Mozejko (2015) explained that resistance to change is the foremost factor in the successful incorporation of ICT in teaching. Understanding how ICT-based technology will enhance teaching was reported as the major factor behind teachers' resistance to integrating ICT in education (Oriji, 2016). Tondeur et al. (2016) revealed that teachers' willingness and attitude to change is a significant factor to consider when introducing ICT-based methodology in education. Teachers' classroom activities depend on their pedagogical beliefs about the effectiveness of the teaching strategies (Tondeur et al., 2016), while some studies have suggested that multimedia can be completely agreed upon as a successful teaching strategy concerning teachers' pedagogical beliefs (Lajoie, 2014; Ndihokubwayo et al., 2020; Odcházelová, 2015; Sarowardy & Halder, 2019).

3. Research Problem

Teachers' pedagogical beliefs and their resistance have been recognized as issues that could have a direct or indirect influence on their ability to teach a given subject (Mukuka et al., 2019) and to explore the pedagogical benefits that multimedia is likely to bring to science education (Loper et al., 2019). The present research recognizes the gaps in recent studies that have concentrated on the effectiveness of and barriers to multimedia integration in education or teachers' beliefs about multimedia integration in science education. Nevertheless, limited studies have looked at the correlation between teachers' educational beliefs about learning using multimedia and their resistance to incorporating multimedia in the teaching and learning of physics. Therefore, this research seeks to investigate the link between physics teachers' pedagogical beliefs about using VBM in teaching and the reasons behind their resistance to integrating VBM in the physics classroom. We focus on teachers' beliefs in terms of their understanding of how VBM will enhance their teaching practices and motivate student learning. Hence, based on the research problem highlighted above, this research seeks to answer the following research questions:

- Research question 1: What are the prevailing teaching practices in selected schools' physics classrooms?
- Research question 2: What are teachers' views about the effectiveness of VBM in enhancing the teaching and learning of physics?
- Research question 3: What are teachers' views about the difficulties associated with VBM implementation in physics?

4. Methodology

This section gives an account of the procedures that were employed in addressing the stated research questions. The target population, data analysis techniques, and ethical issues are also highlighted in this section.

4.1 Research Design

An explanatory research design was employed in this research. The research followed a pragmatic worldview (Creswell, 2014). Sequential mixed methods research combining both qualitative and quantitative approaches was used to develop a better understanding of the research problem and to offer concrete solutions for the research problem.

4.2 Sampling and Research Participants

We purposively selected 24 public secondary schools that have smart classrooms (also called computer laboratories) and physics as major subject taught in those schools. The schools were from the Rutsiro (rural) and Rubavu (urban) districts of the Western province in Rwanda. All physics teachers at the selected schools were invited to participate in the study. Forty-seven (35 male and 12 female) of these teachers agreed to participate in the research.

4.3 Research Instruments and Validation Procedures

A questionnaire, interviews, and classroom observation were used to collect data. The questionnaire was developed based on preceding studies on personal educational beliefs, opportunities, challenges, and benefits of using VBM in classrooms. The questionnaire was subjected to a pilot study to check its reliability before distributing it. SPSS Version 21 was used to analyze the pilot study results. The internal consistency analysis of questionnaire items yielded a Cronbach alpha of 0.85, which exceeds the recommended value of 0.7 (Taber, 2017). The pairs' inter-item correlations were more than 0.80, which means that there was no multicollinearity, so all items were independent. Furthermore, a systematic interview associated with discussion to gain a deeper comprehension of participants' responses about VBM use in teaching was employed to collect qualitative data until data saturation was reached. The instruments were checked by experts in science education and ICT education for validation.

4.4 Data Collection Procedure

To collect quantitative data, questionnaires were distributed to 47 participating physics teachers in Rutsiro and Rubavu districts in the Western province, Rwanda. After one week, the completed questionnaires were collected with a return rate of 100%. To collect qualitative data, two weeks after completion of the questionnaires, two schools were randomly selected in each district, and all senior five physics teachers at the schools were requested to participate in a one-to-one interview. Interviews started with structured questions, but participants were allowed time to explain their responses. The purpose with the one-to-one interviews was to obtain deeper insight into the participants' questionnaire responses and to gain more insight into the reasons behind teachers' resistance to integrating VBM in physics teaching and learning. Interviews lasted roughly 50 minutes each and were audio-recorded.

4.5 Data Analysis
To summarize data from the questionnaire, descriptive statistics were used to calculate percentages, standard deviations, standard errors, and means. A paired sample *t* test was also conducted to determine the prevailing teaching practices between usual teaching practices and multimedia-based instruction. Cohen's *d* was also calculated to communicate the magnitude of the experimental effect. Analysis of qualitative data was done by coding. In this case, three themes emerged: physics teaching practices in the selected schools; teacher beliefs about using VBM in teaching and learning; and difficulties associated with VBM implementation in the physics classroom. We assigned as analytically and carefully as possible to each segment recorded (e.g. a sentence) the semantic category to which it refers following the recommendation of Fielding (2012).

4.6 Ethical Considerations
Ethical issues were maintained at all stages of data collection. Ethical approval was obtained from the College of Education, University of Rwanda before starting this study. Authorization to collect data from the selected schools was granted by Rutsiro and Rubavu district leaders and principals in the selected schools. Furthermore, all participants signed a consent form.

5. Results
This section is concerned with the data analysis. It communicates the findings of the research by examining and analyzing the data in detail and interpreting the results from the analysis.

5.1 Personal and Professional Information of Participants
Table 1 presents the demographic information of the participants.

Table 1: Demographic information of participants

Variable	Category	Frequency	%
Geographic location	Urban (Rubavu district)	26	55.3
	Rural (Rutsiro district)	21	44.7
	Total	47	100
Gender	Male	35	74.5
	Female	12	25.5
	Total	47	100
Experience in teaching physics	Less than 3 years	4	8.5
	Between 4 and 6 years	12	25.6
	Between 7 and 9 years	21	44.7
	10 years and above	10	21.2
	Total	47	100
Age	Less than 30 years old	5	10.6

	Between 31 to 35 years old	22	46.9
	Between 36 and 40 years old	13	27.7
	40 years old and above	7	14.8
	Total	47	100

Source: Primary data

For this study, 47 physics teachers from 24 public secondary schools located in two districts, Rubavu (urban) and Rutsiro (rural), participated willingly. Of the sample, 26 (55.3%) participants were from Rubavu district and 21 (44.7%) from Rutsiro district. Regarding gender, 35 (74.4%) participants were male and 12 (25.6%) female. The average age of participants was 34.6 years, and their average teaching experience 8.1 years. Note that selection of participants was done randomly; this can clarify and explain the differences in their personal and professional information and the ratio of male to female participants.

5.2 Physics Teaching Practices in the Selected Schools

Participants' responses to the questionnaire section on teaching practices were aggregated and the standard deviation (SD), standard error (SE), and mean (M) calculated (Table 2). To establish the difference between the two teaching practices, usual teaching practices and multimedia-based instruction, a paired sample *t* test was conducted (Table 3).

Table 2: Descriptive statistics on teaching practices

Teaching practice	N	M	SD	SE
Usual teaching practices	47	4.11	0.57	0.08
Multimedia-based instruction	47	3.19	0.57	0.08

Source: Primary data

Table 3: Results of the paired sample *t* test for usual teaching practices and multimedia-based instruction

	Paired differences			95% CI of difference				
	M	SD	SE	Lower	Upper	*t*	df	*p*
UTP-MBI*	0.92	0.51	0.08	0.80	1.07	16.14	57	0.001

Note. CI = confidence interval; UTP = usual teaching practices; MBI = multimedia-based instruction

Source: Primary data

The results in Table 2 revealed that usual teaching practices (M = 4.11; SD = 0.57) were more dominant among participants than multimedia-based instruction (M = 3.19; SD = 0.57). Cohen's *d* was also calculated using the formula $d = \frac{M_{dif}}{SD_{dif}}$ (M_{dif} = mean difference and SD_{dif} = standard deviation of difference), yielding a *d* value of 1.80. According to the standards for effect size, the calculated *d* value (1.80) represents an acceptable and large effect size since it is greater than the threshold of 0.8 for a large effect. For the paired sample *t* test (Table 3), the difference of 0.92 (95% CI [0.80, 1.07]) was significant (t = 16.14; p = 0.001 [< 0.05]). Besides being statistically significant, the effect size (d = 1.80) was large enough to communicate that usual teaching practices were significantly more dominant than multimedia-based instruction in the selected schools.

5.3 Teacher Beliefs About Using Video-Based Multimedia in Teaching and Learning

Table 4 shows the level to which the participants used certain physics teaching practices in their classrooms. They could choose from the following scales: 1 = *never*, 2 = *seldom*, 3 = *sometimes*, 4 = *often*, and 5 = *always*.

The results presented in Table 4 point out that 25.5% of the participants never used multimedia and a significant number (51.1%) seldom used multimedia in their classroom. Only 6.4% of the participants often or always used multimedia in their physics classroom. Results also revealed that the majority of participants performed the following teaching practices: traditional teaching methods (93.6%), expository teaching (70.2), differentiated instruction (68.1%), project-based or problem-based approach (59.6%), and teaching with experience (53.2%). Other teaching methods that were used but not frequently were peer education, reverse class, and personalized learning, with 48.9%, 38.3%, and 36.3%, respectively.

Table 4: Teaching practices of the participants

No.	Teaching practice	Rating (%)				
		Never	Seldom	Sometimes	Often	Always
1	ICT multimedia-based instruction	25.5	51.1	17.0	4.3	2.1
2	Traditional teaching	0	0	6.4	29.8	63.8
3	Differentiated instruction	0	0	31.9	6.1	62
4	Teaching with experiences	0	21.3	25.5	53.2	0
5	Project-based or problem-based approach	0	2.1	38.3	59.6	0
6	Expository teaching	0	2.1	27.7	38.3	31.9
7	Peer education	0	36.2	14.9	46.8	2.1
8	Reverse class	0	23.4	38.3	38.3	0
9	Personalized learning	4.3	48.9	10.6	36.2	0

Source: Primary data

Even though the responses from the questionnaire showed that participants had been using multimedia in their classroom, we observed through checking their pedagogical documents that few participants had used ICT multimedia in the four weeks prior. During lesson observation, we also noticed that participants did not understand what constitutes effective VBM incorporation in teaching and learning. For instance, there was a case where a participant sent students to the smart classroom to research YouTube videos without giving them clear guidance or guidelines and keywords about the research activity. As a result, the majority of the students were on social media (Facebook) instead of using the computers and internet for pedagogical purposes.

Responses from participants revealed that their pedagogical beliefs fell under learner-centered methods and that most of them believed positively that ICT multimedia is a tool to enhance the quality and relevance of teaching physics in this era of technology. Participants' views about the usefulness of VBM and how this approach benefits themselves, their learners, and the school are reported in Table 5.

Table 5: Participants' views about integrating multimedia (and ICT in general) in physics education

Category	Statement	Frequency (%)
Teachers	VBM provides access to the online information, where the information can be accessible beyond the textbook	95.7
	VBM decreases the time for mechanical activities such as rewriting	93.6
	VBM builds and maintains personal and professional relationships	93.6
	VBM helps to be familiar with smart technology	91.4
	VBM increases the scope of searching, supports communication, and enhances creativity	72.3
	VBM helps to achieve the latest knowledge, to find and organize information, and to share information effectively and easily	70.2
Students	VBM is attractive and arouses students' curiosity	100
	VBM moderates time spent taking notes	93.6
	VBM develops self-efficacy and confidence	91.4
	VBM prepares students for the 21st century, amplifies learners' engagement and motivation, and increases learners' conceptual understanding and retention	91.4
	VBM increases learners' critical thinking	72.3
School	VBM provides access to online content and information	91.4
	VBM helps to be familiar with smart technology	91.4
	VBM upgrades the scope of the research	72.3

Source: Primary data

5.4 Difficulties Associated with Video-Based Multimedia Implementation

Participants were interviewed individually and in a focus group discussion about their perceptions of the challenges to the effective incorporation of VBM. The following question was asked: As a teacher in a school that has ICT equipment, highlight at least four personal perceptions (in line with pedagogical issues) regarding the challenges to the effective incorporation of VBM in teaching and learning. Responses were assigned to themes that recorded the semantic category to which it refers, and themes are listed in Table 6. Themes are recorded in order of most to least recorded.

Table 6: Participants' perceptions regarding barriers to effective multimedia integration

	Theme	%
1	Confidence and self-efficacy to use technological tools	87.04
2	Competence in using ICT tools such as a computer, projector, …	78.57
3	Preparation time versus high teaching loads	75.91
4	Difficulties in assessing and monitoring learners' progress	72.89
5	Poor training and lack of orientation workshops	54.64

Source: Primary data

Apart from the challenges reported in Table 6 which are directly related to teachers, participants in the focus group discussion mentioned other challenges that are linked to schools or students. These included the average number of students per class, eagerness to prepare students for tests and examinations, willingness to complete the syllabus on time, and difficulties to monitor students in a smart classroom.

6. Discussion

This section is dedicated to the discussion of the results presented in the previous section. Findings revealed that participants witnessed the effectiveness of VBM in enhancing teaching and learning. Participants from the selected schools believed that VBM could enhance the relevance and quality of physics teaching and learning. Moreover, participating teachers believed that ICT multimedia such as VBM could be the best answer for the current generation of learners who are digital natives. Participants also revealed that VBM is in line with learner-centered methods where learners actively participate in knowledge construction. Recent studies echo similar findings, that ICT multimedia such as VBM are better strategies to prepare students to navigate in this world where they live now and must work in tomorrow (Antoiniette & Giorgetti, 2006; Kay, 2012). Furthermore, VBM responds to the constructivism theory, which upholds that learners should cooperate and become involved in knowledge construction, while the teacher acts as facilitator (Sorden, 2013).

Moreover, the findings reported in this study revealed that VBM, once effectively integrated into teaching and learning, holds several benefits. It provides an active teaching-learning environment, improves professional development, increases the scope of research, reduces the time spent on some activities (such as rewriting), and facilitates class management. Researchers have echoed similar findings, that multimedia in education is an effective tool to broaden, soften, and improve the relevance and quality of physics teaching and learning (Antoiniette & Giorgetti, 2006). Moreover, VBM has been used successfully in several branches of physics, such as optics (Ndihokubwayo et al., 2020), photoelectric effect (Kunnath & Kriet, 2018), and electromagnetism (Kotoka & Kriek, 2014).

Concerning how and to what extent VBM could be integrated, participants in this study showed that VBM should be integrated to support other teaching methods but not to replace them, and should be used depending on the topic and not be limited to a set time. This correlates with previous findings, that multimedia should be used but not so that it monopolizes the classroom (Winner, 1986). In general, participants in the selected schools believed positively in the use of ICT multimedia as a strategy to enhance physics teaching and learning. However, results from both the questionnaire and interviews revealed that to a great extent participants resisted integrating it in their classroom.

Furthermore, it seems that resistance to VBM integration was not the major problem, but instead the reasons why participants resisted integrating multimedia. Although participating teachers and educational literature have revealed the potential of using VBM to enhance the learning of physics and STEM concepts, some participants resisted integrating it in teaching activities. This was due to various factors.

Firstly, participants cited a lack of confidence as one of the crucial factors that impede teachers from integrating VBM (and technology in general) in the classroom. This was indicated by the majority of the participants as impeding factor. Participants revealed that some teachers are technologically handicapped and their fear of failure makes them feel nervous about using technology in teaching. Therefore, they are not confident to use VBM in teaching and learning. Becta (2004) argued that little experience and lack of confidence in the use of ICT in everyday life negatively influence teachers' motivation to use technology in education. There is a need to understand that teachers who have confidence and self-efficacy in using technology in everyday activities appreciate the effectiveness of VBM in their teaching and other personal work.

Secondly, lack of competence, which is in one way or another related to teacher confidence in using ICT, and poor training in the incorporation of technology in education were reported as hindrance to VBM implementation in physics teaching and learning. Participants revealed that teachers' lack of competence to use computers in everyday life and lack of enthusiasm about bringing computers into their daily lives caused a hindrance to the use of technology. Hence, this caused resistance to integrating VBM in physics teaching and learning. Another study found similar challenges, that many teachers who are not competent in using technology feel worried about using it in front of a class of learners who perhaps knows more than they do (Becta, 2004).

The third factor highlighted was lack of time. Participants revealed that integrating VBM in education is time consuming. They believed that even though teachers may be competent, confident, and self-efficient in using technology, lack of time inhibits them to incorporate technology use in the classroom. Participants revealed that pressure to prepare students for examinations and pressure to complete the syllabus on time, coupled with large size classes, were factors hindering them from using VBM. Although it has been shown that small classes are more advantageous to both teachers and learners (Nye et al., 2000), research has revealed that teachers' beliefs about how a given methodology will enhance their teaching practices and their students' learning were more important than class size (Becta, 2004). There is a need to understand that VBM could be an effective way of controlling time-related issues and large classes. This is because the teacher's role in a learner-centered approach such as VBM is more that of a guide than a teacher who might be regarded as a master of everything in the classroom.

The forth factor reported by participants in this study regarding hindrances to VMB integration was that assessing and monitoring learners' progress is challenging in a VBM class setting. Horner et al. (2018) also cited similar difficulties that may lead to teachers' resistance to ICT integration in their classrooms. As reported in Tables 1, 2, and 3, participants in this study preferred to use teaching methods that are considered a simple way to assess and monitor learners' performance. These include traditional teaching methods, characterized by chalk and talk, and expository teaching methods, characterized by questions and answers. However, this is at variance with the ICT policy in Rwandan education that advocates for the transformation of teaching and learning and improvement of education quality across all levels of education in Rwanda (Rwanda. MINEDUC, 2018).

7. Conclusion, Recommendations, and Limitations

In this study, we examined VBM in physics classrooms through the lens of teachers as agents of change. The study focused on the link between teachers' pedagogical beliefs and their resistance to integrating VBM in physics teaching and learning. The findings of this study showed that the resistance itself seems not to be a problem; instead, the reasons why teachers resist integrating VBM are the pillars of this relationship. Therefore, we conclude that teachers' pedagogical beliefs and their resistance to integrating VBM in teaching and learning physics are linked by the struggles they experience and the hindrance they face in the incorporation of this teaching practice. We thus conclude that the relationship between teachers' beliefs about using VBM and their resistance to integrating VBM is quite strong.

Even though the findings of this study do not significantly contrast what has been reported in literature recently, this is one of few studies conducted in Rwanda and possibly Eastern Africa in which physics teachers revealed why they resist incorporating VBM into teaching activities. This study contributes to the existing literature about the challenges associated with the effective integration of ICT multimedia in physics classrooms and the reasons why some teachers resist integrating it in teaching physics. This study is novel in that identifying the reasons for teachers' resistance to incorporating VBM in physics teaching and learning will help create a picture of what is happening in Rwandan secondary schools. Thus, this study provides a baseline for the effective integration of VBM. This seems to be the right way for informing teacher development officers, curriculum developers, and policymakers about homegrown initiatives and solutions rather than only depending on what has been done in other countries. To this, an investigation of the most significant causes of teacher resistance to integrating VBM in teaching and how the identified factors could be addressed to ensure that VBM is effectively integrated into teaching and learning is highly recommended. Future researchers could also examine the effect of different multimedia to find the most suitable ones for different didactic settings worldwide.

This study had two major limitations. First, participants of the present study were limited to physics teachers in public schools. Second, the research focused on only 2 out of the 30 districts in Rwanda.

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