
Secondary School Teachers' Perceived Influence of Instructional Materials on Students' Learning Science Subjects in Muhanga District in Rwanda

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ABSTRACT: *The study aims at investigating the relationship between teachers' utilization of instructional materials and students' attitudes towards learning science subjects in Rwandan secondary schools. The sample size comprised sixty-three science secondary school teachers in Muhanga district that were selected purposively to participate in the study. A descriptive research design was used and data were collected using an online designed survey using google form. Teachers Scale Questionnaire for the use of Instructional materials and students' exhibited attitudes questionnaire each contained seven affirmative statements were used as the research tools. Participants' responses were based on the five point Likert scale to disclose their perceptions in relation to the topic being investigated. The findings from Pearson's Product Moment Correlations (r) indicated that constructs used were strongly correlated, moderately correlated, and few were weakly correlated. Use of illustrations, use of photographs and visual aids to demonstrate concepts enhance students' remembering and retention of instructions therefore the variables exhibit strong correlations (r = .923; .803). Use of laboratory equipment and reagents during experimentation, use of models and drawings to illustrate concepts exhibited a moderate correlation with students' classroom participation (r = .449; r = .785). Creativity and innovation and integration of audio-visual aids into lessons were strongly correlated (r = .947). Strong correlations were found between use of tech-tools during classroom practices (r = .871), use of a variety of instructional materials (r = .901) and creativity and innovation. Interestingly, use of printed materials, visual aids, and audio-visual aids lead to improved students' classroom interaction, and was strongly correlated with teachers' integration of audio-visual teaching and learning aids into lessons (r = .889). The findings of this study constitute the basis to validate the relationship between teachers' use of instructional materials and students' attitudes in the learning process. We therefore recommend teachers to maximize the use of variety of instructional materials during classroom practices.*

KEYWORDS: Instructional materials, student attitude, learning experiences, active participation, classroom practices, teaching aids

INTRODUCTION

Teaching resources are tools which teachers, tutors as well as laboratory assistants involved in the field of teaching use to help the learners understand and comprehend easily what is taught (Hafidz Zaid, 2020; Ordu, 2021). Most important is that teachers use teaching aids to improve classroom instruction, obtain learners' attention and create motivation to learn (Namaziandost et al; Puspitarini & Hanif, 2019). Above all teaching materials reinforce ideas, facts and skills already learnt by the students (Jesionkowska et al., 2020). It is reliably agreed that teaching materials become user- friendly and interactive in teaching and thus help to remove the anxiety, fear, boredom or any other complex feeling which the students may develop while learning (Bulolo et al., 2022; Getie, 2020).

Instructional materials are classified as traditional and modern teaching instructional materials. Traditional instructional materials are in the category of textbooks, charts, pictures and posters, maps, atlases and globes, flashcards, flip cards and worksheets, scientific apparatus, materials and models used in classrooms and science laboratories (Ulandari, Amry, & Saragih, 2019).. On the other hand, modern instructional materials include computers, internet surfing, laptops, electronic note books, e-readers, computer educational games, online dictionaries, online encyclopedias, picture dictionaries, talking dictionaries, online tests, online e-books, audio – video teaching aids for learning various subjects including languages; PowerPoint slides and games; flash educational games; Lesson relayed on radio through satellites; lessons on TV relayed by certain TV channels; Educational CDs and DVDs, projectors and interactive white boards usually called smart boards (Burns,2011).

Traditional instructional materials

Traditional instructional materials include and are not limited to print materials, graphic media, photographic media, maps, atlases and globes, flashcards, flip cards and worksheets, visual aids, audio-visual aids, scientific apparatus, materials and models used in classrooms and science laboratories.

Print materials

Printed materials appear in form of symbols, in the form of characters, numerals and words that are arranged on an area or surface called a page. The page may include pictures and illustrations in the form of sketch, photographs, charts, graphs, tables, and line drawings. Print materials are hard copy paper, microfilm, microfiche, questionnaires, handouts, forms, brochures, manuals, pamphlets, written reports, newspapers, book magazines and braille. Recent study emphasizes that print materials are important as they allow students to revise the academic content (Nicolaou et al., 2019)

Graphic Media

These include overhead projectors, charts transparencies, mobiles, graphs, models, dioramas, maps, globes, and drawings. Graphics are instructional resources that summarize significant information and ideas through combination of drawings, words, symbols and pictures. Worthy to note is that graphics are among the most useful and powerful aids that a teacher can use in the classroom for teaching because they are easy to use, easily made, portable and can be used in all subject areas, and in different levels of age groups in a classroom setting (Akerson et al,2019). Graphics make abstract ideas more realistic and highlighting information more vivid. Importantly, graphic learning materials create mental pictures in the minds of the reader, for example, graphics summarize certain types of information such as statistical data into charts/ graphs that motivate the learner trying to make sense of the information contained in the resource (Lin et al,2021). For easy understanding of the lessons, the teachers use teaching aids like the charts, pictures and posters that they display in the walls of the classrooms (Adams, 2022). These not only decorate the walls of the classrooms but also are important tools for teaching in the classrooms. Moreover, J. Lee et al (2023) indicates that colorful charts in the classrooms motivate students toward learning.

Photographic media

These include print slides, filmstrips and motion pictures. Photographs help students to interpret information correctly and vividly (Arulanand et al., 2020). Photographs assist students in creating a mental picture of what they are seeing and learning. A good photograph should arouse interest and attract the learner, should be clear of any distortion. It should as well show a variety of details and stimulate in the student to understand more (Papin & Kaplan, 2022).

Maps, Atlases and globes

The lessons in geography subject become realistic when the teachers use wall maps, atlases and globes to make the student understand and know various geographical concepts and the mentioned instructional materials aid students to know the locations of various places in the world, for instance, teaching of geography in the classrooms is meaningless without the use of these teaching aids (Kerski, 2003).

Flashcards, flip cards and worksheets

Flash cards and flip cards are another useful teaching aid used especially in small classes to teach vocabulary and important concepts, and worksheets are important teaching and learning aid to the students to work out exercises given in these worksheets (Sage et al., 2020; Yilmaz, 2016).

Visual aids

Visual aids in the form of pictures, models, charts, maps, videos, slides, real objects are tools that help to make an issue or lesson clearer or easier to be understood. There are many visual aids available these days and use sense of vision and are therefore called visual aids and these are

models, actual objects, charts, pictures, maps, flannel board, flash cards, bulletin board, chalkboard, slides and overhead projector. Out of these black board and chalk are the commonest ones (Rose, 2022). Kim,(2020) indicates that visual aids are those devices, which are used in classrooms to encourage students learning process and make it easier and interesting.

Visual aids are the best tool for making teaching effective and the best dissemination of knowledge. A research conducted by Cuban et al. (2001) indicated that psychology of visual aids as under 1% of what is learned is from the sense of taste where as 1.5% of what is learned is from the sense of touch, 3.5% of what is learned is from the logic of smell, 11% of what is educated is from the logic of hearing, and 83% of what is learned is from the sense of sight.

According to Shabiralyani et al. (2015), visual aids are the devices that help the teacher to clarify, establish, correlate, co-ordinate precise conceptions, understanding and appreciations. These teaching aids support the teacher to make learning actual, active, motivating, encouraging, significant, and glowing.

Following are the significances of this research; every individual has the tendency to forget. Proper use of visual aids helps to retain more concept permanently. Students can study well when they are inspired properly through different visual aids. Visual aids grow the accurate image when the students see and hear properly. Visual aids provide complete conceptual thinking and create the environment of interest for the students. Visual aids help to increase the vocabulary of the students (Bennis, 2007).

Audio-visual aids.

Current teaching aids that are in use provide stimulation to ears and eyes other than use of one sense organ. The emerging teaching aids involve use of more than one sense organ for better mental images. These teaching aids are visual aids in form of illustrations, textbooks, magazines. They may also be auditory aids such as sound recordings from CDs), Audio media- audio tapes, audio cassettes, records, telecommunication as well as audio-visual aids that use a combination of audio and video materials such as DVDs (Ordu,2021).

Scientific apparatus, materials and models used in classrooms and science laboratories

No science lesson can be said to be complete unless the children are shown the practical examples by conducting the science experiments in the lab or class. Models of parts of the human body and many other models depicting the replica of the things taught in the class are very important teaching aids. Clay models are very prominently seen in the schools. Visit to science museums, planetariums; zoological parks and places of scientific importance will serve as very good teaching aids to the students (Hafner, 2014).

Modern teaching aids.

Modern teaching aids include computers, internet surfing, laptops, electronic note books, e-readers, computer educational games, online dictionaries, online encyclopedias, picture dictionaries, talking dictionaries, online tests, online e-books, audio-video teaching aids for learning various subjects, PowerPoint slides, games; flash educational games; Lesson relayed on radio through satellites; lessons on TV relayed by certain TV channels; Educational CDs and DVDs, projectors; interactive white boards also called smart boards etc.

Modern teaching aids are very helpful in this respect because they use the play way method and make teaching like playing some games especially in the case of very young learners. The use of graphics, audio and visuals in the modern training aids makes them very impressive as they leave an imagery of the lessons in the minds of the students (Shabiralyani et al., 2015). Studies have revealed challenges of using instructional materials and these are; non-availability of materials, laziness of the teachers, lack of skill and strategies, financial constraint, lack of appropriate materials in textbook, time constraint, lack of support from authority (Dhakal, 2020).

Teaching is a concept that demands teachers to possess the knowledge and skills but also the professional competence in the use of teaching methods and instructional materials to be able to influence the behavior of learners. In secondary schools, instructional materials appear to be inadequate and poorly designed. The result is that the students and teachers do not effectively utilize the learning opportunities provided by such materials in the teaching learning process (Onuoha et al., 2021).

Problem statement

The Ministerial order for the ministry of education of Rwanda-N° 001/MINEDUC/2021 of 20/10//2021 determining standards in education in its Articles 5,9 and 11 clearly state the necessity for appropriate and sufficient instructional materials as required by the school's curriculum in primary, secondary and vocational schools. The teaching and learning materials are meant to help teachers impart knowledge and students, who are recipients of knowledge to understand, practise, apply knowledge, as well as develop standard cognitive skills (Rwanda Official Gazette n° Special of 20/10/2021). The education that should be received is not to sit in the classroom and cram books, but that kind of education where individual students should be helped to understand and realize their potential (Buhungiro, 2016).

It is on this background that Rwanda competency-based curriculum (CBC) is based. Competency based curriculum emphasizes developing students' skills and competencies and the approach for the curriculum is that students should be availed instructional materials in order to improve teaching and learning quality in Rwandan schools. This is so because students learn better by seeing and doing (Umuhoza & Uworwabayeho, 2021). Competency based curriculum has been developed but competency based curriculum falls short of sufficient instructional materials.In

developing countries, Rwanda inclusive teachers do not employ a variety of instructional materials. They do not prepare a variety of media for use in the teaching and learning. Teachers' instructional materials are limited to textbooks and syllabuses and do not go beyond. Instructional materials and learning activities are theoretical, abstract and ineffective, and this undermines the central role of instructional materials as tools for assimilation and retention of knowledge (Mupa & Chinooneka, 2015).

Teaching science subjects necessitates the availability of adequate instructional materials and other resources to convey the instruction in an efficient and effective way. Insufficiency and the lack of a variety of instructional materials and teaching aids by teachers in some Rwandan secondary schools make the quality of teaching and learning questionable. Ndiokubwayo & Habiyaremye (2018) find that the quality of teaching depends on teacher's creativity and innovation, ability to contextualize learning events to the real-life situations of students and this is what instructional materials are up to. The unavailability of these instructional materials in secondary schools often leads the teachers to apply talk and chalk, as they have no visual or audio visual aids to see, touch, smell and hear in the process of teaching and learning. Therefore, when the instructional materials are not available, learners cannot do well in schools (Lee et al., 2019).

Habiyambere (2015) remarks that we learn and remember 10% of what we hear 40% of what we discuss with others and as high as 80% of what we experience directly or practice. In Rwanda, for example experience has shown that spoken words alone in the communication of ideas are grossly ineffective and inefficient in producing desired learning outcomes. Every year, when the results of public examination are released, there has always been failures in some Government schools. The reason for this could be ascribed to few instructional resources, and the methods of improvisation of these instructional materials is not enough.

Despite the fact that instructional materials are very important, observations are that some schools in Rwanda lack basic instructional facilities and materials for the teaching and learning processes and this has hindered the quality of education in Rwanda (Umuhoza & Uworwabayeho ,2021). Ngirabakunzi (2017) asserts that the most frequently used instructional strategy in schools has been board and chalk as the lecturing method. This kind of instruction is currently so low and cannot match realities of modern times.

There has been emphasis on recitation and rote learning in schools that lack instructional materials and as such, learners lack practical experiences that could help them to develop skills and concepts (Tuimur & Chemwei, 2015). In as far as, instructional materials are concerned, in such circumstances schools in Muhanga district cannot boast of having enough and the right instructional materials and every effort should be made to provide the right and updated instructional material to schools and colleges to upgrade standards of teaching and learning.

In order to understand well how instructional materials remain wanting in Rwanda schools is that Rwanda Basic Education Board (REB) has distributed about 250,000 laptops to 1,624 primary schools and about 79,199 Laptops computers and 1,412 projectors in 739 secondary schools. 720 secondary schools were given the 4G internet making 64% in primary and 53% in secondary education by 2016. Also 1,800 laptops associated with projectors and flash disc were distributed to Science, Technology, Engineering, and Mathematics teachers by 2021. Among the afore mentioned instructional items distributed the share that went to Muhanga District were received by 28 teachers in public primary and 68 teachers in public secondary schools. These instructional materials were few in accordance to those required in the whole district (Iyamuranye & Ndagijimana, 2022).

In the context of developing world, inadequate learning instructional materials have been a factor holding back students' attitudes in secondary science classrooms. For example, Nyarugenge district, Rwanda, research conducted by Issacar & Hesbon (2021) indicate that secondary school teachers do not adequately use various instructional materials. The researcher reported that from the sample size of 244 respondents' students, 42.4 % of the respondents asserted that they always use textbooks as the learning resource. The same research revealed that 22% of the participants could use computers and projectors during classroom lessons and 8.2 % reported use of charts during lesson delivery.

According to Byukusenge et al (2022) there was an exceptional role of technology-enhanced instructions using animations as instructional materials. Score-based analysis of both control and experimental group exposed those students who were taught with animations average score of 84.41 % while those using traditional approach methods of teaching and learning had an average of 47.11 %. The general view observed was that, insufficiency and the lack of a variety of instructional materials and teaching aids by teachers in some Rwandan secondary schools make the quality of teaching and learning questionable.

One of the major problems faced by secondary schools is that the government provides insufficient funds, and hence few instructional materials purchased. Secondary schools depend to the large extent on the government for funding and Muhanga secondary schools are no exception. The funds are provided in form of capitation grants. The capitation grant is aimed at improving the quality of education by making sure that sufficient teaching and learning material are found at school level. In particular, the capitation grant is meant to finance the purchase of textbooks and other teaching and learning materials, run repairs, administration materials, and examination expenses (Tety, 2016).

Twizeyimana et al (2020) is of the view that, lack of instructional materials can lead to poor implementation of the chemistry as a subject and the whole of science curriculum in general. Further research has revealed that improvisation of instructional materials obtainable from the

local environment, or designed by the teacher or with the help of local resource personnel to enhance effective teaching and learning activities have not helped. There has been inability to acquire standard materials due to socio-economic problems, specifically; schools in the eastern province of Rwanda have demonstrated insufficient teaching and learning as they fail to provide relevant instructional materials.

What is so much puzzling is that teachers who possess pedagogical content knowledge and skills meant for students during the learning process find it difficult to identify credible sources, question authenticity and accuracy of information, connect new knowledge with prior knowledge, and discern significantly the right instructional materials to apply. A lot remain desired by teachers who deliver volumes of information in form of texts, graphics, video and audio as they try make sense out of these (Ordu, 2021).

Most of the teachers prefer to teach in the way they were taught and they resist the change that can bring any improvement in the instructional system. Some teachers apply the instructional methods that cannot allow students to acquire the appropriate knowledge and skills for this era. The studies conducted by (Ndiokubwayo et al, 2020) revealed that physics teachers still use teacher-centered approaches which are dominated by lecturing method, demonstrating and computing as students follow applying chalk and blackboard. Some of the teachers use discussion as learner-centered method that cannot work for all topics (Venuste, 2020). Such kind of instructions affects science students who are left with poor conceptual development, poor critical thinking skills and lack of motivation in the science subjects (Nyirantambineza & Minani, 2022).

Student learning depends on teachers' qualification and professionalism and this has to translate into designing and developing varying teaching techniques as well as mixed instructional materials. Despite the effort of the Ministry of education and other subsidiary institutions such as, Rwanda education board, Rwanda TVET board, there still exist issues related to teachers' understanding of the rationale of instructional materials in the teaching and learning process. There are problems of, teachers' creativity and innovation realized in the process of improvisation, and teachers' ability to identify and effectively use the available standard instructional materials (Dusabeyezu & Andala, 2022).

Therefore, this study was conducted to analyze teachers' perceptions and utilization of instructional materials in teaching and learning science subjects with a particular focus on accessibility and utilization in Rwanda secondary schools in Muhanga district. Apart from rigorous analysis of views, the researcher provided suggestions and recommendations that would improve the teaching and learning practices in Rwanda secondary schools.

Research objective

To investigate the impact of teachers' utilization of instructional materials and students' attitudes towards learning science subjects in secondary schools.

THEORETICAL FRAMEWORK

According to previous studies (Riding & Sadler-Smith, 1992; Thomas & McKay, 2010) the process of design and delivering instructions forms the core part in the learning cycle. The nature of instructional materials aligns with the capacity to satisfy the individual learning needs thereby ensuring smooth, collaborative and active learning. For teaching and learning sessions to become explicitly meaningful, instructional designs and resources remain fundamental to allow students' efficient and effective interaction with the learning materials. In this study, the Kolb's learning theory is taken into consideration based on its relation to experiential learning (Atkinson Jr & Murrell, 1988; Kolb, 1984). The Kolb's theory revolves around four stages that form the learning cycle as indicated in Figure 1.

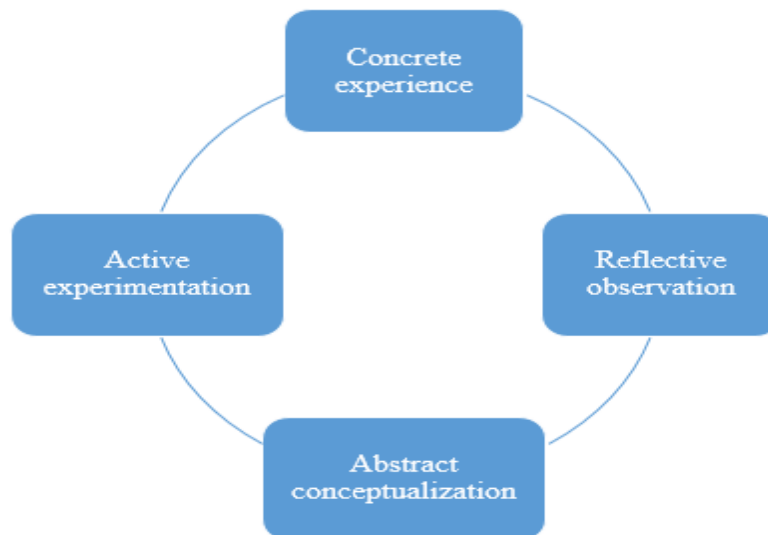


Figure 1. The four stages involved in the learning cycle (Kolb, 1984)

Students through active experimentation understand science concepts. Students' engagement into practice leads to concretization of the learning content thereby acquiring long lasting experiences. It is through individualized reflective observation that complex concepts with an abstract nature can be easily perceived and conceptualized. The researcher explored Kolb's theory towards an effective establishment of the contribution of instructional materials in teaching and learning science subjects. The hypothesis is that well- designed instructional materials and resources could help teachers to find the pathways for students through classroom practices that comprise the four stages in the Kolb's learning cycle

Conceptual framework

Independent variables

Instructional materials

1. Traditional instructional materials

- Print materials
- Maps, Atlases and globes
- Graphics & drawings
- Photographs
- Visual aids
- Audio-visual aids

2. Modern instructional materials computers, laptops, electronic note books, e-readers, online e-books, PowerPoint slides etc and games; flash educational games; Lesson relayed on radio through satellites; lessons on TV relayed by certain TV channels; Educational CDs and DVDs, projectors; interactive white boards also called smart boards etc.

Dependent variables

Students exhibited attitudes

- Reproducing information
- Attention
- Reading skills
- Classroom participation
- Perception of abstract concepts
- Retention of instructions
- Interest and motivation
- Creativity and innovation
- Improved interactions

Intervening variables

- Large class size
- Insufficient financial resources
- Less allocated time

Figure 2. Conceptualized potential benefits in the learning environment where teachers and students access and utilize instructional materials

The conceptual framework presented in Figure 2 indicates the relationship between the independent and dependent variables under the study as well as intervening variables. Indicators of the independent variables such as printed materials, models and drawings, photographs, visual aids, audio-visual aids, and tech-enabled teaching and learning are hypothesized to induce positive students' learning attitudes in science lessons. As depicted under the dependent variables, identified indicators of attitudes include reading skills, classroom participation, perception of abstract concepts, retention of instructions, interest and motivation, creativity and innovation, and improved interactions.

Contextually, science subject teachers inevitably encounter challenges of the scarcity of instructional materials during teaching and learning activities in developing countries that in turn hinder effective and efficient transfer of knowledge and skills to students. We anticipate that with learning environment where required instructional materials are accessible and exploitable, teachers are likely to promote various learning approaches including but not limited to active learning, interactive learning, practice-based learning, and inquiry-based learning among others. Moreover, Teachers could promote creativity and innovation among students in their hands. Besides, students may actively participate in the learning cycle, experience improved understanding of concepts, achieve better in science subjects and develop desirable and promising attitudes towards learning science subjects. A brief literature review presented turns around benefits of accessibility and utilization of instructional materials in teaching and learning science subjects.

LITERATURE REVIEW

Instructional materials have been found to be very essential in science education especially during science class interaction as instructional materials enhanced instruction delivery (O'Connor et al., 2021). More to that research has indicated that well-designed, developed instructional materials plays a major role in raising students' attitude in learning science courses (Davis et al., 2018). Resourceful instructional materials to convey instructional messages have been categorized into two main categories: standard instructional materials (Bukoye, 2019) and improvised instructional materials (Okori & Jerry, 2017). The first type is purchasable in their standard calibration while the second type is available from teachers' creativity and innovation and they are self-made instructional materials.

However, little consideration has been given to the use of instructional materials during content delivery as a fact of enhancing student knowledge and skills as well as changing student attitude to science subjects in Rwandan Secondary Schools. Teachers who use instructional materials are able to enrich student learning and thus students will acquire innovative and creative skills as they learn when teachers use adequate instructional materials (Dey & Bandyopadhyay, 2019; Fernandez-Antolin et al., 2021). Other than mastering the subject content, teachers are always key players in designing learning materials (Lai & Peng, 2019; Margot & Kettler, 2019). Teachers constitute the bridge with which students under proper guidance grasp the required skills that make them cope with current competitive global market (Jackson & Collings, 2018; Malik, 2018).

It is of paramount importance to understand that teachers achieve educational goals in learning, and this is best achieved when there is sufficient teaching and learning resources and to this end previous studies have indicated that instructional materials are very crucial in teaching and learning effort (O. Lee et al., 2019). According to Pouta et al. (2021) Students' understanding is so much correlated to teachers' use of appropriate instructional materials.

Teaching and learning in the 21st century necessitate the sense of investing excessive efforts aiming at designing, developing, and creating friendly and attractive learning environment that captures learners' attention and this can mainly be achieved through meaningful teaching and learning when instructional materials are applied by the instructor.

Oppong (2021) opines that teachers transfer knowledge and skills effectively to learners when they have at hand essential teaching and learning resources. Instructional materials have been also viewed as teaching and learning vital during classroom instruction delivery as realized by Udeagbala et al (2020). Peters et al. (2019) finds that previous researchers have been devoted to investigating the justification for instructional materials in boosting learners' active participation. Besides, instructional materials stimulate interest, motivation, easy perception, and visualization of presented content. Subsequently, application of learned materials into real life situation could be promoted using well-designed instructional materials.

One important dimension in teacher education that is getting a lot of attention is related to the use of instructional materials. Instructional materials are those materials used by a teacher to simplify their teaching. They include both visual and audio-visual aids and could be either concrete or non-concrete. These instructional materials bring life to learning by stimulating students to learn. The use of instructional materials in the classroom has the potential to help the teacher explain new concepts clearly, resulting in better student understanding of the concepts being taught. However, they are not ends in themselves but they are means to an end. It is held that good teaching resources can never replace the teacher but the teacher uses them to achieve their teaching and learning objectives. Some of the instructional materials necessary for effective teaching and learning of Social Studies include the chalkboard, models, graphs, charts, maps, pictures, diagrams, cartoons, slides, filmstrips, radio, and television. The importance of the use of these materials cannot be underscored. Tuimur & Chemwei (2015) hint that instructional materials are critical ingredients in learning and that the curriculum cannot not be easily implemented without them.

In developing countries like Rwanda, insufficient funds to support educational undertakings have been correlated to the use of insufficient and ineffective /outdated teaching and learning resources, therefore due to these challenges encountered during in classroom activities/concerned bodies such as educational administrators, teachers, and learners are encouraged to take part into improvisation (Ibrahim et al., 2021). Much literatures have been produced disclosing that in the shortage of standard instructional materials (Rufus & Muhammad, 2018), improvised ones can play a similar role with almost the same accuracy in measurements. Recently, studies showing the advantages of improvisation towards improved learners' performance have been considerably increasing (Obi & Obi, 2019). Other investigations indicated promising educational outcomes in terms of attitudes, reduced disruptive behaviors, increased creativity and innovation in the improvised materials mediated learning environment (Sandoval-Obando et al., 2018). Moreover, both interactive and

project-based learning have been highly facilitated by teachers and learners involvement in improvisation of teaching and learning materials (Bryson & Andres, 2020).

Recent advances in education have significantly attracted educators towards designing and developing easy, cheap and reliable instructional materials worldwide (Cho et al., 2021). Instructional materials have been regarded as intermediary between teachers/educators and students during the course of instruction delivery (Magulod Jr et al., 2020). Essentially, planning, designing, and developing teaching and learning materials entail tremendous effort of the academic community particularly those who regularly interact with students for instance teachers remain at the forefront among others (Lukas & Yunus, 2021).

A growing body of literatures has evaluated the contribution of instructional materials in the context of teaching and learning (Vermote et al., 2020), and indicated that in any instructive framework, the most common component overwhelming is the requirement for the learners to understand the instructions of the presented content. Yet, this may not be accomplished until the instructor as the overseer of information have the legitimate comprehension of the topic, appropriately utilized educational materials, and embraced reasonable strategy in teaching and learning process (Ahmad & Garba, 2021). In his analysis, (Tety, 2016) described instructional material as a means of motivation towards learning, to complement the written of spoken words in the transmission of knowledge, attitude and ideas.

Abdu-Raheem & Oluwagbohunmi (2015) in their lens asserted that instructional materials captures learners interest as the lesson becomes more practical representative and attractive and they allow students to engage enthusiastically and efficiently in the learning process. The findings further validate the position of instructional materials as having the power to accommodate learners' goodwill for acquiring skills and knowledge with confidence to apply them in solving emerging real life problems.

RESEARCH METHODOLOGY

This section gives details of the methodology followed throughout the whole process of the research. The data discussed in this study were obtained based on planned investigation to disclose teachers' utilization of instructional materials and its influence on students' learning science subjects in Muhanga secondary schools. The study uses descriptive research design and employed quantitative research methods. Purposive sampling was used to obtain the sample size ($n = 64$) from the target population of ($N = 67$). The sampling method was suitable because the researcher considered participants whose characteristics are known by the researcher. The researcher in this study used online survey in the form of questionnaire to collect data from parents. The questionnaire comprised 14 affirmative statements, and participants were required to use a five Point Likert Scale which uses numbers to evaluate the strength of responses, from 1 indicating

strongly disagree to 5 indicating strongly agree. Data were collected by use of a questionnaire through an online survey, and were analyzed with the help of Statistical Package of Social Science (SPSS 26.0) to generate Pearson's correlations. Finally, tabulation method was used to present data.

RESULTS AND DISCUSSION

In this section, results are presented and discussed according to the research objective of the study.

Demographic information

Demographic data gives information in regard to participants and is fundamental for the assurance of whether the people in a specific report are an agent test of the target population for generalization purposes.

Table 1: Demographic information of study participants: Gender (A); Age range (B); Qualifications (C); Teaching level (D); and work experience (E)

Characteristic	Number (%)	Characteristic	Number (%)
Participants			
(A) Gender	45 (71.4)	(B) Age range	25 (35)
Male	18 (28.6)	25-30 years	29 (46)
Female		30-35 years	12 (19)
		35-40 years	
Total	63 (100)		63 (100)
Profession related information			
(C) Qualifications		(D) Teaching level	
Advanced diploma (A1)	8 (12.7)	Lower secondary level	20 (31.7)
Bachelor (A0)	55 (87.3)	Upper secondary level	10 (15.9)
		Both levels	33 (52.4)
Total	63 (100)		6 (100)
(E) Teachers' work experience		Less than 2 years	9 (14.3 %)
		From 2 years to 4 years	8 (12.7 %)
		From 4 years to 6 years	28 (44.4 %)
		From 6 years to 8 years	10 (15.8 %)
		Above 8 years	8 (12.7 %)
Total			63 (100 %)

Source: primary data, 2023

In this study both male and female participants were involved. According to Table 3A, 45 (71.4 %) and 18 (28.6 %) corresponding to males and females respectively. The maturity of participants was essential to the researcher in order to further validate the responses provided during data

collection. Therefore, data presented in Table 3B, the maturity ranges are as follow: 25-30 years old, 22 (35 %), 30-35 years old, 29 (46 %), and 35-40 years old, 12 (9 %). Qualification of participants was another fundamental characteristics to help in ensuring the expertise of participants in instructional materials related issues (Table 3C). The researcher considered the responses returned by the holders of an A1 Diploma, 8 (12.7 %) and Bachelor's degree, 55 (87.3 %). With a reference to Table 3D, the study included participants from various level of teaching such that fall into three categories namely lower secondary, 20 (31.7 %), upper secondary level, 10 (15.9 %) and a combination of both levels, 33 (52.4 %). Moreover, participants' experience in their profession is fundamental and empasizes the reliability of the data gathered. It is against this background that participants included in this study belong to different ranges of experience, less than 2 years, 9 (14.3 %), from 2 years to 4 years, 8 (12.7 %), from 4 years to 6 years, 28 (44.4 %) from 6 years to 8 years, 10 (15.8 %) and above 8 years, 8 (12.7 %) (Table 3E).

Table 2. Teachers Scale Questionnaire for the use of Instructional materials

S/N	Statement	SA		A		N		D		SD	
		F	%	F	%	F	%	F	%	F	%
S1UI	Teachers use of illustrations to demonstrate concepts	48	75	16	25						
S2UI	Models and drawings are used to illustrate concepts	35	54.6	23	35.9	2	3			4	6.25
S3UI	Laboratory equipment and reagents are used during experimentation	57		7	10.9						
S4UI	Teachers use photographs and visual aids as teaching and learning aids	16	25	25	39	60.9		20	31	3	4.6
S5UI	Teachers' integration of audio-visual teaching and learning aids into lessons	41	64	14	21.8	4		5	7.8		
S6UI	Teachers use tech-tools during classroom practices	55		5		5		4	6.25		
S7UI	It is better for teachers to use a variety of instructional materials	64	100.0								

Source: primary data, 2023

Table 3. Teachers Scale Questionnaire for Students Exhibited Attitudes when Instructional materials are used

S/N	Statement	SA		A		N		D		SD	
		F	%	F	%	F	%	F	%	F	%
S1SA	Use of illustrations enhances students' remembering of concepts	46	72	18	28						
S2SA	Use of laboratory equipment and reagents improves Students' classroom participation	54	84	3	5	1	2			6	9
S3SA	Photographs and visual teaching aids improve students' perception of abstract concepts	20	31	40	63			4	6		
S4SA	Models and drawings enhance students' retention of instructions	61	95	3	5						
S5SA	Audio-visual teaching-learning aids induce students' interest and motivation	38	60	20	31	4	6	2	3		
S6SA	Tech-enabled teaching and learning brings about creativity and innovation	38	59	22	35	2	3	2	3		
S7SA	Printed materials, visual aids, and audio-visual aids lead to improved students' classroom interaction	35	55	23	36			4	6	2	3

Source: primary data, 2023

As stipulated in Table 2 & 3, the researcher constructed a questionnaire to reflect on teachers' use of instructional materials and attitudes exhibited by students while engaging into the learning process. Instructional materials explored encompasses those teaching and learning aids that help students to use the sense organs such as hearing, seeing, and touching. To facilitate findings presentation, two tables containing Pearson's Product Moment Correlations (r) with their significance level (p-values) were generated from SPSS version 26.0 (refer to Table 4 & 5).

Table 4. Pearson's Product Moment Correlations (r) between teachers' usage of instructional materials (UIs) and students' attitudes (SAs)

Pearson's Product Moment Correlations with their significance level		S1UI	S2UI	S3UI	S4UI	S1SA	S2SA	S3SA	S4SA
S1UI	R	1							
	Sig. (2-tailed)								
	N	64							
S2UI	R	.328**	1						
	Sig. (2-tailed)	.008							
	N	64	64						
S3UI	R	.229	.449**	1					
	Sig. (2-tailed)	.069	.000						
	N	64	64	64					
S4UI	R	.750**	.356**	.212	1				
	Sig. (2-tailed)	.000	.004	.093					
	N	64	64	64	64				
S1SA	R	.923**	.270*	.197	.803**	1			
	Sig. (2-tailed)	.000	.031	.119	.000				
	N	64	64	64	64	64			
S2SA	R	.662**	.785**	.449**	.564**	.611**	1		
	Sig. (2-tailed)	.000	.000	.000	.000	.000			
	N	64	64	64	64	64	64		
S3SA	R	.547**	.425**	.380**	.471**	.544**	.680**	1	
	Sig. (2-tailed)	.000	.000	.002	.000	.000	.000		
	N	64	64	64	64	64	64	64	
S4SA	R	.384**	.726**	.299*	.428**	.355**	.664**	.668**	1
	Sig. (2-tailed)	.002	.000	.016	.000	.004	.000	.000	
	N	64	64	64	64	64	64	64	64

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Findings from Table 4 show that teachers use of instructional materials (UIMs) is strongly, moderately and weakly correlated with students attitudes (SAs). It is shown that teachers' use of illustration to demonstrate concepts, and teachers use of photographs and visual aids as teaching and learning aids enhance students' remembering and retention of instructions therefore the variables exhibit strong correlations ($r = .923; .803$). Teachers' use of laboratory equipment and reagents during experimentation as well as teachers' use of models and drawings to illustrate concepts were moderately correlated with improved students' classroom participation ($r = .449; .785$). The use of illustrations to demonstrate concepts, use of Models and drawings to illustrate concepts, use of laboratory equipment and reagents, and use photographs and visual aids as teaching and learning aids moderately correlate with improved students' perception of abstract concepts ($r = .547; .425; .471$). Moreover, a weak correlation is observed when laboratory equipment and reagents are used during experimentation ($r = .380$). The use of illustrations to

demonstrate concepts exhibited a weak correlation ($r = .384$) with retention of instructions while use of models and drawings to illustrate concepts showed a strong correlation ($r = .728$). The use of laboratory equipment and reagents weakly correlate with retention of instructions ($r = .299$) whereas use photographs and visual aids as teaching aids showed a moderate correlation ($r = .428$).

Table 5. Pearson's Product Moment Correlations (r) between teachers' usage of instructional materials (IUMs) and students' attitudes (SAs)

Pearson's Product Moment Correlations with their significance level		S5IM	S6IM	S7IM	S5SA	S6SA	S7SA
S5IM	R	1					
	Sig. (2-tailed)						
	N	64					
S6IM	R	.871**	1				
	Sig. (2-tailed)	.000					
	N	64	64				
S7IM	R	.877**	.809**	1			
	Sig. (2-tailed)	.000	.000				
	N	64	64	64			
S5SA	R	.907**	.776**	.889**	1		
	Sig. (2-tailed)	.000	.000	.000			
	N	64	64	64	64		
S6SA	R	.947**	.871**	.901**	.919**	1	
	Sig. (2-tailed)	.000	.000	.000	.000		
	N	64	64	64	64	64	
S7SA	R	.889**	.846**	.864**	.946**	.913**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	64	64	64	64	64	64

** . Correlation is significant at the 0.01 level (2-tailed).

Students' interest and motivation strongly correlates with teachers' integration of audio-visual teaching and learning aids into lessons ($r = .907$), and teachers use of tech-tools during classroom practices ($r = .776$). This variable also strongly correlates with teachers' use of a variety of instructional materials ($r = .889$). Strong correlations were also obtained between creativity and innovation and teachers' integration of audio-visual teaching and learning aids into lessons ($r = .947$), use of tech-tools during classroom practices ($r = .871$), use of a variety of instructional materials ($r = .901$). Interestingly, use of printed materials, visual aids, and audio-visual aids

lead to improved students' classroom interaction and was strongly correlated with teachers' integration of audio-visual teaching and learning aids into lessons ($r = .889$), Teachers use of tech-tools during classroom practices ($r = .846$) and use of a variety of instructional materials ($r = .864$).

Sixty-four science teachers from secondary schools in Muhanga district disclosed their views on the use of instructional materials and their effect on students' attitudes. The return rate of questionnaires was 100 %, which accounts for acceptable responses return rate. The researcher constructed questionnaires that comprised statements that reflects on teachers' use of instructional materials and students' attitudes toward learning. Correlational analysis confirmed relationship between teachers' use of instructional materials and students exhibited attitudes. The use of illustrations to demonstrate concepts as well as use of photographs and visual aids significantly correlate with students remembering ability and ability to retain instructions with a strong correlation ($r = .923; .803$). These findings corroborates those obtained by Al Mamun (2014) in which interviewed students asserted that teachers' use of various audio-visual teaching and learning aids makes the lesson interesting and enjoyable.

Our findings revealed that students' interaction with laboratory equipment and use of reagents during experimentation as well as teachers' use of models and drawings to illustrate concepts were moderately correlated with improved students' classroom participation ($r = .449; .785$). These findings support that carrying out experiments by students enhances individual student classroom participation, which leads to positive attitudes toward learning.

Our findings revealed that abstract nature of instructional content could be alleviated by use of illustrations, participating into lab-based activities, use of photographs and visual aids. These findings validate the fact that students tend remember what they hear and see later than what they hear only. The retention of instructions was seen to be facilitated by use of models and drawings to illustrate concepts with a strong correlation of .728. These finding are in line with those found by previous researchers (Cabero-Almenara et al. 2019; Liaw, 2008) which asserted that learning models contributes to the easy perception of the presented instructional content. The findings of this study emphasized that students' interest and motivation could be enhanced by teachers' integration of audio-visual instructional materials ($r = .907$). As previous findings in the literature (Di Serio et al., 2013; Puspitarini & Hanif, 2019) indicated that audio visual instructional materials boost students' eagerness to follow instructions thus supporting the relationship obtained in this study.

CONCLUSION

This study analyzed the impact of teachers' utilization of instructional materials on students' attitudes towards learning science subjects in secondary schools. In the light of the findings of this study, the instructional materials are crucial in any academic institution and are extremely valuable

in teaching and learning process. Participants strongly correlated, moderately correlated and weakly correlated use of instructional materials and students' attitudes toward learning. The fact that the study concentrated on teachers' use of instructional materials and their effect on students' attitudes, future studies could investigate how attitudes identified in this study affect classroom performance.

Recommendations

The findings of the current study motivated the researcher to recommend and suggest the following points of improvement to the Government and stakeholders in education:

- i. Government and stakeholders in education should provide sufficient standard instructional materials and organize trainings to equip teachers with essential skills to develop and use instructional materials.
- ii. School administrators should create teaching and learning environment that gives teachers the ground to participate in instructional content design.
- iii. To enhance the students' participation in science subjects, teachers should strive to improve their teaching methodologies by using mixed instructional materials in the teaching and learning activity.
- iv. There is a need for teachers' capacity building to ensure that they are representatives of quality teaching and learning that leads to quality education.
- v. Issues related to production, distribution and maintenance of instructional materials should be reduced in partnership with the government and stakeholders in education.

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