**Successes and Challenges of Biology Teachers in Implementing the Outcomes of School-Based In-service Training in the Nyanza and Kamonyi Districts, Rwanda**

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## Abstract

A school-based in-service (SBI) training program is a professional development program conducted among teachers of the same school or different schools. In SBI training, teachers collaborate, share and address challenges in their teaching. This study aims on the one hand to assess the degree to which biology teachers succeeded in implementing the knowledge and skills acquired through SBI training in their teaching. On the other hand, it aims to assess its impact on learners’ outcomes and the challenges they faced in implementing them in the Nyanza and Kamonyi districts in Rwanda. A mixed-methods research design was adopted. Probability sampling technique was used to select a sample of 21 schools from the two districts which had 51 biology teachers (comprising 21 from Kamonyi district and 30 from Nyanza district). Data were collected using questionnaire and classroom observation checklist. The findings of this study showed that the majority of teachers (96%) who had participated in SBI programs agreed that it had increased their confidence and capacity to employ active learning pedagogies that had improved the lifelong learning skills and performance of their learners. However, 67% of teachers who participated agreed they experienced various challenges like scarcity of resources in implementing the gains. In view of its numerous benefits, it is recommended that further exploration should be carried out on how SBI activities and knowledge gained from it could be fruitfully implemented in secondary schools.

Keywords: school-based in-service training; vicarious learning; peer learning; continuing professional development

## Introduction

In this world of technological advancement, researchers devise and propose teaching and learning methods that can be used to make a meaningful science teaching and learning (Albiladi & Alshareef, 2019; Dewi & Primayana, 2019; Fidele et al., 2019).In previous era, teaching and learning methods were concentrated on teachers, teacher was expert and central of classroom teaching and learning practices (Matsuyama et al., 2019). Teachers plan the lesson and deliver without cooperation and collaboration with others teachers and learners were passive observers during the teaching and learning activities (Otara et al., 2019).

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Expert teacher teaching method was used to teach and learn Biology worldwide however the result from researchers revealed the lower level of performance of learners in biology (Mu, 2010; Musa, 2022). This lower level of learners’ performance has raised many concerns among the education stakeholders and much attention from researchers in education to find out the best teaching approach that can fit with learners learning and performance (Mapulanga, 2019). It is from that perspective that various studies were conducted to estimate the fitting approach to teaching all subjects worldwide (Caena & Redecker, 2019; Fidele et al., 2019; Mahoney et al., 2021; Samuel Dick Mwapwele et al., 2019) .

In Sub-Saharan African countries, different studies attested that continuous professional developments (CPDs) in a school or between Schools helped teachers to collaborate and share knowledge and improve teaching and learning activities(Ngema & Lekhetho, 2019; Parsons et al., 2019). The CPD project was initiated in Rwanda after expanding from free basic education from 9 years of basic education to 12 years of basic education, to reinforce collaboration among teachers under a project of strengthening School-Based Collaborative Teacher (SBCT) training project (Uworwabayeho et al., 2020).

Different CPDs were organized to strengthen capacity through experience sharing, cooperation and collaboration of school Head teachers, Director of Studies and Sector Education Officers (Ndihokubwayo et al., 2021; Uworwabayeho et al., 2020). Furthermore, CPD through school in service training (SBI) was extended to teachers intended to maintain collaboration among them and knowledge sharing(Wangeleja, 2015). School- based in service training has been inserted in teaching and learning to enhance teachers’ collaboration during designing lesson plan, discussion and have reflection on how they can link contents with student ideas (Bizimana et al., 2021).

In Rwanda, School based in service training was implemented through ministry of education (MINEDUC) in collaboration with Rwanda education Board and MasterCard Foundation after shifting the curriculum from teacher-centered to learner-centered curriculum to construct Learners-Based Teaching and Learning Methods (LBTLM) (Journal, 2018). School Based in service (SBI) training was initially imposed to mathematics, science and entrepreneurship teachers from Kigali city and Southern Province to assist them to know the manner learners learn better, what builds effective teachers and plan the lesson centered to learners(Training, 2016).

Okae-anti, (2007) argued that School Based in-service training which may be done through workshops, seminars allow teachers to build their self-efficacy, confidence, discover the best teaching method, be competent and motivated, and new knowledge realization. However, the proper implementation of School in service training is hindered by lack of time, budget and motivation among teachers(Stevenson et al., 2016). The current study will evaluate the effects of school based in-service training on biology teachers’ classroom practices, whether biology teachers practice knowledge and skills gained from School based in service training (SBI) in Rwandan secondary schools.

## General overview of school-based in-service training (SBI)

Continuing professional development programs (CPDs) are considered as strategies used in teaching and learning to improve teaching and ensure that learners acquire appropriate knowledge (Asmari, 2016) . Rouf & Mohamed, (2018) took CPDs as a road map to strengthen teachers’ proficiency, experience, and development toward improved teaching practices. CPDs are taken as an essential tool used in academics to boost teachers’ professionalism and equip them with enough skills for their career (Rouf & Mohamed, 2018). Through CPDs, Derakhshan et al., (2020) remarked that teachers clarified different academic classroom teaching and learning styles. CPDs have been used in Rwanda nationwide to advance the implementation of a competence-based curriculum approach in school teaching and learning (Byusa et al., 2020). In the UK, the incorporation of continuous professional development was used by biology teachers in bio-technology and genetic modification teaching. Through them, biology teachers have significantly elaborated their teaching practices of bio-technology and genetic modification and other biology topics (Gray & Bryce, 2006). Tobondo & Retnawati, (2018) found that CPDs are fundamental elements that influence a teacher and increase their confidence, cognitive abilities and keep abreast of educational issues.

In the past, the teacher centered teaching approach or traditional teaching approach where the teacher was a sage on a stage was dominating learners' participative teaching approach, where learners took a central part in their learning (Makulova et al., 2015). A learner-centered approach was adopted to produce efficacy of learners in the labor market. The achievement of learners-centered approach was achieved through collaboration among teachers, either in schools or other schools (Wabule, 2016).

To improve skills related to learners-centered approach, the government of Rwanda has adopted different continuous professional development based on School based in-service training (SBI) program. SBI training program was introduced into secondary schools in Rwanda to increase training of in-service teachers whose training opportunities were limited (Iwasaki et al., 2015).

SBI training program is among types of drills organized at school level either by teachers or by school leaders for particular drives. Researchers  found that the most drives of school-based in-service training  are to increase collaboration among teachers and to construct a bridge that links teachers’  theoretical skills with practices in classroom teaching practices (Simpson & Muvunyi, 2020). Moreover, School-based in-service training is  an intelligible various action conducted at the school level or among schools through peer learning to  extend and widen knowledge, attitudes, and skills that are trustily  linked with the work of teaching to advance  teachers’ professional capability and the efficacy   of their school (Rifa’i, 2022; Seibert et al., 2017). Through SBI teachers identified that technology can be best approach toward proper Biology teaching, Pahlifi & Fatharani, (2019) observed that android is an effective tool to teaching respiratory system. The core effect of School-Based in Service (SBI), program is to enhance the planning, implementation, and evaluation of teaching and learning activities by focusing on learners' needs (Peleman et al., 2018). SBI provided numerous benefits in teaching and learning, it accurately increases teachers’ competency and understanding various learning theories such as social networks, communities of practice, organizations of learning, knowledge management, knowledge translation, and research utilization(Bolderston, 2007).

## Types of SBI

### Workshops and Seminars

Seminars and workshop are training organized by long term experienced educators intended to provide knowledge and skills on a specific topic. It has observed that the seminars engage participants in discussions and foster their hands-on activities (Essien et al., 2016). Dr Jayendrakumar N. Amin, 2016; Nurulloh et al., 2020) reported a positive correlation between teachers’ participation in workshop and seminars and learners’ academic achievement. Workshop and seminars support participant to refresh skills and enhance innovative sprit in teaching and learning.

### Mentoring

Mentoring is a supporting and guiding connection between a more seasoned educator (the mentor) and a less seasoned educator or student (the mentee) (Banu et al., 2016). Mentoring in the field of education is aimed at developing professionally, enhancing teaching or learning abilities, and assisting the mentee in navigating the difficulties and complexities of the educational environment (Ambrosetti, 2014)**.**

Some common activities employed in mentoring are:

* *Observation and Feedback:* Mentors may observe the mentee's teaching or learning practices and provide constructive feedback to help them improve.
* *Goal Setting:* Setting clear professional goals and objectives for the mentee and working together to achieve them.
* *Sharing Knowledge:* Sharing educational resources, teaching materials, and research findings to enhance the mentee's knowledge base.
* *Reflective Practice:* Encouraging the mentee to engage in reflective practice, where they critically evaluate their teaching or learning methods and make improvements.

### Coaching

The goal of coaching in education is to enhance the abilities, performance, and professional growth of teachers or students through a systematic and encouraging approach (Wai Yee, 2016). It is a team-based, outcome-driven strategy that emphasizes assisting people in realizing their greatest potential. Depending on the particular objectives and requirements of the teacher or student, coaching in education might range in length. It could be a continuous, long-term partnership or a quick intervention.

Some important roles educators provide in coaching are:

* *Facilitator:* A coach in education serves as a facilitator of growth and learning. They help educators or students identify their strengths and areas for improvement.
* *Objective Observer:* Coaches provide objective feedback and observations, highlighting specific areas where improvement is needed.
* *Resource Provider:* Coaches often offer resources, strategies, and tools to help educators or students achieve their goals.
* *Motivator:* Coaches motivate and inspire their clients to set and work toward their educational objectives.

### Peer Observation and Feedback

Peer observation in teaching and learning is mostly done amongst teachers to learn from each other. It is achieved among teachers in class where they observe classroom teaching practices of other each teacher(Ridge & Lavigne, 2020). This allows them to enhance their innovative sprit of teaching and professional growth through exchanging of ideas.

### Teacher Exchanges and Job Shadowing

Teacher exchanges involve educators from different schools, districts, or even countries swapping positions for a set period of time (*DfE,* 2016). The primary goal is to expose teachers to different teaching environments, cultures, and educational systems. Moreover, job shadowing involves one teacher observing another teacher in their classroom or educational setting for a specific period (*Danijela,* 2021). It offers the opportunity to learn from an experienced colleague by directly observing their teaching methods and strategies. Teacher exchanges and job shadowing can contribute to ongoing professional development, improving teacher effectiveness, and ultimately benefiting students. These experiences can be arranged at various levels, from local school-based exchanges to international programs, depending on the resources and opportunities available to educators. Additionally, they can be formal programs organized by educational institutions or informal arrangements made between teachers and schools.

### Study Groups and Book Clubs

In this technological dynamic world, a number of teachers and other academicians are technologically grouped in different online platforms to collaborate, share teaching experience and resources, discuss on the effective teaching instructions that boost quality of teaching and learners’ academic achievement.

## Theoretical Framework

### Guskey’s Model of school-based in-service training

The current study is based on Guskey’s Model. Guskey has developed this modern model aiming at finding out and demonstrate the deeper meaning of continuous professional development in teaching and learning undertakings. He observed that the continuing training of teachers where they meet and vicariously learn, allow them to meaningfully change their belief and attitudes, improve their professional skills, make them update and enhance their classroom teaching practice (see Figure 1).

The model of teacher changes from archaic teaching and learning beliefs and attitudes in order to change and choose the proper teaching approach. Teachers’ change is due to teachers’ continuous professional development and peer leaning and lead to the academic growth of learners.

### Albert Bandura’ Vicarious learning theory.

Bandura defined vicarious learning theory as the type of learning theory which focus on learning through the exchange of experience among people (Haro Soler, 2019). It has been observed that the proper implementation of this learning theory among teachers can increase their self-efficacy and confidence toward proper teaching. This is due to fact that, various learning boosts teachers’ retention, motivation, ability to guess the best instructional teaching approach that can satisfy learners’ need and materials that profoundly assists teaching and learning accomplishments (Mayes, 2015; Myers, 2018).

Albert Bandura’s theory of social or vicarious learning is inserted in school amidst teachers through a school-based in-service training program to which teachers share knowledge and experience by observation and discussions. During collaboration, teachers have to be attentive individually on what is being presented to raise the rate of grasping the content in order to reproduce it accurately, attractively and meaningfully, in classroom teaching and learning practices. In this study, Albert Bandura’s theory is taken into consideration based on its relation to constructivism learning theory. Figure 2 illustrates Albert Bandura’s model of vicarious learning theory. Albert Bandura’s model emphasizes the role of observational learning, imitation, and modeling in the learning process and is not specifically designed for classroom teaching, its principles can be applied to enhance the teaching and learning experience(Asiyah et al., 2021). Through it teachers boost a student's intrinsic motivation and self-efficacy through verbal persuasion, positive reinforcement and constructive feedback.

Dewey's inspiration as an innovator in the field of pragmatism recommended upcoming researchers to explore deeply into how teachers can develop their teaching aptitude from the knowledge acquired and instructional approaches developed from collaboration (Casey & Quennerstedt, 2020).

### General understanding of school based in-service training programs

SBI training program was initiated by the Ministry of Education of Rwanda, in conjunction with the Japanese International Cooperation Agency, in 2013. The program, designated the School-based Collaborating Teacher Training Project (SBTTP) aims at supporting schools to reinforce teachers’ teaching capacity (Dorimana et al., 2021). It has been reported that the successful implementation of such training countenance teachers to shift from their old tactic of teaching to a new one that makes teaching more meaningful (Darling-Hammond, 2017; Emmanuel Kayode, 2015). According to (Friday & Ph, 2016) in school-based in-service training, teachers gain an advanced teaching ability depending on the level of learners and content to teach. Hence, teachers who frequently participate in SBI teach differently compared to how they previously taught and modernize their teaching to make it more related to the needs of the community and world at large.

It had been revealed that SBI abreast teachers’ pedagogical strategies in their subject areas allow them to lead students to learn more accurate and relevant knowledge than their counterparts without recent SBI experiences (Jitendra et al., 2022; Simanjuntak, 2023). Recent SBI experiences can, therefore, boost teachers’ meaningful teaching, increase learners’ meaningful learning and academic achievement, as well as develop teachers’ capacity to employ instructional approaches that will ensure all learners success.

### Attitude and feeling of learners toward biology teaching and learning

Biology reflects on topics that intensely reflect on human life such as human anatomy, genetics and ecosystem that arouse learners’ interest toward biology learning (*Rogayan,* 2019).This engross learners’ discussion and ask numerous questions outside the desired curriculum. However, in advanced level learners are scared of biological knowledge acquainted(*Francom,* 2014). Thus, teachers have to design and incorporate effective teaching approach to every biological topic. Through cooperation and collaboration in School Based Training, Biology teachers share knowledge and teaching experiences at every level to remove the fear of learners toward biology learning. Moreover, biology teachers are challenged by a bigger volume of biology content and misconception of learners toward biology learning.

### Limitations that hinder effective implementations of knowledge and skills gained from SBI in classroom practice

It has been observed that SBI abreast teachers’ use knowledge and skills gained to teach more effectively than teachers with little or non-recent SBI. However, the former experiences challenges that hinder the implementation of new skills gained from SBI (Nur & Ozkan, 2017) These include

1. *Lack of environmental assistance* - the use of new approaches toward effective teaching requires unification of people. Thus, the teachers who want and miss helpful assistance from the school leader can’t effectively implement skills gained in classroom practices.
2. *Scarcity of time* - teachers are mostly overwork-loaded and limited time to plan and implement. Thus, being overloaded and constrained time, become burden to abundantly integrate new skills in classroom teaching practices.
3. *Teachers’ mindset -* teachers who have been familiarized with a specific teaching strategy in long time resist to modify and adopt new skills. The change to a new strategy requires readiness and sacrifice. Thus, resistance to change can affect effective implementation of acquired skills in classroom practices.
4. *Insufficient resources* - often effective implementation of new approach of teaching necessitates new appropriate teaching resources like technology, pedagogical documents and resources. Thus, a teacher can fail to translate the skills gained into classroom practices if the resources are insufficient.
5. *Lack of follow-up and feedback* - after teachers have been trained there must be the follow-up to provide them with feedback to confirm the implementation of new skills gained, if not teacher may lose interest toward implementation of new skills.
6. *School policies -* if the implementation of new skills and knowledge gained in training are not aligned with school policies and plans teachers may be impeded in implementing them. Thus, collaboration amidst teachers and school leaders are necessary to close the gap and make a link between school based in-service program and school policies.
7. *Irrelevance knowledge* - if the skills gained from SBI didn’t match with specific teacher’s needs in classroom practices, the teacher faces problem of effective implementation while teaching. Effective collaboration among teachers and school leaders may eradicate those obstructions to foster effective and audacity while implementing the skills and gained in classroom practices.

## The research objectives

The overall aim of this study was to investigate successes and challenges of secondary school biology teachers’ in implementing knowledge and skills acquired throughSBI training in the Nyanza and Kamonyi Districts in Rwanda. The following specific objectives were taken into consideration in this research:

* To assess the degree to which biology teachers implement the knowledge acquired through SBI training into their teaching and learning practices.
* To assess the successes and challenges of secondary school biology teachers’ in implementing knowledge and skills gained throughSBI training.

## Methods

This section details the research design, population of the study, sampling techniques, research instruments, and issues related to their reliability and validity, data collection methods/procedures, and ethical considerations made in the study.

### Research design

The study is a case study research type, the researcher has used a survey research design that involved the collection both quantitative and qualitative data on the views from teachers related to classroom teaching after attending SBI training programs.

### Study population and sampling techniques

The study population consisted of 223 secondary schools including 102 secondary schools of Kamonyi District and 121 schools of Nyanza district in southern province of Rwanda. Probability sampling technique was used to select a sample of 21 secondary schools used in the study comprised of 10 secondary schools from Kamonyi district and 11 secondary schools from Nyanza district. These schools had in total 51 biology teachers including 21 biology teachers from Kamonyi district and 30 biology teachers from Nyanza district.

### Data collection procedures and instruments

This study was conducted among public, government aided secondary school biology teachers of southern province in Rwanda knowledgeable about SBI, since researcher was sure that those schools adopt teacher training program and there is an appropriate time reserved for CPDs. It was conducted after being ethically checked and approved by the research committee from the University of Rwanda College of Education (UR-CE). Researcher described to the Schools leaders and biology teachers about the objective of the study. Headteachers sign to acceptance of the research which is going to be done in their schools also teachers sign voluntarily the consent form confirming their participation in the study before administration of the instruments. The instrument of the study was survey questionnaire and classroom checklist. The questionnaire consisted of 23 items intended to answer the following research questions:

(a) To which degree do biology teachers implement the knowledge acquired through school based in service training into teaching and learning practices?

(b) What are the impact of school based in service training on classroom teaching and learning practices and learners’ outcomes?

(c) What are challenges that teachers face when implementing skills and knowledge gained from school based in-service training programme?

Each item of the questionnaire had graded using four Likert-scales ranging from (1) strongly disagree, (2) disagree, (3) Agree and (4) strongly agree has been administered to the teachers who provided the answer in their appropriate time. Classroom observation checklist which had been answered by the research when attending teaching session was made of 6 items rated from (1) strong, (2) some and (3) None, envisioned to ensure a concrete implementation of different skills including the use of ICT, involvement of learners in teaching through small group, classroom cooperation and collaboration and all means that encourage learners’ active participation and raising their interest in teaching activities. Researcher ensured the submission of all questionnaires from respondents. The research instruments were adopted from (Barua, 2013; Whitehurst et al., 2014) and enriched to move forward with the purpose of the study. The reliability of the instrument was run using Cronbach alpha and was at a level above .8.

### Validity and reliability of instrument

Having developed the research instruments, the researcher ensured their validity and reliability. Validity in research design help the researcher to make sure that the research instruments measure what they intended to measure. Hence, research instruments were given to experienced faculty members for review and feedback. Reliability is measurement for consistency and stable in results produced(Milligan et al., 2016; Taherdoost, 2016).

 In this study, the test-retest reliability and Cronbach's Alpha coefficient were used to check the consistency of the result from participants.

### Data analysis and presentation

Data analysis consists of examining the acquired information and making interpretations. Microsoft office excel (MS Excel) was applied to analyze data using table and pie charts and Statistical Package for Social Sciences SPSS 21.

## Results

### Demographic characteristics of participants

This section provides information regarding demographic background of the biology teachers who participated in the study. As indicated by frequency and percentages, most participants were male, teaching experience between 2 to 5 years and work in government aided day schools. Table 1 portrays the gender distribution of participants.

**Table 1 Gender distribution of participants**

|  |  |  |
| --- | --- | --- |
|  | Participants | Percent |
| Male | 28 | 55 |
| Female | 23 | 45 |
| Total | 51 | 100 |

The study comprised 51 secondary school biology teachers from 21 schools of Kamonyi and 30 of Nyanza district of southern province. Forty-five per cent (45%) of the total members were female while fifty five percent (55%) were males.

Figure 3 shows the distribution of participants by years of teaching experience in secondary school biology. Most (47%) of the teachers who participated in the study are beginning teachers; 2 (4%) have are in their first year of teaching and 22 (43%) have been teaching for not more than 5 years. Schools based in-service training is of paramount importance for such beginning teachers, it was therefore helpful to have nearly have of the participants in this category. The next group with 6-10 years’ experience constituted 37%. The more experienced teachers with above ten years teaching biology teaching experience were few and constituted only 16%.

**Table 2 Distribution of participants by type and category of schools**

|  |  |
| --- | --- |
|  | **Participants** |
| Number | Percentage |
| *Type of school* |  |  |
| Public | 21 | 41 |
| Government aided | 30 | 59 |
| Total | 51 | 100 |
| *Category of school* |  |  |
| Boarding | 19 | 38 |
| Day  | 32 | 62 |
| Total | 51 | 100 |

Source: Primary data, 2023

As indicated in Table 2, fifty-nine percent (59%) are teachers of government aided schools while forty one percent (41%) public schools, the researcher did not work with participants from private schools.

Also, with regard to category of schools, Table 2 indicates 32 (62%) teach biology in day secondary schools while 19 (38%) teach in boarding schools.

### Teachers’ perceptions about skills acquired from SBI

This part describes perceptions of Biology teachers related to SBI. Those perceptions envelope skills and knowledge gained from SBI and their implementation in classroom teaching practices. Tables 3 and 4 show the respondents agreement/disagreement to statements about skills and knowledge gained from SBI and their implementation in classroom teaching practices.

**Table 3 Percentage of teachers indicating their agreement/disagreement to statements about skills and knowledge gained from SBI**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Items  | Strongly Disagree | Disagree | Agree | Strongly Agree |
| 1. I acquired ICT, class management skills in different SBI I have attended.
 | 0 | 0 | 49 | 51 |
| 1. SBI offers an opportunity to understand biology content and translation during teaching and learning
 | 0 | 2 | 43 | 55 |
| 1. I use skills and experiences gained from my colleague to improve my teaching and Learning process during SBI training.
 | 0 | 0 | 53 | 47 |
| 1. I learn to consult my colleagues to improve teaching practice.
 | 0 | 0 | 39 | 61 |
| 1. I often use practical knowledge, methodology and experience I gained during SBI.
 | 0 | 0 | 51 | 49 |
| 1. Due to knowledge acquired in SBI, it is simple to explain meaningfully difficulty biological concepts
 | 0 | 4 | 57 | 39 |

Primary data, 2023

**Table 4 Percentage of teachers indicating their agreement/disagreement to statements about implementation of skills and knowledge gained from SBI**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Items  | Strongly Disagree | Disagree | Agree | Strongly Agree |
| 1. I use the skills from SBI in biology classroom teaching practices.
 | 0 | 4 | 57 | 39 |
| 1. The knowledge gained through in-service training program contributes positively to my professional teaching practice.
 | 0 | 0 | 51 | 49 |
| 1. I think that being trained in SBI allow me to teach differently from the other Biology teachers who are not trained during teaching.
 | 0 | 4 | 37 | 59 |
| 1. Through knowledge gained in school based in-service training, I contribute at high level in classroom control, in terms of my relationship with students?
 | 0 | 2 | 53 | 45 |
| 1. The knowledge gained through SBI improves the design and delivery of contents.
 | 0 | 4 | 35 | 61 |
| 1. School based in service training contributes to my vocational development.
 | 0 | 4 | 51 | 45 |

Primary data, 2023

The results in Table 3 shows most participants strongly agreed or agreed which signify that they acquired skills from SBI which assist them in classroom teaching. A substantial proportion, that is, 49% and 51% of teachers, who participated in the study, agreed and strongly agreed respectively, that they acquired knowledge on the use of ICT, class management skills; while 43% agreed and 55% strongly agreed that SBI offered them opportunities to understand some biology content which had enhanced their teaching and learning.

Again, 53% and 47% of teachers, who participated in the study, agreed and strongly agreed correspondingly that they use skills and experiences gained when sharing with their colleague to improve my teaching and boost retentions of learners towards learning; while 39% agreed and 61% strongly agreed that they consult their colleagues to improve teaching practice engage learners in learning activities. Moreover, 51% agreed and 49% strongly agreed that they use practical knowledge, methodology and experience from SBI to teach meaningfully compare to others.

**Table 5 Percentage of teachers indicating their agreement/disagreement to statements about impacts of teachers’ SBI skills and knowledge on their classroom teaching practices and learners’ outcomes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Items  | Strongly Disagree | Disagree | Agree | Strongly Agree |
| 1. Students are motivated by comparing how they were before I acquired skills from SBI.
 | 0 | 4 | 59 | 37 |
| 1. Learners’ interest and dispositions into biology classroom learning have been upgraded compared to before I gained skills from SBI.
 | 0 | 4 | 63 | 33 |
| 1. Mindset of learners to take biology as a difficult subject have eradicated.
 | 0 | 14 | 49 | 37 |
| 1. Students focus better when they're attending biology classes compare to before teacher acquired skills from SBI.
 | 0 | 6 | 45 | 49 |
| 1. Learners’ academic achievement has advanced compared to before I have attended SBI.
 | 0 | 10 | 47 | 43 |

Primary data, 2023

Table 4 indicate that 57% of Biology teachers who participated agree that they implement skills earned from SBI to improve biology classroom teaching practices while 39% strongly agreed. 51% agreed while 49% strongly agreed that the knowledge gained when they share with their colleague allow them to enhance retention of learners and motivation toward biology learning. Moreover, 37% of biology teachers and 59% agreed and strongly agreed correspondingly that that their participation in SBI allow them to teach differently from the other Biology teachers who are not trained during teaching. Thus, they profoundly improved the professional career. 53% agreed and 45% strongly agreed that through knowledge gained in school based in-service training they developed classroom management capability and interactive atmosphere with students. Subsequently, 35% agreed and 61% strongly agreed that knowledge they gained assist them to design and delivery of contents. Generally, from SBI teachers develop designing and planning skill of the content and strive to achieve the objective of the lesson.

Table 5 shows the proportion of teachers indicating their agreement/disagreement to statements about impacts of teachers’ SBI skills and knowledge on their classroom teaching practices and learners’ outcomes.

The results in Table 5, indicates that 59% of teachers who participated in the study agreed while 37% strongly agreed after attending SBI they innovatively develop strategies of motivating students. Moreover, 63% and 33% agreed and strongly agreed that learners’ interest toward Biology learning has been enhanced. 49% agreed and 37% strongly agreed mindset of learners to take biology as a difficult subject have eradicated since they are significantly enjoying classroom teaching practices and methods used. 45% and 49% agreed and strongly agreed that Students focus better when they're attending biology classes compare to before teacher acquired skills from SBI. Subsequently, 47% agreed whereas 43% strongly agreed that learners’ academic achievement has advanced compared to before I have attended SBI (see Table 5).

**Table 6 Percentage of teachers indicating their agreement/disagreement to statements about reasons impeding teachers’ use of SBI skills and knowledge in their classroom teaching practices**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Items  | Strongly Disagree | Disagree | Agree | Strongly Agree |
| 1. Resistance for some teachers/poor mindset
 | 8 | 25 | 49 | 18 |
| 1. Inadequate or lack of training/workshops
 | 4 | 17 | 55 | 25 |
| 1. Lack of Self -study materials like books, online tools.
 | 8 | 10 | 55 | 27 |
| 1. Resistance of school leaders to afford teachers materials needed to implement potentially the knowledge gained from SBI.
 | 8 | 26 | 49 | 26 |
| 1. Inability of teachers to use technological tools (computer, calculator, mobile phones...)
 | 14 | 18 | 53 | 17 |

Primary data, 2023

Decisively, did not only affect greatly teacher teaching skills but also improve learners’ academic performance.

### Resistance and challenges of teachers to implement what they learnt in the SBI

Table 6 provides information that impede implementation of knowledge gained from SBI in classroom practices. Resistance of teachers to shift from traditional teaching method to modern, insufficient of teaching materials, ICT illiteracy are among hinder implementation of skills gained. Table 6 shows the proportion of teachers indicating their agreement/disagreement to statements about reasons impeding teachers’ use of SBI skills and knowledge in their classroom teaching practices.

Based on a number of factors, the degree to which teachers employ Information and Communication Technology (ICT) tools and abilities during school-based in-service training programs might vary greatly. These factors include the training's quality, the teacher's motivation and technological comfort levels, the resources' accessibility, and the institution's or school's support (Mwila, 2018). Teachers' comfort and familiarity with ICT can vary widely. Some educators may embrace technology and readily integrate it into their teaching, while others may be more hesitant or resistant due to limited prior exposure (Prasad, 2015).

Table 7 shows the observed proportion of teachers demonstrating SBI training related classroom teaching experiences and practices in their lessons. In this study, it was observed that 41% of the participants used ICT in most lessons while they were teaching while 47% used it in only some of the lessons and 12% never employed it in their teaching activities. However, the transformation of Rwanda's economy from one centered on agriculture to one based on knowledge was one of the key goals of Rwanda Vision 2020. The advancement of information and communication technologies as well as the delivery of high-quality scientific and technology education skills were acknowledged as important strategies (ILO, 2023). Today, the proportion of secondary and elementary schools in the nation that have internet connectivity is around 47% and 54%, respectively. Thus, the country still has a long way to go in order to accomplish its goals, particularly, the National Vision 2050, which emphasizes that access to quality, affordable education is central to human resource development (Gatete, 2016).

**Table 7 Observed proportion of teachers demonstrating SBI training related classroom teaching experiences and practices in their lessons**

|  |  |  |  |
| --- | --- | --- | --- |
| Items  | Most lessons | Some of the lessons | None of the lessons |
| 1. Does the teacher use ICT as learned in SBI?
 | 41 | 47 | 12 |
| 1. Does teacher emphasize on small group in classroom instruction?
 | 65 | 33 | 2 |
| 1. Does teacher help learners to participate, cooperate and collaborate?
 | 75 | 24 | 2 |
| 1. Learners are Involved in sharing/planning/evaluating.
 | 51 | 43 | 4 |
| 1. Does teacher Use multiple modes of instruction, with emphasis on active learning?
 | 55 | 43 | 2 |
| 1. Does teacher Provide effective rules/routines that supported individual needs?
 | 47 | 51 | 2 |

Primary data, 2023

The findings from participants of the study revealed that 65% of teachers emphasized the use on the use of group discussions in teaching while 33% employ it sometimes in teaching and learning. Group discussion in teaching and learning is a pedagogical technique that involves a group of students coming together to engage in a structured conversation about a specific topic or subject(Lee & Martin, 2023). This conversation is related to Albert Bandura’ Vicarious learning theory which was designed to encourage active participation, exchange of skills, critical thinking and collaborative learning among group members (Bahn, 2001). Group discussions are used to foster a deeper understanding of course material, encourage critical thinking, improve communication skills, and enhance a sense of community and collaboration among students(Stenlund et al., 2017). As observed by researcher during classroom teaching practice, Teacher foster strongly collaboration and active participation of learners at 75%. Collaboration is enhanced during group discussions when exchanging fully the knowledge. Collaboration of Teachers is more efficient and effective when they participate in different continuous professional development (Bendtsen et al., 2022).

Moreover, Learners were strongly involved by the teachers in sharing/planning/evaluating at a rate of 51% as indicated in observation checklist. In the context of learning, Sharing of knowledge refers to students actively contributing their knowledge, experiences, and insights with their peers (Lin, 2020). This can occur through class discussions, group projects, presentations, or online forums. When students share what they know, it not only helps reinforce their understanding but also benefits their classmates by providing diverse perspectives.

Teachers used a strong level multiple mode of instruction in classroom practice, with emphasis on active learning at 55%. The Use of multiple modes of instruction in classroom practices with an emphasis on active learning is an effective teaching strategy that can engage students, enhance their understanding, and promote long-term retention of knowledge(Khan et al., 2017). Albert Bandura’s model of vicarious learning theory argued learners raise their classroom attention, retention when participated in teaching practice(Asakura et al., 2022). Furthermore, teachers employed strongly strategies supporting each student learning needs at 47%. Effective teachers often provide rules and routines that support individual needs in the classroom(Basham et al., 2016). These rules and routines are essential for creating a structured and inclusive learning environment where each student's unique needs can be addressed.

Overall, engaging learners in classroom teaching practices creates a positive and effective learning environment that fosters not only academic success but also the development of valuable life skills and a passion for learning.

**Discussion**

In this study 55% participants are male while 45% are female and most (47%) of them are beginning teachers (i.e., do not have above 5 years of teaching experience). Most schools used were government aided schools and day schools. Globally, the representation of women in STEM fields has been historically lower than that of men, in Africa the percentage of females studying STEM subjects vary significantly from country to country. In Rwanda it has been reported in 2018 that females accounted for around 37% of students studying science and engineering fields at the tertiary level in Rwanda that results to few number of female science teachers in secondary school(Wuyts et al., 2022). Moreover, according to observation made the experienced teachers implement more skills from SBI than others with less experience. Thus, school and educational stakeholders have to prepare SBI program for new recruited teachers in order to run up with this fruitful teaching and learning approach.

Previous researchers confirmed that teachers develop new teaching skills, gain knowledge and professional teaching competences from SBI (Friday & Ph, 2016; Hans Jorgen Knudsen, Elvira Hadzibegovic-Bubanja, Soren Nielsen, 2013; Training, 2016). In this study as indicated by higher percentages, biology teachers ensured by their strong agreement the paramount meaning of attending SBI in their teaching endeavors and professional growth.

Through Vicarious learning fostered by collaboration among teachers and strong link among teachers made from Schools based-in-service training program they learn among themselves and make them able to explain complex terms to learners(Haro Soler, 2019; Mayes, 2015). This is indicated in table3 where a number of participants strongly agreed the positive impact of SBI in their teaching, it help them to improve and make a meaningful teaching and learning. 59\* attested that they become new in their teaching and thought they are different from the other Biology teachers who are not trained during teaching while 61\*strongly agreed that the knowledge gained from SBI improve the design and delivery of contents.

Most of teachers strongly agreed and agreed that they teach nicely in comparison to before attending and enhancing skill from SBI. This is agreement with vicarious learning theory which attested that through social collaboration, teachers learn how to teach and develop the best way of teaching when they interact(Haro Soler, 2019; Mayes, 2015).

Through SBI teachers strongly agreed and agreed consistently at high percentage that they developed classroom management Skills, motivate leaners, eradicate misconceptions of learners and improve learners’ academic achievement. These biology teachers are in agreement with (Saito et al., 2006) who raised mathematical teaching capability , learners lifelong learning and outcomes after attending School based in-service training workings . Moreover, skills gained from SBI assist teacher to consistently and strongly use ICT, small group, involve learners and share and arouse learners learning attentiveness as indicated in table 6 where 41\* and 47\* uses strongly and sometimes ICT in teaching.

Different studies demonstrated that, the use of ICT in teaching and learning, teaching through group discussions and collaboration, supporting each learner individually and relating content with the real life experiences are amidst skills that teachers gain from SBI(Hans Jorgen Knudsen, Elvira Hadzibegovic-Bubanja, Soren Nielsen, 2013; Saito et al., 2006; Training, 2016). Researcher informs the teacher before visiting them in classroom teaching and visited them two times for every teacher. In the first classroom observation every teacher has informed however, for the second classroom observation, they were visited randomly to ensure consistency implementation of such skills gained from SBI. As indicated in table 6, teachers generally implement strongly skills at higher percentage gained and improve quality of teaching and raise learners’ academic scores.

Though, the advantages played by SBI in classroom teaching practices the implementation of knowledge and competences gained continues to be burdened by resistance of teachers to adopt a new teaching approach as agreed in high percentages in table 5, those burdens that hinder effective use of skills gained from SBI are confirmed by (Nawab, 2017) who observed that inadequate training, scarcity of time, resistance of school leaders to afford the needed materials required to implement effectively, and efficiently skills gained from SBI impede the use of skills and knowledge gained in classroom practices.

## Conclusion and Recommendation

Educational experts have underlined benefits of School based in service training program on teachers’ classroom teaching and learners learning. The findings from this study displayed that there are scarce of training program like seminars and works shop related to school based in-service training program. The findings also showed that attending schools-based training program boost Biology teachers teaching skills, confidence and learners’ academic performance. Furthermore, the findings indicated that numerous challenges associated to schools based in service and translation of knowledge acquired in classroom teaching practices include insufficient resources that facilitate them to entirely use the knowledge and skills, resistance of teachers to change from old teaching to modern teaching approaches.

Based on these findings, more efforts should be implemented to ensure enough school based in-service training among schools and afford enough teaching materials that support teachers to translate profoundly the skill and knowledge gained into classroom teaching practices.

**Recommendations**

SBI training helps teachers to improve their teaching capability and learners’ outcome and consequently, leads to improved quality of education. To achieve this, it is recommended that the Ministry of Education and Rwanda Basic Education Board:

* must provide adequate support to secondary schools in order to sustain teachers’ efforts to engage in continuous professional development through SBI training;
* should encourage school leaders to increase the number of SBIs and other training that build capacity and capability of teachers;
* should collaborate with schools to ensure that teachers have enough teaching materials including ICT tools so that they can translate the knowledge and skills gained from SBI training to classroom practices.

It is also recommended that school administrators create the enabling environment for teachers to engage in regular SBI training to support each other and design instructional materials, as well as supervise them in the implementation of SBI training related classroom teaching experiences and practices in their lessons. Finally, it is recommended that teachers should be made to change their mindset in order to see regular attendance of SBI training as very necessary for their professional growth.

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