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Teachers' Perceptions of Ibox Use for Integrated Science Lessons in Secondary Education Improvement Project Schools

Joshua Awuni[1] and Ezekiel Akotuko Ayimbila[2]
[1]Bongo Senior High school, Science Department, Bongo, Ghana
Corresponding author: awunijoshua@yahoo.com
[2]School of Science, Mathematics and Technology Education, C. K. Tedam University of Technology and Applied Sciences, Navrongo, Ghana
Co-author: ezekielakotuko@gmail.com

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ABSTRACT

The study sought to determine the level of use of iBox by integrated science teachers in the initial Secondary Education Improvement Project (SEIP) supported Senior High Schools in the Upper East Region of Ghana. This research tested teachers' perceptions such as Computer Self Efficacy (CSE), Perceived Ease of Use (PEoU) and Perceived Usefulness (PU). The study employed a cross-sectional survey research design. Out of the 162 participants sampled, 155 questionnaires were fully completed and validated. Data analysis procedures included frequencies, percentages, crosstabs and chi-square tests. The results of the study indicated a statistically significant association between CSE and iBox utilisation and integration in science lessons. The results also showed a significant relationship between PEoU and iBox utilisation by teachers. Integrated Science teachers indicated a high PU but a statistical analysis revealed no significant association between PU and iBox use for science lessons. It was recommended among others that the GES and the SEIP to provide regular in-service training in information technology for integrated science teachers. It was suggested that future research be carried out on the differential perceptions of rural and urban SHS integrated science teachers of the benefits associated with iBox utilisation.

Keywords : Perception, Technology Integration, Integrated Science, iBox

I. INTRODUCTION

Instructional technology has become compelling component that has impacted many aspects of classroom experiences at the second cycle level of the countries educational system (Sarfo, Amankwah, Oti-Agyen, & Yidana, 2016). Hence the impact of instructional technology over the past few decades has become huge. The manner in which these fields operate today is very much in variance with the ways they operated in the past because of the rapid growth of technology (Yidana, 2009). However, a critical review of technology integration in education in Ghana, indicates that there is an inadequate influence

and far less change than other fields have experienced. Boni (2018) noted that students and teachers are not fully confident and creative enough to use ICT for teaching and learning. Boni however identified some current knowledge gaps pertaining to the barriers and strategies of technology integration in Ghana. Education is one of the most important investments in building human capital resources of the country (Ministry of Education, 2018)and it makes Ghana technologically innovative and a good path to economic growth. Rapid increase and improvement in information technology have led to the flow of technology into education. It is noted that most teachers agree to the positive effect the use of instructional technology has on how students learn and participate in classroom (Asiedu-Addo, Apawu, & Owusu-Ansah, 2016).

All educational levels in Ghana are becoming increasingly pressured to integrate technological tools in lesson delivery and demonstrations. There is no doubt that educational reforms have placed greater emphasis on Information and Communications Technology (ICT) and Science and Technology to the new curriculum (Adu-Gyamfi, Donkoh, & Anim, 2016). This is to equip learners with the sufficient knowledge and skills that they require in the 21st century (Yidana, 2009). Their application is also suggested by many scholars as imperative for enhancing quality in teaching and learning. According to Sarfo et al. (2016) over the past decades, teachers and educational systems in Ghana regarded the use of information and communications technologies as an important tool for improving the effectiveness of teaching and learning with low application in classroom management and assessment. Yidana (2009) also stated that the use of ICT for educational purposes yields positive outcomes on the part of the students such as increased motivation, active learning, providing efficient resources and better access to information. Yidana further posited that with motivation it enhances learners' attention and quest for knowledge and that assessment is more authentic and transparent. Technology has great potential to increase learners' motivation, link learners to various information sources, support collaborative learning, and allow teachers more time for facilitation in classrooms (Gebremedhin & Fenta, 2015). Technology and collaborative teaching are important ingredients that help students to develop self-confidence in learning and enhancing their understanding of scientific concepts (Amedeker, Antwi, & Hanson, 2011)

Sarfo et al. (2016) stated that in the wake of technology pluralism, educational practitioners, particularly teachers, have no other choice than to learn and adopt ICTs in their routine work. They further mentioned that much deployment of ICT could be realised in schools based on the competence of teachers and this should not be over-emphasized. The major barriers observed were low confidence, inadequate competence and unavailability of requisite resources. Since low confidence, competence and accessibility have been found to be the vital components of technology integration in secondary schools. Information technology resources comprising hardware and software, improved professional development, adequate time and technical backstopping for in-service teachers are indispensable for technology integration. A comprehensive amalgamation of all these, is necessary for good teaching. However, the availability of all these components increases the tendency for excellent integration of technology in teaching and learning. Therefore, second cycle school teachers collectively agree that ICT has the potential to improve student learning outcomes and effectiveness if it is properly implemented (Innovation Unit, Aga Khan Education Services and the Aga Khan Foundation, 2018). If educational technology is implemented under the appropriate conditions, including suitable sources, training methods and access to technical support, it can result in meaningful outcomes on teaching and learning. The outstanding factor that affects the achievement of students is not the availability of

technology but the pedagogical design for effective use of instructional technology.

The SEIP is expected to provide connectivity to 125 SHS. The pedagogical rationale is that the (i-campus and iBox) programme ensures all students have access to model teachers, can view laboratory demonstrations, are taught complex concepts in a simplified manner and receive simultaneous education regardless of location (Gebremedhin & Fenta, 2015). Though the SEIP program is a perfect blueprint, technology evolves at a startling rapid rate. Therefore, it is very critical to assess the perception of teachers towards i-box integration in teaching and learning Integrated Science among some selected SEIP schools in Ghana.

1.1 Statement of the Problem

Cullen, Mallet and Murphy (2019) indicated that the greatest challenge faced by the Centre for National Distance Learning and Open Schooling (CENDLOS) was the limited take up of the iBox materials. The report noted that in schools where there was an iBox with materials available to support learning and teaching, students and teachers were not using them to the extent to which it was envisaged. Preliminary assessment of the nine (9) SEIP schools in the Upper East Region also revealed a low usage of the iBox in teaching integrated science lessons.

1.2 Purpose of the Study

The purpose of this study was to investigate teachers' perceptions regarding the use of iBox for integrated science lessons in SEIP schools in the Upper East Region of Ghana.

1.3 Specific objectives of the Study

1. To determine the relationship between the teachers' perceived Computer Self Efficacy (CSE) and iBox use among the integrated science teachers.
2. To ascertain the relationship between the teachers' Perceived Ease of Use (PEoU) of iBox and its use among the integrated science teachers.
3. To find out the relationship between the teachers' Perceived Usefulness (PU) of iBox and its use among the integrated science teachers.

1.4 Research Questions

The following research questions were addressed in the study:

1. What is the relationship between the teachers' perceived Computer Self Efficacy and iBox use among the integrated science teachers?
2. What is the relationship between the teachers' Perceived Ease of Use of iBox and its use among the integrated science teachers?
3. What is the relationship between the teachers' Perceived Usefulness of iBox and its use among the integrated science teachers?

1.5 Research Hypotheses

1. Ho: There is no relationship between teacher's perceived Computer Self Efficacy and iBox use in integrated science lessons.
2. Ho: There is no relationship between teacher's Perceived Ease of Use of iBox and its use in integrated science lessons.
3. Ho: There is no relationship between teacher's Perceived Usefulness (PU)

II. Literature and Theoretical Underpinning

2.1 The iBox

The iBox device acts as a local file server. It contains a quad core processor and the current versions have 2 terabytes of local storage (Secondary Eduation Improvement Project [SEIP], 2014). The iBox is a Local Area Network (LAN) server that provides educational content for both teachers and students within the environs of selected SEIP schools. However, the i-campus is an online version of the iBox allowing students and teachers to share their classroom experiences across the country. They both host teaching notes, laboratory simulations, test items, mailing service and self-practice modules. The iBox project will run over the period of October 2014 to November 2019 (SEIP, 2014).

The World Bank (as cited by Cullen et al., 2019) stated that iBox deliver pre-prepared video lessons, student exercises and content assessment to SHS students and teachers. The report mentioned that independent verification indicated that the technology was not being adequately used by students and teachers in many schools that still lacked the infrastructure such as computer labs to access the content. The current educational policy prohibiting cell phones and/or tablets further prevented students from accessing the iBox on their personal devices.

Secondary schools with iBox and televic classrooms are equipped with computers, printers, instructional software, electronic references, video players, overhead projectors and LED televisions (SEIP, 2014). The iBox is installed into the ICT laboratory in each school as a heavy-duty box fixed inside a custom-made cage on a wall as shown in figure 1

Figure 1: iBox installed in a senior high school (Cullen, Mallett, & Murphy, 2019).

The iBox does not rely on access to the internet to function. It can accommodate up to 100 hard-wired or wi-fi enabled users at a time, though the reach depended to a certain extent on precisely where it is located and the configuration of rooms around it. Its advantages were that a school needed only laptops, desktops, tablets or smartphones to access the content, removing the need for an expensive or unreliable connection to the internet. The iBox as a local server gave complete control over content and it was only the materials created and installed under the direction of CENDLOS which were loaded **(Cullen, Mallett, & Murphy, 2019)**. This does mean that adding and updating materials involves physical access to the machine. So far, this is being carried out on an annual basis. CENDLOS has also developed a web-based access to iBox content via icampus https://icampusgh.com. However, this would entail access to the internet for users. Access to the materials whether located on the iBox or on the icampus website is restricted and necessitates a login credentials **(Cullen, Mallett, & Murphy, 2019)**.

2.2 The Content of the iBox

According to Cullen, Mallet and Murphy (2019), CENDLOS has developed materials in the core SHS subjects of mathematics, English language, integrated science and social studies. It has also developed materials in the elective sciences (physics, chemistry and biology), in all cases drawing on the expertise of curriculum developers, SHS subject leaders and university academicians to create curriculum-relevant SHS science lessons. The lessons are primarily aimed at the students, though the lesson notes at the beginning are equally appropriate for the teacher. The iBox contains lesson notes, lesson videos, interactive activities and module quizzes in integrated science, physics, chemistry, biology and core mathematics which can be accessed remotely by students and teachers via a wifi.

2.4 Introduction of ICT in Education

The Ministry of Education (MOE) and the Ghana Education Service (GES) have introduced Information and Communications Technology (ICT) into schools via different courses of action (Ministry of Education, 2018). The application of information and technology is underpinned by (Adarkwa, 2018) as a necessity for improving quality in teaching and learning. The MOE and the GES have also made huge investments in ICT with the hope of achieving the goal of improving the quality of education through enriching the learning environment with the support of educational software, hardware and technologies. Integrating educational

technology training into all levels of pre-tertiary education and attempting to provide teachers and student with access to computer-based equipment and information sources are among the objectives of the Ghana Education Service. SEIP through the MOE/GES launched the i-campus and i-Box alongside other governmental interventions in an attempt to integrate technology into mainstream classroom experiences. One of such interventions by government is the Televic. Though the Televic has received less attention due to its low coverage in pre-tertiary schools, it is a powerful educational tool that seeks to integrate technology fully into classroom activities (Verbeke, 2018).

2.5 Technology Integration in the Classroom

Some researchers in Ghana have reported that technology integration in the classroom will not only make students familiar with the practical application of technology that is essential years later after school but it had the benefit of improving students' active participation during lesson delivery **(Agyei, 2013; Darko-Adjei, 2018; Sarfo, Amankwah, Oti-Agyen, & Yidana, 2016)**. It is obvious that enhancing students' engagement can result in an increase in their performance. Karbo **(2009)** showed that there are numerous challenges impeding technology integration in Ghana. Notable among these challenges are the inadequate information and communications technology related resources; inadequate training of teachers in computer proficiency and inadequate support from the Ministry of Education and the Ghana education service toward ICT integration in the classroom. It is therefore evident that the availability of facilities and services play crucial role in integrating ICT in classroom experiences.

Research conducted by Yeboah (2016) using closed ended Likert-type questionnaire, revealed that most Information and communications Technology teachers were holders of first degree which is a requirement for teaching senior high schools in Ghana. The research unearthed that teacher required regular in-service training especially for those who teach ICT. The findings identified inadequate infrastructure for teaching and learning ICTs in the various senior high schools.

Wejnert (2002) outlined six factors relating to the individual actor that influence adoption of technology in teaching. Aligning Wejnerts findings to the context of the iBox, it would be the secondary school of which the integrated science teacher is a member, how familiar the teacher is with the iBox technology, the status or position occupied by the science teacher in the school, the socioeconomic characteristics of the teacher, the teachers' perception regarding social networks and some personal characteristics of the teacher. All these factors have direct bearing on the use of the iBox among some teachers in the study area.

2.6 Perceived Ease of use and Behavioural Intention

It is expected that experience will moderate the effect of perceived ease of use on behavioural intention such that the effect will be weaker with increasing experience (Venkatesh & Bala, 2008). Davis (1986) stipulated that perceived ease of use, that is, how easy or difficult a system was to use, is an important obstacle for individuals while using a system. Nevertheless, once individuals get familiar with the system and gain practical experience with the technology, the effect of perceived ease of use on behavioural intention will reduce gradually when individuals gain additional procedural knowledge about how to use the technology.

2.7 The Social Cognitive Theory (SCT)

The relevance of PEoU is supported by Bandura's (1982) theory of self-efficacy which was defined as "judgement on how well one can execute courses of action required to deal with prospective situation" (Bandura, 1982, p. 122). The SCT defines human behaviour as a triangular, dynamic and reciprocal interaction of certain factors. These aspects comprise personal factors, behaviour and the environment.

According to Bandura's theory, an individual's behaviour is distinctively determined by each of these three factors. While the SCT upholds the behaviourist theory that response consequences mediate behaviour, it contends that behaviour is largely regulated by the precursor cognitive processes (Al-Mamary, Al-nashmi, Hassan, & Shamsuddin, 2016). Bandura's theory makes a distinction between self-efficacy judgments from outcome judgments. The latter is mainly concerned with the extent to which behaviour, once successfully executed, is believed to be linked to valued outcomes. Bandura's "outcome judgment" variable is similar to perceived usefulness (Davis, 1986).

2.8 Conceptual Framework of the Study

The concept of the study below is adopted in this research to guide in the various steps. As shown in Figure 2, the teacher perception is categorised into; perception of ease of use, perception of usefulness and perception of computer self-efficacy. All these three factors have direct influence on the integration of iBox in the science classroom.

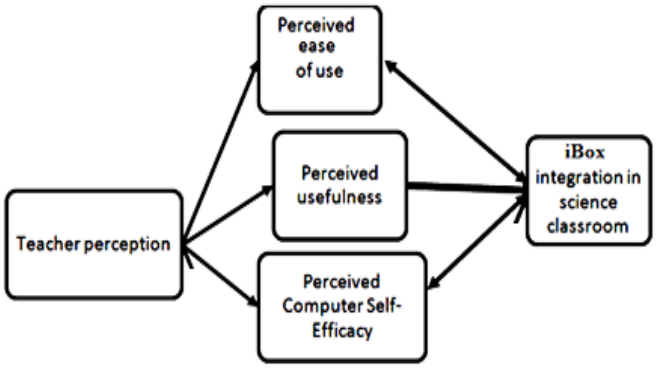

Figure 2 : Teacher perception regarding technology integration in science classroom

III. Methodology

3.1 Design of the Study

The research design adopted in this study was a cross-sectional survey. This research focused on determining teachers' perception towards iBox use in teaching integrated science. Hence, the use of cross-sectional survey method. Cross-sectional survey as a study in which a sample of a population at a single point in time is adopted for the research. The participants in a cross-sectional study are selected based on the inclusion and exclusion criteria set for the study (Setia, 2016). Cross-sectional survey method is less expensive. This methodology allows for the collection of a large amount of data from a sizeable population in a very economical manner. Again, the limited time scale for the research made the cross-sectional survey approach appropriate. Moreover, the approach allowed for the investigation of a particular phenomenon, perception of teachers towards iBox use in teaching integrated science, to some depth in a short time. A major disadvantage of the cross-sectional method is that chance differences between samples may seriously bias the results. However, the large sample size in this study mitigated the problem of chance.

3.2 Study Area

This research was conducted in the Upper East Region of Ghana.

3.3 Population

There are 125 initial SEIP schools in Ghana who benefited from the iBox project and 9 of these schools are located in Upper East Region. The arrangement was to select integrated science teachers from both track gold and green. The total number of teachers targeted per each track of the 125 senior high schools is 9 making a total of 18 for both tracks. Therefore, the target population of the study comprised 18 teachers drawn from both track gold and green for each senior high school making a total of approximately 2,250 integrated science teachers for all SEIP schools in the country.

3.4 Sampling Procedure

The non-probability sampling technique was adopted to obtain the sample. The Upper East Region was selected for this study and narrowed down to only the

nine (9) SIEP senior high schools in the region. The purpose was to target track gold and green integrated science teachers in senior high schools who had access to the iBox facilities. An estimated number of nine (9) participants per track were included in this study. The total number of teachers who were therefore eligible to be included in this study sample was eighteen (18) teachers per school. The total number of participants was therefore hundred and sixty-two (162) with access to iBox facilities in the UER. Out of the total number of 162 participants, 27 of them comprised one (1) school top management officer (Headmaster or Assistant headmaster) and two (2) ICT/iBox coordinators. This implied three (3) participants from each of the nine (9) schools made up to a total of twenty-seven (27) of the 162 participants.

3.5 Instrumentation

The main instrument used in this study was questionnaire.

3.5.1 Questionnaire

The main source of data collection strategy adopted in this study was the use of questionnaire. The questionnaire was sent to each individual in the sample, with a request that they completed and returned it by a given date. With questionnaire, it was possible to include a larger number of respondents and to reach out to respondents in more diverse locations than it was practical with the interview. The questionnaire had the advantage of guaranteeing confidentiality or anonymity, thus perhaps eliciting more truthful responses than would be obtained with a personal interview. The questionnaire also eliminated the problem of interviewer bias. The disadvantage of the questionnaire was the possibility of respondents misinterpreting the questions.

IV. Results and Findings

Research Question 1 :

What is the relationship between the teachers' perceived Computer Self Efficacy and iBox use among the integrated science teachers?

Table 1 : Teachers' Perceived Computer Self Efficacy

Variable	VG		G		S		P		VP	
	F	%	F	%	F	%	F	%	F	%
Ability to effectively use a computer	15	9.7	29	18.7	18	11.6	60	38.7	33	21.3
Use of new computer software programs with a minimum of effort	20	12.9	14	9.0	15	9.7	65	41.9	41	26.5
Confidence with the keyboard and mouse usage in computer applications	10	6.5	28	18.1	41	26.5	43	27.7	33	21.3
Ability to type, edit and format lesson plan on Microsoft word application using computer.	11	7.1	30	19.4	19	12.3	59	38.1	36	23.2
Knowledge in the use of Microsoft Powerpoint, Excel, and office picture manager	14	9.0	29	18.7	27	17.4	61	39.4	24	15.5

Proficiency in the use of computer and related applications	15	9.7	24	15.5	23	14.8	59	38.1	34	21.9
Speed in using computer to typeset end of semester questions	10	6.5	30	19.4	30	19.4	59	38.1	26	16.8
Capability in using computer to play music, watch movies and perform other multimedia functions	7	4.5	56	36.1	17	11.0	56	36.1	19	12.3

Key: *VG=Very Good, G=Good, S=Satisfactory, P=Poor, VP=Very poor*

Available statistics showed that a high number 111 (71.6%) of respondents had satisfactory to poor ability to effectively use a computer as indicated in table 1. This is however further substantiated by the high number of respondents who agreed to their inability to use new computer software program, low confidence in using computer keyboard and inability to type, edit and format lesson plan on Microsoft word application using computer. Teacher's responses also point towards a consistent high average that is over 50% of them affirmed to their inability to use Microsoft Power point, Excel, and Office Picture Manager, low proficiency in the use of computer and related applications, low speed in using computer to typeset End of Semester Examination questions and inability to use the games and multimedia features of computers.

Table 2 : Frequency of iBox Integration and Teacher's Perceived CSE

	Computer Self Efficacy (CSE)					
Number of times iBox is integrated in science lesson	**VG**	**G**	S	P	VP	Total
Nil	46.7%	82.8%	94.4%	88.3%	87.9%	83.9%
Once a week	13.3%	6.9%	5.6%	1.7%	12.1%	6.5%
Twice a week	0.0%	10.3%	0.0%	10.0%	0.0%	5.8%
More than twice a week	40.0%	0.0%	0.0%	0.0%	0.0%	3.9%
Total	15	29	18	60	33	155
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Key: VG=Very Good, G=Good, S=Satisfactory, P=Poor, VP=Very poor

From Table 2, descriptive statistics using crosstab showed a high percentage, 83.9% of respondents failed to integrate and use the iBox in their lessons in class. Although a good number 46.7%of the 15 respondents agreed to exhibiting very good ability to effectively use a computer, they however failed to use and integrate the iBox in their lessons in class. It is also evident that moderate number of respondents 40.0% of the 15 respondents who indicated they had very good computer self-efficacy, actually integrated iBox in their lesson for at least twice or more times a week.

Testing of Null Hypothesis 1

Ho: There is no relationship between teacher's perceived Computer Self Efficacy and iBox use in integrated science lessons.

Table 3 : Chi-Square Tests of CSE and iBox use in integrated science lessons

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	70.509[a]	12	.000
Likelihood Ratio	46.613	12	.000
Linear-by-Linear Association	15.554	1	.000
N of Valid Cases	155		

a. 15 cells (75.0%) have expected count less than 5. The minimum expected count is .58.

A chi-square test of independence in Table 3, showed that there was a significant association between frequency of iBox use in teaching integrated science and the teachers' computer self-efficacy, X^2 (12, N= 155) = 70.5, p = .001. Therefore, the null hypothesis is rejected. For that reason, there is a relationship between teachers' Computer Self Efficacy (CSE) and iBox integration and use in integrated science classroom. This finding is in conformity with TAM3 tools (Venkatesh & Bala, 2008). The TAM3 model posits that Computer Self Efficacy is moderated by Perceived Ease of Use (PEoU) which influences Behavioural Intentions and Use Behaviour. That is teachers will tend to integrate and use a new educational technology depending on their previous competency in basic computing.

Research Question 2

What is the relationship between the teachers' Perceived Ease of Use of iBox and its use among the integrated science teachers?

Table 4 : Integrated Science Teacher's Perceived Ease of Use of iBox

Variable	VE		E		NED		D		VD	
	F	%	F	%	F	%	F	%	F	%
How is the accessibility of the iBox wifi on devices (e.g., smart phone, laptop, palmtop etc.)?	4	2.6	3	1.9	22	14.2	61	39.4	65	41.9
How do you assess your ability to create a user account on the iBox?	9	5.8	6	3.9	14	9.0	53	34.2	73	47.1
How do you assess your ability to download subject-based content on the iBox without assistance?	8	5.2	12	7.7	23	14.8	43	27.7	69	44.5

How easy or difficult is it for you to create students account on the iBox?	10	6.5	9	5.8	20	12.9	57	36.8	59	38.1
How do you grade your ability to access the mailing system, send messages, assignments and make announcement?	3	1.9	7	4.5	15	9.7	61	39.4	69	44.5
What is your perceived ease of use of iBox?	13	8.4	10	6.5	24	15.5	55	35.5	53	34.2

Key: *Very Easy =VE, Easy=E, Neither Easy nor Difficult=NED, Difficult=D, Very Difficult=VD*

This aspect of the questionnaire focused on the accessibility and ease of use of iBox in the science classroom at the various senior high schools in the region. It was evident from records shown in Table 4 that most of the teachers 126 (81.3%) confirmed to it being difficult to very difficult in accessing the iBox through wifi on devices such as smart phones and laptops. The table also depicts a high frequency of respondents 108 (69.7%) perceived iBox to be difficult to integrate and use in their lessons. The results generally shows that a high percentage of the respondents affirmed to the fact that integrated science teachers perceived iBox to be difficult to very difficult in its use in the science classroom.

Table 5: Frequency of Utilisation of iBox and PEoU

	Teacher's Perceived Ease of Use of iBox					
Number of times iBox is integrated in science lesson by teachers	**VE**	**E**	**NED**	**D**	**VD**	**Total**
Nil	46.2%	60.0%	95.8%	89.1%	86.8%	83.9%
Once a week	7.7%	10.0%	0.0%	5.5%	9.4%	6.5%
Twice a week	0.0%	30.0%	4.2%	5.5%	3.8%	5.8%
More than twice a week	46.2%	0.0%	0.0%	0.0%	0.0%	3.9%
Total	13	10	24	55	53	155
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Key: *Very Easy =VE, Easy=E, Neither Easy nor Difficult=NED, Difficult=D, Very Difficult=VD*

A crosstab analysis of data as shown in Table 5 portrays a significant percentage of respondents 86.8% of 53 respondents who indicated iBox was very difficult to use, also did not integrate or use it in their science lessons. A moderate percentage of respondents that is 46.2% of the 13 science teachers who perceived iBox to be easy to use integrated iBox in integrated science lessons for at least twice or more times in a week. Also, of the 13 respondents 46.2% of them did not integrate it in their science lessons.108 (69.7%) of the 155 respondents perceived iBox to be difficult or very difficult to use and actually did not frequently use it in their science lessons.

Testing of Null Hypothesis 2

Ho: There is no relationship between teacher's Perceived Ease of Use of iBox and its use in integrated science lessons

Table 6 : Chi-Square Tests of PEoU and iBox use in integrated science lessons

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	82.991a	12	.000
Likelihood Ratio	44.867	12	.000
Linear-by-Linear Association	23.726	1	.000
N of Valid Cases	155		

a. 15 cells (75.0%) have expected count less than 5. The minimum expected count is .39

A chi-square test of independence showed that there was significant association between frequency of iBox use in teaching integrated science and the teachers' perception of the Ease of Use of iBox X^2 (12, N = 155) = 83.0, p = .001 as indicated in table 6. Hence the null hypothesis is rejected. The research therefore revealed a significant relationship between integrated science teachers' Perceived Ease of Use (PEoU) of iBox and its use in the classroom. This finding was consistent with that of Nair and Das (2012)who stated that Perceived ease of Use (PEoU) was found to positively affect teachers' attitude towards computer use and PEoU had a significant effect on Perceived Usefulness as well.

Research Question 3

What is the relationship between the teachers' Perceived Usefulness of iBox and its use among the integrated Science teachers?

Table 7: Perceived Usefulness (PU) of iBox

Variable	SD		D		N		A		SA	
	F	%	F	%	F	%	F	%	F	%
Integrating and using iBox in my class improves my overall performance as a teacher	17	11.0	22	14.2	33	21.3	73	47.1	10	6.5
I am unable to cover integrated science content within a semester if I integrate iBox in my class	17	11.0	88	56.8	20	12.9	23	14.8	7	4.5
I am able to assess student's performance quickly with iBox than with paper and pen test	13	8.4	17	11.0	21	13.5	41	26.5	63	40.6
I perceive iBox to be Useful for lesson delivery	12	7.7	14	9.0	16	10.3	40	25.8	73	47.1
Students' test achievements improve when iBox is integrated in science classroom.	12	7.7	14	9.0	77	49.7	29	18.7	23	14.8

Key: Strongly disagree=SD, Disagree=D, Neutral=N, Agree=A, Strongly agree=SA

Field data from questionnaire administered to respondents depicts an almost evenly distributed response on the item regarding improvement of teachers' performance in instructional delivery as depicted in table 7. A slightly higher percentage of respondents 83(53.6%) "Agreed" and "Strongly Agreed" to that item in the questionnaire. A similar trend is observed on the item relating to integrated science content coverage, assessment of student's

performance and student's test achievement improving with iBox use and integration. A greater number of respondents 113(72.9%) agreed and strongly agreed to iBox being useful for lesson delivery.

Table 8: Teachers' Perceived Usefulness (PU) of iBox and Frequency of use

Number of times iBox is integrated in science lesson by teachers	Teacher's Perceived Usefulness (PU) of iBox					
	SD	**D**	**N**	**A**	**SA**	**Total**
Nil	100.0%	92.9%	81.3%	80.0%	82.2%	83.9%
Once a week	0.0%	0.0%	12.5%	10.0%	5.5%	6.5%
Twice a week	0.0%	7.1%	6.3%	5.0%	6.8%	5.8%
More than twice a week	0.0%	0.0%	0.0%	5.0%	5.5%	3.9%
Total	12	14	16	40	73	155
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Key: Strongly disagree=SD, Disagree=D, Neutral=N, Agree=A, Strongly agree=SA

Observing from the data analysed in Table 8, a significant number of respondents 73 strongly agreed to the usefulness of iBox but however a large percentage of 82.2% of the 73 respondents did not integrate nor use it in their lesson delivery. A low figure of 5.5% of the 73 respondents strongly agreed to the usefulness of iBox and actually used and integrated it twice or more times in a week. Only 12 of the respondents strongly disagreed to the usefulness of the iBox however all of them 100% did not integrate or use the iBox in their lessons.

Testing of Null hypothesis 3

Ho: There is no relationship between teacher's Perceived Usefulness (PU) of iBox and its integration and utilization in integrated science lessons.

Table 9 : Chi-Square Tests of PU of iBox and its integration and utilization in integrated science lessons.

	Value	**df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	7.261[a]	12	.840
Likelihood Ratio	10.855	12	.541
Linear-by-Linear Association	2.845	1	.092
N of Valid Cases	155		

a. 15 cells (75.0%) have expected count less than 5. The minimum expected count is .46.

A chi-square test of independence, table 9, showed that there was no significant relationship between frequency of iBox use in teaching integrated science and the teachers' perception of the Usefulness of iBox X^2 (12, N = 155) = 7.3, p = .840. The researcher therefore failed to reject the null hypothesis. There is no relationship between teachers' perception about the usefulness of the iBox and its utilisation and integration in integrated science classroom. This was in variance with the findings of (Nagy, 2018) whose results confirmed that perceived usefulness, attitude, and internet self-efficacy had a direct effect on video usage. However, Nair and Das (2012) found PU to have insignificant effect or negative effect on the Attitude towards technology usage.

V. Discussion

The first research question was aimed at ascertaining the relationship between the teachers' perceived Computer Self Efficacy (CSE) and iBox use among integrated science teachers. It was found out that there existed a statistically significant association between teachers' CSE and iBox use for integrated science lessons and hence the null hypothesis was rejected. Teachers who agreed that they had good CSE tend to use the iBox more than teaches who disagreed to having good CSE. Teachers who therefore had good CSE integrated and used the iBox during integrated science lessons. The findings under this research question were in conformity to the proposition of the TAM3.

The second research question was to find out if there was relationship between teachers Perceived Ease of Use (PEoU) of iBox and its use for integrated science lessons. The available data confirmed a statistically significant relationship between teachers' PEoU and the use of the iBox for integrated science lessons and therefore the null hypothesis was rejected. Teachers who perceive the iBox to be very easy to use tend to use the iBox more frequently than teachers who thought otherwise. The results obtained from the data analysed regarding this research question was consistent with the TAM3 posits.

The third research question was raised to determine whether there is a relationship between teachers' Perceived Usefulness (PU) of iBox and the use of the iBox for integrated science lessons. The teachers' PU for the various schools under SEIP was found to have no statistically significant association with iBox use for integrated science lessons. The researcher therefore failed to reject the null hypothesis. Regardless of teachers' acceptance of usefulness of the iBox, the majority of teachers did not integrate nor use the iBox during their science lessons.

5.1 Educational Implication and Practice

This study would add onto knowledge by providing new evidence about ICT use among integrated science teachers in Ghana. The results of this study will add on to the existing body of research regarding iBox implementation in the classroom which is relatively new and has received limited attention among secondary school teachers and students.

1) 5.2 Suggestions for Future Research

This study was cramped by time and finances. There is the need to carry out further and more comprehensive studies of the iBox in the following aspects;

i. Gender issues in the integrated science teacher's utilisation of the iBox for science lessons.
ii. The differential perceptions of rural and urban SHS integrated science teachers of the benefits associated with iBox utilisation.

VI. CONCLUSION

The GES through the SEIP setup the iBox with uploaded modules for four core subjects; English, Mathematics, Integrated Science and Social Studies for SHS1, 2 and 3. The iBox is an interactive platform which relies on internet connectivity for schools to be able to communicate with each other regarding modules. The result from this study pointed to the fact that the majority of integrated science teachers within the study area do not integrate and use it during lessons. Teachers widely held low CSE, perceived iBox to be difficult to use and accepted that it is a useful technological tool for teaching and learning.

Data Availability

The statistical data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that there are no conflicts of interest in carrying out of this study.

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Appendix

Questionnaire

The purpose of this survey is to assess teachers' perceptions of iBox use for integrated science lessons in SEIP schools of Upper East Region. This questionnaire is basically administered for academic purposes and respondents are assured of privacy and confidentiality

Participation is completely voluntary and you may discontinue participation at any time. Your implied consent is recognized by your completion of this survey.

BACKGROUND CHARACTERISTICS OF RESPONDENTS

(*Kindly Tick by Right-Mouse clicking*)

1. Sex of Respondent

☐ Male ☐ Female

2. Age of respondent

☐ Under 30 ☐ 31 - 40 ☐ 41-50 ☐ Over 50

3. Educational level of respondent:

☐ HND ☐ First Degree ☐ Second Degree ☐ Other (Specify)

4. Number of years with GES:

☐ 1-5yrs ☐ 6-10yrs ☐ Over 10yrs

5. Number of years in your current school [ ] 1-5yrs [ ]6-10yrs [ ] Over 10 yrs

☐ 1-5yrs ☐ 6-10yrs ☐ Over 10yrs

6. What is/are your position in the school?

☐ ibox/ICT coordinator

☐ Head of Department

☐ Integrated Science Teacher

☐ Senior school management

7. How many periods do you teach in a week (If you are a subject teacher)

☐ 3-9 Periods per week

☐ 10-16 Periods per week

☐ 17-22 Periods per week

8. How many times do you integrated iBox in your lessons in a week

☐ Nil

☐ Once a week

☐ Twice a week

☐ More than thrice a week

TEACHERS' PERCEPTION REGARDING IBOX INTEGRATION AND USE IN CLASSROOM

Kindly tick by right-mouse clicking the appropriate number based on the code below:

Adapted from TAM3

ITEM	*Teachers' perceived* ***Computer Self Efficacy*** *(CSE)*	Very Good	Good	Satisfactory	Poor	Very Poor
9	Ability to effectively use a computer	**1**	**2**	**3**	**4**	**5**
10	Use of new computer software programs with a minimum of effort.	**1**	**2**	**3**	**4**	**5**
11	Confidence with the keyboard and mouse usage in computer applications.	**1**	**2**	**3**	**4**	**5**
12	Ability to type, edit and format lesson plan on Microsoft word application using computer.	**1**	**2**	**3**	**4**	**5**
13	Knowledge in the use of Microsoft Powerpoint, Excel, and office picture manager	**1**	**2**	**3**	**4**	**5**
14	Proficiency in the use of computer and related applications	**1**	**2**	**3**	**4**	**5**
15	Speed in using computer to typeset end of semester questions	**1**	**2**	**3**	**4**	**5**
16	Capability in using computer to play music, watch movies and perform other multimedia functions	**1**	**2**	**3**	**4**	**5**

ITEM	***Teachers' Perceived Ease of Use (PEoU) of iBox***	Very Easy	Easy	Neither Easy Nor Difficult	Difficult	Very Difficult
17	How is the accessibility of the iBox wifi on devices (e.g smart phone, laptop, palmtop etc.,)	1	2	3	4	5
18	How do you assess your ability to create a user account on the iBox?	1	2	3	4	5
19	How do you assess your ability to download subject-based content on the iBox without assistance?	1	2	3	4	5
20	How easy or difficult is it for you to create students account on the iBox?	1	2	3	4	5
21	How do you grade your ability to access the mailing system, send messages, assignments and make announcement?	1	2	3	4	5
22	What is your perceived ease of use of iBox?	1	2	3	4	5

ITEM	*Teachers' Perceived Usefulness (PU) of iBox*	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
23	Integrating and using iBox in my class improves my overall performance as a teacher	1	2	3	4	5
24	I am unable to cover integrated science content within a semester if I integrate Box in my class	1	2	3	4	5
25	I am able to assess student's performance quickly with iBox than with paper and pen test	1	2	3	4	5
26	I perceive iBox to be Useful for lesson delivery	1	2	3	4	5
27	Students' test achievements improve when iBox is integrated in science classroom.	1	2	3	4	5

Teachers' perception regarding facilities and services available for implementation of i-box

28. (a) Indicate which of the following facilities are available in your school's ICT laboratory (***Tick as many as are applicable***)

- ☐ ibox Server
- ☐ Display screen (TV)
- ☐ Uninterrupted power supply (Solar system)
- ☐ wifi supported computers
- ☐ Internet service

29. Kindly state one technical factor that affects the integration of iBox in teaching integrated science in your school

30. What factors/steps have been put in place to ensure the effective use of the iBox in your school:

i. By Respondent

ii. By Management