



Use of Electronic Resources in Teaching and Learning Physics in Higher Secondary Schools under Pemagatshel District, Bhutan

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The study explored the use of electronic resources in teaching and learning Physics by teachers and students of Higher Secondary Schools under Pemagatshel Dzongkhag. The study employed mixed methods approach. Survey questionnaires, semi-structured interview and observation check list were employed to collect data from the field. The respondents were selected using non-probability convenience sampling and purposive sampling techniques. Quantitative data was statistically analysed and interpreted using Statistical Package for the Social Sciences (SPSS) version 22 and qualitative data was analysed thematically.

The key findings suggest that majority of teachers and students were aware of, and utilized e-resources to support teaching and learning Physics. The Khan Academy site was explored the most by both teachers and students. Majority of the students made use of journal articles to complete their Physics project work. The findings of this study concluded that teachers and students have a positive attitude towards the use of e-resources. They perceived the use of e-resources makes Physics lessons interactive and lively.

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1. INTRODUCTION

The Electronic resource (e-resource) is an online digitized information facilitated by human beings using computers with internet connectivity. It comes in different formats including text, audio, video, maps, pictures, etc. The use of e-resources in libraries began with the development of the machine-readable cataloguing (MARC) format in 1960s, before the introduction of the World Wide Web in 1990 by Tim Berners-Lee [1]. Various e-resources such as CD-ROM Books, Project Gutenberg were initiated after 1960. However, Web-based e-resources were widely available since the 1990's.

According to Choejey et al. [2], the internet was introduced on June 2, 1999 to celebrate the reign of His Majesty the Fourth King. However, even before the commencement of the internet, computers were already in use in few government offices. Initially, there were about 2000 computers in the country and the figure remained almost the same until the year 2000 [3]. Even fewer were used to share information. Computerization of government offices started in 1984 with technical and financial support from United Nations Development Programme (UNDP). Until the end of 2006, Bhutan Telecom Limited was the only internet service provider in the country. In October 2006, Tashi InfoComm Limited, joined the market to provide telecommunication facilities including the internet [4].

Bhutan has witnessed remarkable changes in collections, services and access to e-resources since 1999 with the introduction of internet. Computers and computer applications have been widely introduced, and libraries were established in schools. The Government of India (GoI) donated e-Library to the 12 colleges under the Royal University of Bhutan and 49 schools in the year 2016 that was fully equipped with computers and necessary internet facilities to complement efforts of the library which provides access to a remarkable wealth of e-resources. Further, Bhutan Education Blueprint clearly states the need of incorporating information and communication technology (ICT) in teaching and learning processes. In line to this, iSherig-1 and iSherig-2 were launched in 2014 and 2019 respectively to provide a platform to explore available e-resources [5,6].

Physics as a science is known for its abstractness in nature. Without available e-resources and ICT, Physics teachers do not possess adequate knowledge, which sometimes lead to contradictions of ideas. According to Adeyemo [7], students who learn Physics instruction using simulated programs perform more conceptual mastery than their counterparts who were taught by the traditional method of teaching.

According to Paulina et al. [8], electronic information resources help to expand access, usability and establish new ways for students to use information more productively in their academic activities. Also, they can be relied upon for timely information which is very important and necessary for their academic work. Moreover, the use of e-resources by students is necessary because they provide better and easier access to information compared to print media [9].

This study intends to explore the use of e-resources by teachers and students in learning Physics. The study intends to answer the following research questions:

What are the prominent e-resources used by Bhutanese teachers and students in teaching and learning Physics?

Among available e-resources, which one is commonly used by teachers and students?

2. LITERATURE REVIEW

Several studies have been carried out on the use of e-resources by researchers, teachers and students. E-resources present users with a wide range of opportunities that are absent in traditional environment and early generation information seekers. Information can be easily located with the help of key words while using e-resources and information can be saved for later use [10]. A study by Kashyap (2017) on use of e-resources by post graduate students of Government Nargarjun Science College Raipur, Chhattisgarh found out that majority of the students used e-resources for study purpose, writing notes and assignments.

A study carried out by Nisha and Ali [11] on the use of e-journal by users of IIT Delhi and Delhi University found that they are not only using them for building and updating knowledge but also for collecting relevant materials for their

study and research purpose. Also, Kumar and Kumar [12] revealed that more than 75 per cent of the respondents used the internet services mainly for educational and research purposes. Bhutan too realized the importance of internet facilities to make use of available free e-resources. According to the ICT policy of Bhutan, all schools must be connected to the internet and schools must be equipped with one computer for 10 students in secondary school and a computer for every 30 students in primary school by the end of 2018 [5].

In the same line, in a study by Adeniran (2013) regarding the usage of e-resources by undergraduates at the Redeemers University, Nigeria, discovered that the majority of the respondents made use of the e-resources for research, assignment, current awareness, information acquisition, and e-mail. Additionally, various studies have concluded that electronic library resources were both used and favored by professors and students alike and they perceived electronic format as convenient and time saving (Dadzie, 2003) [12,13].

However, Bashorun et al. [14] found out that use of e-resources in the University of Ilorin, Nigeria (Unilorin) was low. The reasons indicated to low usage were lack of time because of the time required to focus on teaching, lack of awareness of e-resources provided by the library, power outage, ineffective communication channels, slow network and inadequate searching skills. Similarly, a study conducted by Anuradha and Usha [15] in Indian Institute of Science found out that e-books are hard to read and browse, and students are used to reading printed textbooks and they do not want to change the habit.

In this technology era, schools in Bhutan also have access to free e-resources such as wikipedia, google books, Khan Academy, Project Gutenberg, UNESCO Bangkok’s web portal for teachers and UNESCO Bangkok’s e-Library [5]. Bhutan is gearing to adapt with the development of technology in the education system.

3. METHODOLOGY

In the present study, survey questionnaires, face to face interview and observation checklist were used as a data collection tools. The respondents rated their response for the survey items on a four-Likert scale with 1 being ‘Strongly Disagree’ and 4 being ‘Strongly Agree’. The survey questionnaires were adapted from Sejane [16], Amankwah (2014) and Dukic [17].

4. RESULTS AND DISCUSSION

The survey questionnaire was used to study the use of e-resources in teaching and learning Physics. Table 1 displays the teacher respondents’ ratings on the use of e-resources while teaching Physics. Nine items out of thirteen in this category received mean scores between 3 and 4 suggesting that respondents feel the importance of using e-resources in teaching Physics. The item *I watch online videos to make Physics concept clear* ($M = 3.80, \sigma = 0.45$) has the highest rating. This is followed by the item *I use e-resources to complete my lesson plan* ($M = 3.60, \sigma = 0.55$). The item *I use electronic books regularly* ($M = 2.40, \sigma = 0.55$) has the lowest rating. The item *I explore web links given in the textbook* ($M = 2.60, \sigma = 1.14$) has also one of the lowest rating. The overall mean on the use of e-resources by teachers is 3.18 and standard deviation of 0.70.

Table 1. Teachers’ rating on the use of e-resources in teaching physics

	Mean	Std. deviation	Level of opinion
I use e-resources to complete my lesson plan	3.60	0.55	High
I use e-resources for research	2.80	0.84	Moderate
I use computer simulations to teach Physics	3.00	0.82	High
I watch online videos to make Physics concept clear	3.80	0.45	High
I use e-resources to update latest information in Physics	3.20	0.84	High
I can use e-resources without any problems	2.80	0.45	Moderate
I use google whenever i have doubt	3.80	0.45	High
I use google scholar regularly	3.40	0.89	High
I use electronic books regularly	2.40	0.55	Moderate
I use electronic mail (e-mail) to learn Physics	3.00	1.00	High
I explore web links given in the textbook	2.60	1.14	Moderate
I use e-resources in school	3.60	0.55	High
I use e-resources at home	3.40	0.55	High
Average	3.18	0.70	High

Table 2. Students' rating on the use of e-resources in learning physics

	Mean	Std. deviation	Level of opinion
I use e-resources to complete my home work	2.69	0.76	Moderate
I use e-resources to complete my assignment	3.17	0.68	High
I use e-resources to complete my project work	3.54	0.54	High
I use e-resources to update my notes	2.56	1.06	Moderate
I use e-resources to update new information in Physics	2.96	0.75	Moderate
I can use e-resources without any problems	2.80	0.92	Moderate
I use google whenever i have doubt	3.22	0.77	High
I use google scholar regularly	2.38	0.71	Moderate
I use electronic books regularly	2.41	1.02	Moderate
I use electronic mail (e-mail) to learn Physics	2.30	0.73	High
I use web links given in the textbook	2.33	0.74	Moderate
i use e-resources in school	2.67	1.08	Moderate
I use e-resources at home	3.56	0.58	High
There are sufficient computers in the lab	2.50	0.80	Moderate
Average	3.01	0.86	High

Table 3. Knowledge on use of e-resources in writing physics project work (N =9)

Sl. No	Response	Frequency	Percentage
1	From the teachers	5	55.5
2	From the friends	1	11.1
3	From the relatives and parents	2	22.2
4	From internet	2	22.2

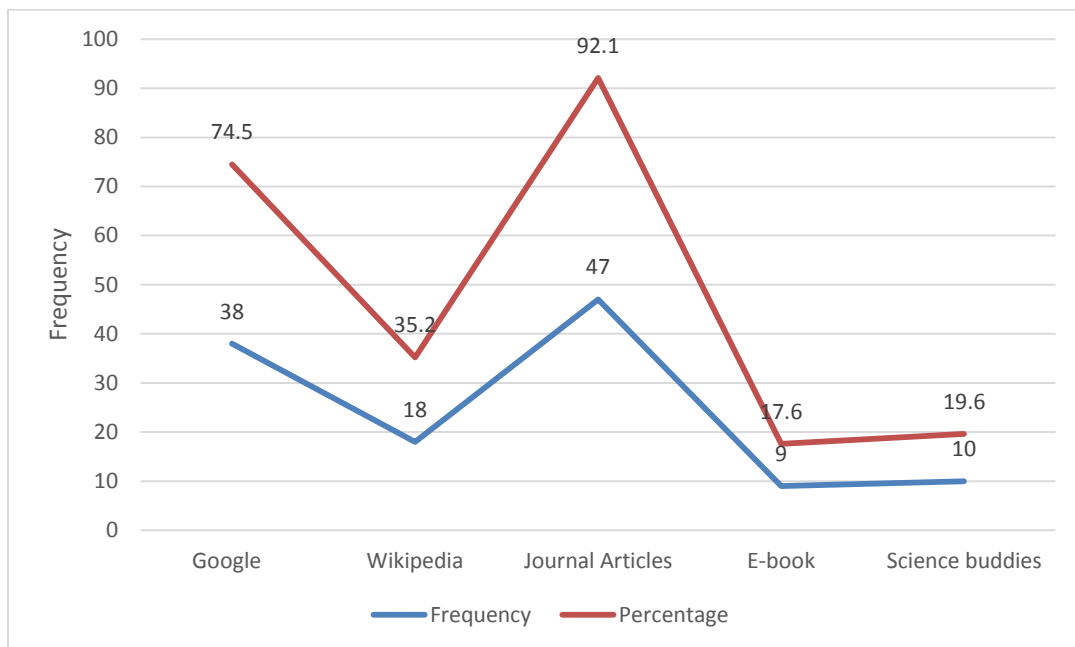


Fig. 1. Type of e-resources used in writing physics project work

The result of the data analysis revealed that both teachers and students explore web links such as Khan Academy, Meritnation, Wikipedia, Online Guruji, Google, Amoeba sisters, YouTube videos on Physics by Professor Walter Lewin, M. Physicswalla, Pradeep Kshetrapal, and

Bozemann science to learn Physics concepts. It was found out that Khan Academy site is commonly used by both teacher and student respondents in teaching and learning Physics. The use of e-resources provides a comfortable platform to locate relevant information and more

options to explore the concepts using different search engines. The abstract topics in Physics can be easily understood with the use of computer simulations and animations. This finding is in line with Adeyoyin et al. [10] in which they have discovered that e-resources present users with a wide range of opportunities that are absent in traditional environment and early generation information seekers. Information can be easily located with the help of key words while using e-resources and information can be saved for later use. This finding is parallel to the study by Mengistul and Kahsay [18] who investigated the use of computer simulation as a teaching aid in students' understanding in learning the concepts of electric field and electric force.

Next to Khan Academy, student respondents revealed that they used Wikipedia to learn Physics and to write Physics assignments. This indicates that student respondents are not aware of reliable electronic sites to learn Physics. Wikipedia is a site in which every user can upload and edit any kind of information. This will result in obtaining incorrect concepts by students. This is in line with the findings of Majid and Tao [19] and Ibrahim (2004) on use of e-resources reported that online databases have not been equally patronized by users.

The findings on the use of e-resources pointed out that teacher and student respondents find necessary information in Physics in electronic form and the use of e-resources also inspires them to learn Physics more. This is in line with Adeniran (2013) who pointed out that the majority of the respondents made use of the e-resources for research, assignment, current awareness, and information acquisition. Furthermore, Kola [20] suggested that the integration of ICT in Physics increases the effectiveness of the teaching and improves the learning of the students since the approach allows for more interactions.

On the contrary, the findings confirmed that the use of electronic books by student and teacher respondents is the least amongst the available e-resources. The reasons behind the minimal use can be attributed to lack of awareness, incompetencies to select the best ones, lack of time and resources, internet connectivity and possession of technological devices. Some of the respondents revealed that they cannot get main points as many unnecessary information is provided in electronic books. Moreover, student

respondents rely upon the prescribed Physics textbook and lectures from the subject teachers. This is supported by Anuradha and Usha [15] in which students found that e-books are hard to read and browse, and that they are used to reading printed textbooks and they do not want to change the habit. However, this finding is in contrast to the study by Swain [21] on students' keenness on use of e-resources, which reported that students expressed keen interest in the use of e-journals and e-books.

5. CONCLUSION

The findings of this study revealed that Physics teachers and students mostly use Khan Academy site to learn Physics. Besides this, teachers and students also explore e-resources in Meritnation, Wikipedia, Online Guruji, Google, Amoeba sisters, Bozemann science, and YouTube videos by Professor Walter Lewin, M. Physicswalla, Pradeep Kshetrapal to learn Physics concepts. The study also concluded that teachers and students are aware on the use of electronic resources in teaching and learning Physics.

6. RECOMMENDATIONS

The recommendations presented are based on findings and discussions of each of the research questions. The researcher would like to make the following recommendations:

1. Ministry of Education to ensure that schools have sufficient numbers of computers placed in the computer laboratory. This will help students to make use of available e-resources in learning Physics.
2. School administration to explore means to increase internet speed in schools. The fast internet connectivity will ensure all the users make use of e-resources and to have faster downloads.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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