A Study of the Attitude of Teachers towards use of ICT in Teaching of Physics at Secondary Level

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Abstract
With new technologies developing so rapidly, there was an inevitable impact upon all aspects of teaching and learning. Information and communication technology (ICT) can make an enormous difference in the way lessons are presented, while online resources are available with the potential to enhance the learning experiences. Indeed, the availability of information at the press of a button may well change the whole way knowledge is viewed, with increasingly less emphasis on what a student knows and more on what they can do with what is available. In all of this, the attitudes of teachers and learners are important. These may well determine the extent to which the new technologies are employed and how they are employed. So, the main aim of this study is to explore the perceptions and attitudes of teachers and their students towards the use of ICT in teaching of physics at secondary level in Pakistan. The government in Pakistan has set out policies to encourage the use of ICT at school level. In order to collect data, a questionnaire and interview schedule was developed. This questionnaire was used with 138 Physics teachers of secondary schools registered with the Board of Intermediate and secondary Education (BISE) Multan, Pakistan. The data from the questionnaire was analysed to offer an overview of the perceptions of teachers with the responses of sub-groups in the population being compared using chi-square as a contingency test. The Interview schedule was used collect general attitude of science teachers towards the use of ICT during their teaching and what kind of difficulties they faced. The findings of the study make it clear that there was an enthusiastic and positive view about the use of ICT in all aspects of teaching and learning. The students wanted more but the teachers tended to see ICT in terms of a computer and a data projector, replacing the traditional lecture-style teaching approach in Pakistan. The results of the study also revealed that, if the new technologies are to play a major part in the teaching of physics, the facilities to do this must be available in every teaching area (not computer rooms) and this is linked to the very real problem of lack of a consistent supply of electricity in Pakistan.

Keywords: Attitude, Teachers, ICT, Physics, Secondary schools
I. Introduction

The present study is the part of my PhD project with title “A study of attitude of teachers and students in using and impact of ICT in teaching of Physics at secondary level”. Everybody who is related to any profession knows that it is an era of Information and Communication Technology (ICT) in every field of life. But its use depends upon the will and attitude of the users. Especially in teaching, the adoption and integration of ICT in the teaching/learning practices, the attitudes of teachers and students are important. Such attitudes may well strongly influence the way the new technologies can enrich the entire learning process. The focus of this study is an exploration of the attitude of Physics teachers related to their use of ICT in their usual teaching/learning process at secondary schools in Pakistan.

Students in the 21st century are well versed in many areas of ICT. Therefore, it is a real challenge to physics teachers, brought up perhaps before ICT became so dominant, to learn how to cope with the new technologies and to harness their potential in enriching teaching and learning. Mlambo (2007, p.1) quotes Dickson and Irving (2002) when they say that:

“For Physics teachers, their prediction is unfolding into reality as they face the challenge of teaching in a world where Information and Communication Technology (ICT) is now present everywhere. As the delivery of more and more ICT artifacts becomes imminent in schools, a number of questions arise: How ready is the teaching fraternity to take up the challenge of using them? To what extent are the teachers teaching or their students learning with ICT”?

As we know that It is important to recognize that the role of teachers is very critical in using any technology during their teaching. The technological developments have been frighteningly rapid. Many teachers were often educated and trained in a very different world. Appropriate hardware and software needs to be made available to schools and made accessible for learning. Appropriate support needs to be made available for teachers who are faced with the daunting task of developing new approaches while still being required to continue normal teaching.

Now it is important to note difference between the most commonly used concepts: information and communication technology (ICT) and information technology (IT).

Ilmokai (2008, p.12) states that,

“These two concepts are to be taken as synonyms of each other and both concepts referring to the use of computers, the Internet and the digital network, as well as other digital devices and various digital applications used with these tools. ‘Information technology was commonly used before the extensive development of the Internet, but recently it also includes Internet applications’.

Furthermore, Majanja (2004, p.1) says that,

“Information and Communication Technology (ICT) is taken as compound term that is used to refer to the convergence of a wide array of new technologies presently being developed and used in the creation, processing and transmission of information”.

Salomon, Cohen & Nijkamp, (1999, p.4) note that, “at face value, ICT is a collection of technologies and applications, which enable electronic processing, storing and transfer of information to wide variety of users or clients”, while Renwick (2012, p.1) define information and communication technology (ICT) as a technology, “comprised of hardware, software, networks and media for the collection, storage processing, transmission, and presentation of information”.

From these concepts about ICT, it is concluded that the range of ICT has started from traditional kinds of ICTs like radio, television, VCR, VCD and it is now extended to the latest equipment like computer, internet, and other electronic devices helpful in improving delivery of lessons in classroom. Fakhir-ud-din (2012, p.2) shared in UNESCO-PACECAD newsletter about importance of ‘ICT and Literacy’ noting that, “The researches (sic) around the globe have shown that use of ICTs in Education yields far better results as compared to conventional methods of teaching-learning.”

In fact, the use of ICT is a way of innovating the teaching which contributes to learning. George (2006) is quite right in arguing that this kind of innovation has become an integral part of the teaching-learning process. Highlighting the various basic elements affecting the teaching-learning process, Ajayi and Ekundeyo (2008) and Higginson (2005) have indicated that teacher, student, curriculum and classroom, environments are very important. They further added that the use of ICT is equally important in this context simply because it improves the teaching-learning process. It implies that, if teaching-learning process is improved, the achievement of the learners is also improved. However, they are assuming that ICT will improve teaching and learning. While it is to be hoped that the use of new technologies may enrich the entire learning process, there is guarantee that this will be so.

II. The Key Role of Teachers

The literature has a tendency to focus its research and comment on teachers and their attitudes. Those outside the classroom often are quick to see the teachers as the key and they suggest ways by which the teaching could be improved. Thus, for Timss (1999), teachers of science design and manage the learning environments that provide students with the opportunity needed to learn science. They structure the content and pace of lessons, introducing new material, selecting various instructional activities better suitable towards students learning. Woodrow (1991) argues that teachers may help students use technology and tools to investigate scientific ideas, analyze students’ work for misconceptions, and promote attitudes towards science.

The observations of Woodrow are very important. However, teachers have NO control over the curriculum they have to teach, NO control over the resources available for them to teach it, and NO control over the examinations systems which may well reward little more than recall skills. Given these restrictions, the impact of teachers may well be much more limited that suggested.

This study was focused on physics teaching in Pakistan where endless development plans have aimed to move school education forward. Various studies have
shown that science teachers in general are not using the new technologies and Mumtaz (2000, p.320) has drawn the findings together, revealing a list of powerful inhibitors:

- 'Lack of teaching experience with ICT
- Lack of availability of infrastructure
- Lack of on-site support for teachers using technology
- Lack of help supervising children when using computers
- Lack of ICT specialist teachers to teach students computer skills
- Lack of computer availability
- No connectivity in most of Government and Private schools
- Regular power breakdown
- Lack of time required to successfully integrate technology into the curriculum
- Rigid education policies
- Lack of financial support'

This is a frighteningly long list of major problems which hinders most science teachers to adopt ICT as a strategy of teaching in Pakistan. So the researcher designed the present study to explore the attitude of Physics teachers towards the use of ICT in teaching of Physics at secondary school level in Pakistan.

The aim of this study is to determine the attitude of physics teachers in using ICT during their teaching of Physics at secondary school level.

III. Objectives

- To determine the attitude of Physics teachers in using ICT at secondary school level
- To explore the general attitude of Science teachers in using ICT during their teaching at secondary level

IV. Methodology

The nature of the present study is descriptive and mixed method is used. For this purpose, one Questionnaire and semi structured interview schedule was developed, in questionnaire 20 restricted response items and one open ended question was asked and in interview schedule consisted of four questions were developed. The data was gathered by using questionnaire from 138 Physics teachers who were selected from an approximately 10% random sample of the 1088 secondary schools which followed the examinations offered by the Multan Board of Intermediate and Secondary Education, including both English medium and Urdu medium schools, and both genders. Validity for the surveys was check by consulting experts and undertaking pre-trialing while reliability followed the directions given in Reid (2003, 2006).

In handling the data from the surveys, it was recognized that the data were ordinal in nature and, therefore, only non-parametric statistical techniques were employed: chi-square and Kendall’s tau-b (non-parametric correlation). To know the general opinion of the science teachers about the use and difficulty faced by them during the use of ICT were asked through interview schedule. Eleven (11) science teachers include male,
female and English medium and Urdu medium teachers were interviewed by taking notes of their opinions.

V. Findings

Overall, the first survey revealed very little that was new or unexpected. Physics teachers were found to be, in general, positively disposed towards ICT and saw considerable potential in its use on teaching. Inevitably, in an educational system where, to a great extent, teaching is lecturing and success is measured in correct recall, they saw the ICT contribution very much in terms of multimedia projection. The problems in using ICT do not appear to rest with the teachers but with the lack of resources and a reliable supply of electricity.

VI. Results of the study

The following are the results obtained from the attitude questionnaire are given in Table I:

<table>
<thead>
<tr>
<th>Sr. no</th>
<th>Statements</th>
<th>Gender</th>
<th>M</th>
<th>A</th>
<th>U</th>
<th>D</th>
<th>SD</th>
<th>χ²</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mostly, I prefer to use ICT in my teaching of Physics</td>
<td>Male</td>
<td>45%</td>
<td>48%</td>
<td>5%</td>
<td>1%</td>
<td>0%</td>
<td>2.8</td>
<td>1</td>
<td>n.s.</td>
</tr>
<tr>
<td>2</td>
<td>Use of ICT during teaching enhances learning of the students</td>
<td>Female</td>
<td>29%</td>
<td>59%</td>
<td>0%</td>
<td>12%</td>
<td>0%</td>
<td>0.2</td>
<td>1</td>
<td>n.s.</td>
</tr>
<tr>
<td>3</td>
<td>It is easier to use computer in teaching and learning process</td>
<td>Female</td>
<td>34%</td>
<td>53%</td>
<td>9%</td>
<td>4%</td>
<td>0%</td>
<td>6.3</td>
<td>1</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>4</td>
<td>ICT is essential for the effective teaching</td>
<td>Male</td>
<td>38%</td>
<td>55%</td>
<td>4%</td>
<td>3%</td>
<td>0%</td>
<td>3.1</td>
<td>2</td>
<td>n.s.</td>
</tr>
<tr>
<td>5</td>
<td>Use of ICT creates sense of achievement in me while teaching</td>
<td>Female</td>
<td>31%</td>
<td>51%</td>
<td>15%</td>
<td>3%</td>
<td>0%</td>
<td>2.0</td>
<td>2</td>
<td>n.s.</td>
</tr>
<tr>
<td>6</td>
<td>Using ICT as interactive tool enhances students’ learning</td>
<td>Female</td>
<td>30%</td>
<td>54%</td>
<td>13%</td>
<td>2%</td>
<td>1%</td>
<td>0.9</td>
<td>2</td>
<td>n.s.</td>
</tr>
<tr>
<td>7</td>
<td>Use of computer saves time and effort</td>
<td>Female</td>
<td>12%</td>
<td>73%</td>
<td>9%</td>
<td>3%</td>
<td>3%</td>
<td>0.1</td>
<td>1</td>
<td>n.s.</td>
</tr>
<tr>
<td>8</td>
<td>ICT is always helpful in preparation of my class-lessons</td>
<td>Female</td>
<td>15%</td>
<td>56%</td>
<td>9%</td>
<td>20%</td>
<td>0%</td>
<td>0.1</td>
<td>1</td>
<td>n.s.</td>
</tr>
<tr>
<td>9</td>
<td>Using computer is an enjoyable experience</td>
<td>Female</td>
<td>26%</td>
<td>66%</td>
<td>6%</td>
<td>1%</td>
<td>1%</td>
<td>1.8</td>
<td>2</td>
<td>n.s.</td>
</tr>
<tr>
<td>10</td>
<td>I prefer to work by hands, rather than working with computer</td>
<td>Female</td>
<td>8%</td>
<td>26%</td>
<td>14%</td>
<td>37%</td>
<td>15%</td>
<td>0.3</td>
<td>3</td>
<td>n.s.</td>
</tr>
<tr>
<td>11</td>
<td>Use of computer as teaching strategy makes subject matter interesting</td>
<td>Female</td>
<td>37%</td>
<td>60%</td>
<td>3%</td>
<td>0%</td>
<td>0%</td>
<td>1.2</td>
<td>2</td>
<td>n.s.</td>
</tr>
<tr>
<td>12</td>
<td>Computer is a faster way of getting information as compared to reading books</td>
<td>Female</td>
<td>44%</td>
<td>38%</td>
<td>9%</td>
<td>6%</td>
<td>3%</td>
<td>0.0</td>
<td>1</td>
<td>n.s.</td>
</tr>
<tr>
<td>13</td>
<td>I want to know more and more about the use of computer in teaching</td>
<td>Female</td>
<td>39%</td>
<td>56%</td>
<td>3%</td>
<td>2%</td>
<td>0%</td>
<td>1.3</td>
<td>2</td>
<td>n.s.</td>
</tr>
<tr>
<td>14</td>
<td>I am still unable to use computer in teaching</td>
<td>Female</td>
<td>10%</td>
<td>28%</td>
<td>14%</td>
<td>35%</td>
<td>13%</td>
<td>4.5</td>
<td>3</td>
<td>n.s.</td>
</tr>
<tr>
<td>15</td>
<td>I feel hesitation in using computer during teaching</td>
<td>Female</td>
<td>5%</td>
<td>14%</td>
<td>16%</td>
<td>46%</td>
<td>19%</td>
<td>7.5</td>
<td>2</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>16</td>
<td>I have no facility of using computer at home</td>
<td>Female</td>
<td>9%</td>
<td>29%</td>
<td>3%</td>
<td>41%</td>
<td>18%</td>
<td>3.0</td>
<td>3</td>
<td>n.s.</td>
</tr>
<tr>
<td>17</td>
<td>I enjoy using computer in teaching physics</td>
<td>Female</td>
<td>18%</td>
<td>55%</td>
<td>16%</td>
<td>9%</td>
<td>2%</td>
<td>2.3</td>
<td>3</td>
<td>n.s.</td>
</tr>
</tbody>
</table>
I use computer only if it is absolutely necessary

Male | Female
---|---
12% | 21%
46% | 56%
19% | 6%
17% | 15%
6% | 3%

I prepare my teaching notes by using internet

Male | Female
---|---
14% | 6%
35% | 41%
12% | 15%
32% | 32%
7% | 6%

Using computer is the wastage of time

Male | Female
---|---
1% | 3%
6% | 9%
10% | 12%
53% | 44%
30% | 35%

Most of the respondents were agreed on the statements and showing no significance difference between male and female Physics teachers while there was very less agreement on the statements no. 3 and 15 that “it was easier to use computer in teaching and learning process” and “they feel hesitation in using computer during teaching”. The difference of opinion is also significant which was calculated by using chi-square test. These two statements clearly reflects the real situation of teachers that they feel difficulty to operate computers and they feel hesitation to use computer resources during their teaching due to lack of training, no environment, non availability of terminals in their classrooms and especially in developing countries the short fall of electric power which create hindrances to use ICT during teaching learning process.

Table II: Open Ended Question

<table>
<thead>
<tr>
<th>Suggestions given by the teachers to use ICT in teaching Physics (N=138)</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multimedia projector with internet must be available in the classrooms</td>
<td>29</td>
<td>21</td>
</tr>
<tr>
<td>Regular ICT training should be given to the physics teachers</td>
<td>24</td>
<td>17</td>
</tr>
<tr>
<td>Syllabus must support the use of ICT in teaching Physics</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>Teachers must have computer facilities at school as well as at home</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>Physics CDs and Software must be provided to use for students</td>
<td>08</td>
<td>6</td>
</tr>
<tr>
<td>Use of ICT can help teachers to save time</td>
<td>06</td>
<td>4</td>
</tr>
<tr>
<td>Ensure the presence of electricity is essential for the use of technology in classroom</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>Government should allocate more funds for the use of ICT</td>
<td>09</td>
<td>7</td>
</tr>
<tr>
<td>Teaching load must be justified for Physics teachers to use ICT</td>
<td>08</td>
<td>6</td>
</tr>
<tr>
<td>Students should be given time in the school timetable to learn computer use in physics learning</td>
<td>05</td>
<td>4</td>
</tr>
<tr>
<td>ICT can be used during practical work at Physics laboratories</td>
<td>04</td>
<td>3</td>
</tr>
</tbody>
</table>

The comments made by the teachers were grouped into categories, these categories being determined by their actual responses. The findings are summarized in table II.

Three suggestions stand out (% ≥ 15%). If computers are to play a major part in the teaching of physics, the facilities to do this must be available in every classroom. It is interesting that they viewed this in terms of multimedia facilities. There was little emphasis on the use of IT in actual physics experimental work (only 3%). Coupled to this is the very real problem of lack of a consistent supply of electricity in Pakistan, a problem that seems to be getting worse.
The other major issue is that of training. There is not enough detail to indicate what training is in mind. However, it is likely that it will involve the actual use of IT equipment, the use of specific software and the way IT equipment might be used in making physics real as well as data handling. For some of this, IT training expertise is required but for much, there is a need for training from those who not only have IT expertise but also have credibility as teachers, knowing how to make learning effective.

VII. Conclusion and discussion

Overall, this questionnaire revealed very little that was new or unexpected. Physics teachers are, in general, positively disposed towards ICT and see considerable potential in its use on teaching. Inevitably, in an educational system where, to a great extent, teaching is lecturing and success is measured in correct recall, they saw the ICT contribution very much in terms of multimedia projection. The problems in using ICT do not appear to rest with the teachers but with the lack of resources and a reliable supply of electricity.

In many of the Likert type questions, response patterns tended to use only 2 or 3 boxes of the set of 5. Although the impact of ICT was seen positive from the responses received. This approach is clearly not sensitive enough and impact was observed by asking few questions in this questionnaire.

VIII. Interviews Interpretation

Interviews were conducted with 11 science teachers. This interview was completed in fifteen to twenty (15-20) minutes and researcher also ensured to maintain gender balance from randomly selected secondary schools. The interviews adopted a semi-structured format, with a set of questions planned in advance but allowing scope for discussion and questions to develop as suit the way interviewees responded.

A summary is now offered, looking at each question in turn.

Question 1

This simply allowed the interviewee to settle down and feel relaxed. Questions were asked about their experiences. The sample represented a wide cross section of experience, representing all four subjects, most taught at level 9 and while 2 only teaching at level 10. Their training was from a diversity of institutions. 7 of the 11 stated that they enjoyed teaching.

Question 2

Surprisingly, all stated that there were enough computers but there were some shortage when it came to peripherals. Only half the schools had computer rooms and very few had access to computers in their own teaching room. The fact that they did not have access to computers in their own teaching room suggests that the provision of computers was far from sufficient. Perhaps, they were unaware of the potential in having resources to hand in their teaching areas. Overall, the majority felt that their school policy did not support them in the use of ICT.
Looking at the responses overall, the clear impression was given that most of the schools had no provision of computer resources in their classrooms and above all, in terms of school policy, there is no encouragement to use ICT during their teaching. Few teachers use computer resources like multimedia projectors on their own.

**Question 3**

Most of the respondents were agreed to use ICT for younger children starting from senior elementary classes to make aware them about the potential of this media. Computer accessories were confined only to laboratories or main offices. On the other hand, few private English medium school teachers were enjoying the availability of computer resources in their classrooms. Actually, most of the respondents know the advantage of the use of ICT and they were also convinced that, by using computer resources in their teaching science subjects. It was possible to make their life easier than by using the traditional way of teaching. They added that if they produced teaching notes once and then they can use even by modifying soft copies any time by single click.

For the purpose of demonstrating the practical work in their science labs, they could use the internet to show the simulations which were easily available on the different free websites. This could make the learning of their students interesting by using variety of examples and even they can show three dimensional images by using animations available on slides. Above all, all the teachers were lacking in training to develop their own teaching resources by using ICT. Few teachers had had any opportunity to attend workshops but, in practical terms, they felt that they were still not confident in using ICT.

It can be concluded that the most teachers were of the view that the use of computers should start earlier from grade 6 or 7 in elementary classes. Teachers were aware about the potential use of ICT in teaching/ learning process and the use ICT could make their working easier and interesting than the traditional way of resources. But there were no arrangement to get training to use it to maximize their teaching.

**IX. Summary of Interview Schedule**

Bringing together the views of the 11 interviewees offered some very strong clear messages which seemed to be held consistently across the interviewee sample:

1. Full ICT resources must be provided in their classrooms.
2. Training is the essential element to make full use of ICT in their teaching/learning process to enhance the students learning and interest towards their science subjects.
3. Teachers were optimistic about educational changes and wished be able to benefit by the knowledge available in this global village.

A general impression was left of a teaching force that was enthusiastic to embrace the new technologies and who saw, at least in a limited way, the potential of these new technologies in enhancing learning. They were also acutely aware of the resource problems. Thus, overall attitudes towards using ICT were universally and broadly positive.
With the two questionnaires and the interviews, a clear picture of teacher perspectives has been gained. The next step is to consider how the students see ICT in the context of their learning in physics.

X. References


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