

## Measuring English Teachers' Use of Technology: Multiple Measures and Their Importance

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### Abstract

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Governments and administration of schools have been interested in making huge investment in integration of computer technology since 1990. Computer technology have brought many advantages and benefits for learning environment and educational system, however, many researchers have provided evidence that computer technology is affecting the lives of students and teachers. Hence, it is necessary to evaluate the impact of technology on learning so that investments could be steered in the most effective ways. This study aims to explore teachers' technology use in which measurement of technology use is emphasized considering the pertinence of research method to conduct a study. Quantitative research methodology has adopted in which primary data was collected from teachers of K – 12 schools. Comparison has made between single composite and multiple measure approach to study the impact of computer in schools. Results provide a coherent view and insight into the methods of measuring teachers' technology use and improved strategies..

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**Keywords:** Technology use, measurement, education & learning, integration of computers

### 1. Introduction

Today's educational environment is evident of a considerable and huge amount of investment that governments have made during previous years to improve the standard and quality of education. Moreover, these investments were made to bring quality in delivering lessons and teaching methods which exhibit the facilitation of teachers equally as the assistance of students through these technological innovations. Last twenty years have been evident about the implementation of technology in classroom and learning environment with a substantial attention given towards the improvement of teaching methods (Angeli & Valanides, 2009). Hence, the researches and studies now-a-days are showing a considerable impact on the lives of students as well as teachers due to the introduction and implementation of these technological innovations. The massive investments have brought a positive change in the delivering methods by teachers. Many researchers are attempting to find, gauge and analyze the nature of impact on the lives of teachers as a result of technology implementation in educational environment (Hennessy, Ruthven, & Brindley, 2005).

However, it is greatly needed to study the technology using pattern by teachers in order to understand the resulting impact on studies and learning level. In other words, in order to know and analyze the effects of technology on learning and the outcomes of technology integration with learning environment, it is particularly important to know that how the teachers are using and implementing technology to facilitate their activities. Firstly, the more change can be contributed by the teachers' use of technology and its implementation in learning environment (Moersch, 1999).

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This is possible through many ways such as use of technology to deliver lectures as well as using technology for specific activities which are more related to lecture preparation, delivering instructions and facilitate learning. Still there are many other areas where technology can be implemented and categorized as the "teacher's use of technology". It includes the technology use in offices such as lesson preparation, grading, e-mailing and for the personal use to prepare the multimedia products to be included in lectures (Hermans et al., 2008).

Besides the many ways which are described above to define the use of technology by teachers, research lacks the clear picture or coherent definition of "use of technology" which is crucially needed to know before the analysis of technology integration and its impact on learning environment. Much effort has been done by the previous researchers to provide a clear definition and many approaches have been employed in past to measure the teacher's use of technology. These approaches group the different uses of technology and form a single dimension for better analysis (Compeau & Higgins, 1995). However, the unitary dimension for simplification of analysis has not been preferred and many complex efforts and techniques have been used to study various aspects of technology use by teachers. These aspects include the analysis and a valid measurement of technology implementation, the understanding of increase in technology use and interpreting the extent to which technology use can be extended or used (Shapka & Ferrari, 2003).

The following study is aimed to probe the ways and approaches which have been used to measure the technology use by teachers since the last 20 years. Moreover, the study attempts to review the present data in order to show the utility and accuracy of multiple measures which have employed to know the technology use by teachers.

## Literature Review

Technology integration and use by the teachers in classroom or learning environment is not well understood as the use of computers. Various techniques to examine the technology use and its integration have been developed to find out the factors which tend to influence the teacher's level of technology use as well as its utility (Anderson & Maninger, 2007). Teachers need to know the specific skill set and the knowledge in order to use the technology for delivering lectures and other activities. Technology integration, hence, means the due consideration of students' needs, the environment, and student's learning level, the available technology, the curriculum, and mediated design issues and the lesson planning to enhance the impacts of its use. The first study to investigate the use of technology in education was occurred in 1986 in US by the Federal Office of Technology Assessment. The organization was asked by the Congress to assess and compile a report about the technology in schools throughout the United States (Baylor & Ritchie, 2002).

A series of report was given to the Congress by OTA in which the pattern of use and integration of technology in American schools were documented formally. Moreover, the major study finding was the statement that "the level of technology use is greatly dependent upon the teacher's discretion and choice". The second attempt was made in 1995 to review the technology use on the request of Congress in depth in K – 12 schools. In this report, it was found that the different definitions, prepared by the authors and researches of the ten years previous report by OTA to Congress, were somewhat confusing. These definitions were developed according to the first report while in the subsequent study those definitions found to be contradictory to the impacts of technology use in K – 12 schools in America (Yang & Huang, 2008).

For instance the definition of "computer using teacher". In the first report, he was defined as the one who uses computer sometimes to assist his work or deliver lecture to the students. While, in the next report, Becher (1994) defined him as a teachers whose 90 % of students are using computer or require technology during class in any way throughout the year. Hence, the definitions of the same terms differ in ways that one author states it as the use of technology by teacher. These different definitions resulted in the different interpretations of the technology use afterwards greatly impacting the contradictory findings of many researchers. This inconsistency damaged the study findings according to which 75 % of school teachers in America were technology- using. This confusion led to the final remarks by OTA according to which the percentage of technology using teachers in America is greatly variable and reduced as the definition becomes sterner (Smarkola, 2008).

The technological innovation and advancement in ICT during the 1990s allowed the teachers to use computer technology in various ways to support their teaching and assistance for students. However, the computer programming and word processing limited the instructional use of computers to only few functions (Bichelmeyer & Molenda, 2006). These functional included the computer-based simulations and the multimedia presentations which enabled teachers to demonstrate better the teaching material. Afterwards, the invention of internet enabled the teachers to introduce the use of the World Wide Web during the class activities to enhance the quality as well as the areas of learning for students (Cuban, 2001).

Technology use was also becoming popular outside of classroom such as the test development, grading and the record keeping in offices which also supported the teachers in their activities bringing ease to their work. Internet enabled the teachers to communicate more speedily and efficiently through emailing to the administration, colleagues, parents and the students. Additionally, the internet also enabled the teachers to enhance their own skill set and additional resources for lesson planning (Shiue, 2007). This increased use of technology in various and versatile ways made it difficult and complex to define a "technology – using teacher". Since 1994, a series of surveys has been conducting by the National Center for Educational Statistics. These surveys were aimed to explore the access of school teachers to the technology and their extent to which they are using technology, computers and internet (Kruger, 2003).

It was found in a report in 2000 that use of technology for non-instructive purposes was pervasive; however, a great majority of teachers were using technology for learning, teaching and professional activities. It was said in the report that more than a half of all the teachers prefer to use computers for record keeping both at home and at school. More than 50 % of teachers use computer for communication to the parents and colleagues through email and other portals. About 20 % of teachers prefer to use technology in order to post the assignment details and the homework. It was found that the majority of teachers were using computers to prepare their instructional material at school as well as home comprising of 85 % of all the teachers (Hsu, 2010).

The instructional use of technology has been categorized as a separate facet and in the same report by NCES, it was said that more than 50 % of the public school teachers in America use computers for instructional purpose during class with a conditional availability of computer at school. Other facets of technology use measured by NCES are articulated by Rowand (2000). These facets included the use of technology by teachers for the following purposes with a descending order of frequency.

- Preparation of instructional material
- Communication with colleagues
- Keeping record and administrative work
- Access to additional resources for lesson planning
- Multimedia presentation in classrooms
- Access to the best practices and research for teaching
- Interaction with students and parents over email
- Access to the model lesson and class activities

The largest study has been conducted by the Teaching, Learning and the Computing survey in 1998 in order to assess the technology use and practices in teachers. The survey resulted in a series of nine reports which demonstrated the beliefs and the practices of a sample population of US teachers. Becker (1998) documented that the use of technology by the teachers is wide-spread among students and teachers as well as the practices are much varied. For instance, the use of computers by the students has been found to almost 71 % during the 1997 – 1998 in some way. The teachers who reported of not using technology with their students were reported of using it for non-instructional purposes. The strength of this type of teachers was 71 %. In fact, the majority of teaches were preferring using technology to assist their day-to-day activities and professional needs instead of using it for instructional purposes (Kruger, 2003).

The most frequent use of technology was being made to prepare handouts for class and multimedia slides. Additionally, the more than 50 % of teachers reported to use technology for grading and record keeping on weekly basis. Two-third of teachers were found of using technology for communication and emailing while 68 % of them used it for lesson planning. Summarizing the survey findings, it was found that the majority of the teachers were getting support in their activities but most of the technology use was occurring outside of class (Bichelmeyer & Molenda, 2006).

Another study has been conducted on the technology use of teachers by Cuban (2000) who separated the use of computer during class time and outside the classroom. Another limitation which he has elaborated during his study is the limited number of computers available for teachers and students. The findings support and strengthen the finding of the previously done surveys and studies about the technology use identifying many ways and techniques. However, the study has employed a technique to separately describe the use of computer inside and outside the class as well as the definition has many areas exclusive. Such as the definition of "use of technology" by Cuban (2000) has excluded the lesson planning, grading, ICT, preparation, research enhancement and record keeping.

It only addresses the use of technology or elaborates the limited number of compute available as a reason to describe the lack of technology use. However, it is regarded as a less than a complete measure and a confused conclusion ultimately. It is clear in literature that the definition of "teacher's use of technology" is highly complexed and its complexity has been increasing with more varied, advanced and pervasive use of technology in educational system. Hence, the major variations of definition raise many issues and concerns since the first investigation done by the US department of Education in late nineties. Today, many organizations and several researchers have developed their own definitions for the measure of technology use, its frequency and the extent to which it can be further increased for the betterment of the educational experience and instructional purposes (Hennessy, Ruthven, & Brindley, 2005).

Many instruments have developed by the International Society for Technology and the CEO Forum which are effectively spurring reflections taking into account the school teachers, students and parents. These instruments help in collecting the data on the technology use of teachers as well as students and then put the data into the generic variable of "technology use". The fact shows the failure of these instruments in order to find the real impact of technology use and proves these instruments inadequate for the assessment of the impact as well as the measurement of the extent to which technology is being used (Baylor & Ritchie, 2002). Another issue regarding the measurement of technology use is the different interpretation of school leaders about its consequences. It is very much possible that the personal conflicts or the views can intervene during the interpretation or decision making about the implementation of technology. For instance, some of the school leaders and decision maker interprets the term "technology use" as the use of computers solely by teachers. But the others interpret it as the generic measure to gauge the technology uses and skills acquired by a teacher (Culp, Honey, 2003).

After the critical review of how technology use of teachers has been measured and defined by the researcher so far, the rest of the study focuses on the data collection through a survey and the elaboration of the Use, Support and Effect of Instructional Technology Study (USEIT). The multiple measures taken during that study have been used on the data collected and to show the multifaceted approach to measure the use of technology (Ross, & Specht, 2008). Furthermore, it would reveal the potential of the instruments of providing deeper insights. Firstly, it needs to define the term "technology" before proceeding to the data collection, analysis and conclusion drawing. Hence, it can be said that the term technology implies the use of computer including laptop and personal computers, Palm Pilots and LCD Projector. Moreover, the technology integration refers to the use of technology and computers for the day-to-day activities including the lesson preparation, communication, feedback provision, research work and multimedia projects. Besides the advantages of the technology use during the class room or outside the class, there are certain issues and concerns associated to its use which can also be measured as the inhibiting factors (Van Braak, & Valcke, 2008).

## Methodology and Sampling

Analysis and findings of USEIT have been used in preparing this study to explore a multi-dimensional definition of technology and its use education system. The USEIT study has examined the use technology in education system, underlying factors behind its use and the ultimate impact of technology use on learning and knowledge gained by students. The study includes a survey done through an administered questionnaire to the teachers of English courses at Jazan University in Saudi Arabia. The study areas were English, science, social studies, mathematics and language arts. The study sample varies largely with respect to school type and grade levels. School types are high, middle and elementary while each grade level presents a different kind of information and data collection with a large number of teachers participating in the study.

The questionnaire was developed on the basis of current literature to focus on issue related to the teachers' technology use. The questionnaire includes 45 items which are grouped together and focused on the technology use by teachers and both out and inside of the classroom. Basic information as well as demographic information has been collected in the first section of the questionnaire. Afterwards, questions have been asked by grouping the data through grid questions which was convenient for both respondent and the researcher. A group of questions consisting of twelve items was focused on the data collection about the frequency of technology use by teachers. Technology use through hardware was probed in this grouped question such as scanner, LCD projector or a desktop computer being used in a classroom. The rest of thirty three items have been pertinently used in the analysis and findings because of their importance in the research which is basically to probe out the impact of technology use in educational systems. Twenty one of these items were ultimately used to form seven scales related to technology use separately.

## Multi-Dimensional Definition of Technology Use

Two methods have been largely used to define the technology use in education system. First, a composite measure which define general use of technology and its index. Second, multiple measures in which each of the measure represents a specific kind of technology use. These multiple measures are collectively used to present technology use and its impact. The approach of a composite measure results in an aggregate measure which shows the frequency of technology use by teachers for a range of purposes and tasks. The items which were related to the teacher's frequency of technology use are summed up and presented in form of a histogram which is displayed in the following figure. The composite measure of technology uses in normally distributed with -0.04 skewness while the majority of participants are clustered in the middle with a normal distribution on each side of the distribution.

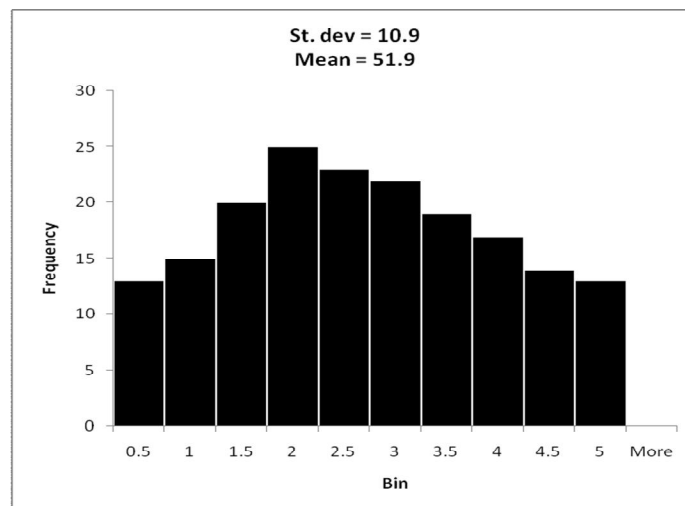
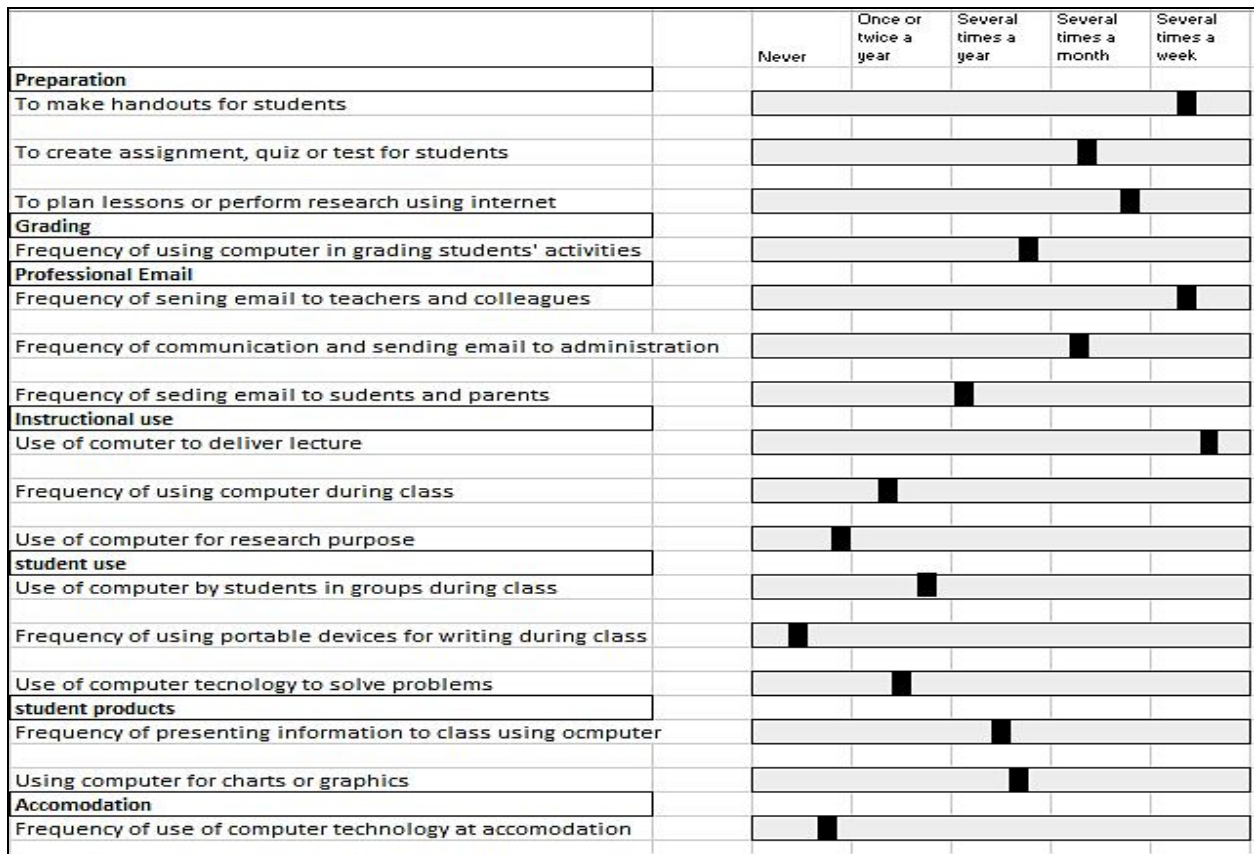


Figure 1: (Composite measure of technology use by teachers)

The second approach of multiple measures involves various kinds of uses which are popular in teachers and for which teachers are particularly making use of technology in their work and responsibilities. Teacher’s responses about these tasks are collected through the survey items which have been used to construct seven scales that help in measuring technology. These seven scales include the following:

- Teacher’s technology use for preparation of class activities
- Teacher’s technology use for professional purposes such as e-mail and communication
- Teacher’s technology use for accommodation
- Teacher’s technology use for instruction and knowledge delivering
- Teachers’ technology use during class time seeking participation from students
- Teacher’s direction for students to create products using technology
- Teacher’s technology use for grading and administering work

These seven scales are named as preparation, professional e-mailing, delivering instructions, accommodation, student use, student products and grading. These seven scales are displayed in the following figure along with mean responses and distribution for each item and each scale.



**Figure 2: (Mean frequency and distribution of items consisting of seven scales of technology use by teachers)**

Above figures demonstrates the items used to examine each category of the technology use by teachers in Jazan University. Mean responses and the distribution vary across the items notably as the items have been measured on a scale of one to five. For instance, when the teachers were asked that how often their students use CD-ROM or computer technology during class or lecture time, the responses were on average use of technology which resulted in a relatively normal distributed showing that responses are just below the mid-point. In contrast to this, the distribution of technology use by teacher to make handouts shows negative skewness.

Majority of teachers responded in technology use to make handout very often or several time a week or month. Normal distribution and mean responses show that, on average, teachers use computer to make handout.

Though, grouping of technology use by teachers and collecting their responses show informative and interesting patterns, however, these patterns can be comfortably used to identify the items which can be combined into a single measure on related use of technology. Grouping of items has been done to use principle component analysis to identify and study the items which show a strong correlation. Moreover, a single scale of responses (i.e. one to five) has been used to measure these groups of items and same scales have been used to measure the frequency of technology use by teachers. These factors make it possible to sum up and find an aggregate score for each group of items separately. This aggregate score can be achieved through summing each response of the surveyed items and then dividing it by the total number of item constituting that group. These aggregate score are displayed in the following for each category used to survey the technology use by teachers.

It is clearly seen from the following figure that technology is being used by the teachers mainly for "preparation" purpose. The second major use of technology is for communication i.e. professional e-mailing followed by the teacher-directed use of technology. The following category is teacher's use of technology for grading and administrative work. It is important to note that technology use by teacher range from low to moderate levels except preparation. Technology use for creating students' products and accommodation is least among all the items. It is also pertinent to note that sample population of teachers which is contacted for data collection and analysis excludes teachers of special education. Special education teachers are evident to use technology for lessons preparation at accommodation.

Though the single composite method is an easier approach than measuring seven scales and grouping all the items to form a multiple categories approach. However, it can be said that measuring teachers' technology use by seven scales result in more coherent and accurate understanding of technology use and different purposes where it can be employed successfully to help teachers. It is clear from the normal distribution achieved through single composite that majority of teachers use technology at a moderate level constituting the central position in normal distribution. While, relatively few teachers are not making use of technology or using it on heavy terms which occupy a least far place on histogram. In contrast, the results from multiple measures show that technology use varies dramatically among teachers with respect to the items and purposes. For instance, technology use for "preparation" is exceptionally well while for "accommodation", technology use is least frequent. It implies that use of technology varies largely with respect to the purpose for which it is being used. In the figure below, it is indicated that use of technology for instruction purpose is positively skewed as compared to the normal distribution.

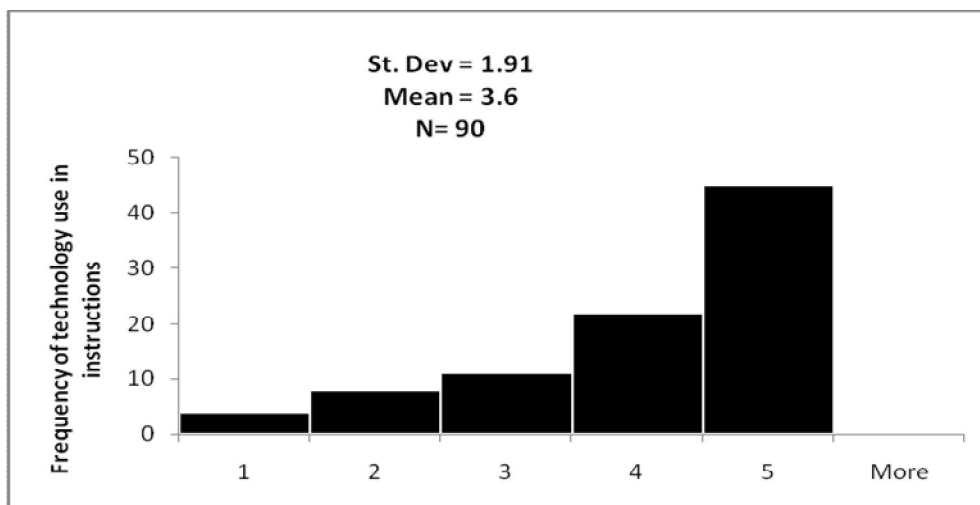
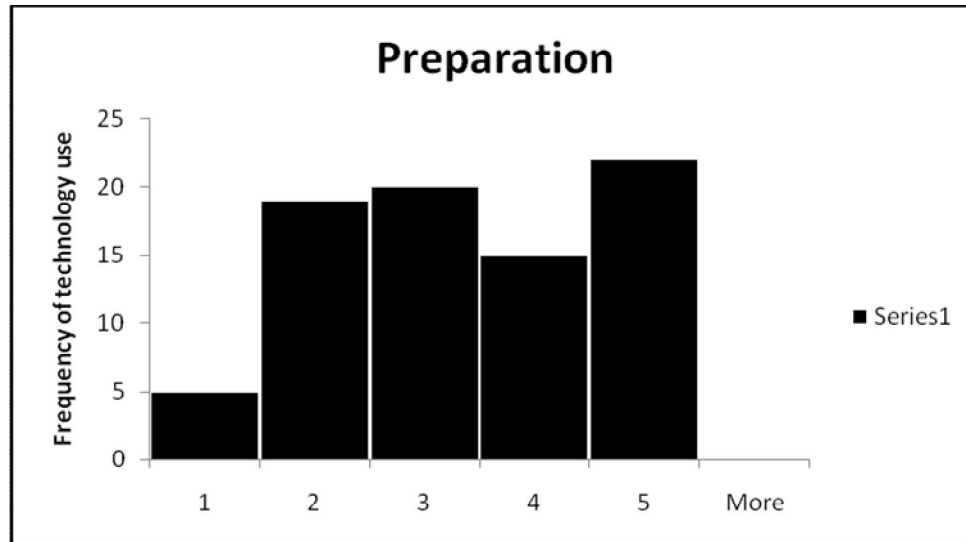


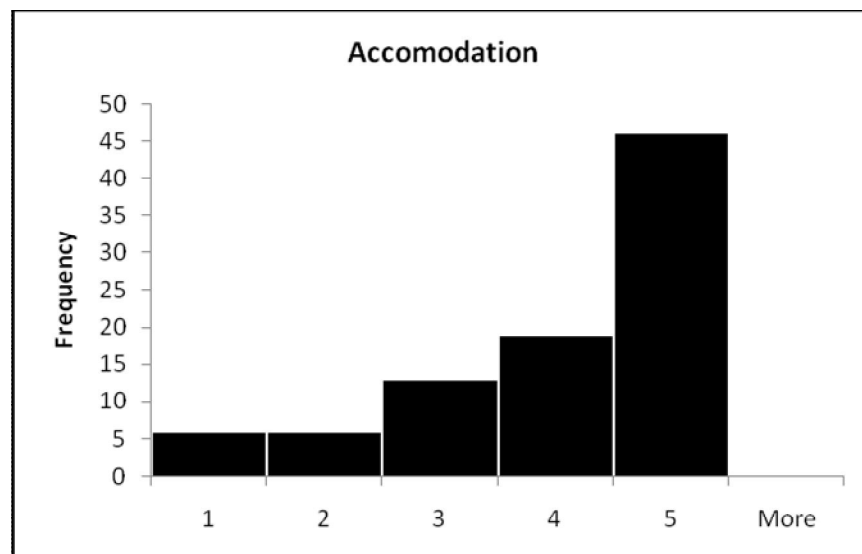
Figure 3: (Histogram for use of technology for "instructions")

Majority of the teachers do not make use of technology for instruction and it is clearly seen from the figure above. In contrast to this, the technology use by teachers for “preparation” is found negatively skewed which implies that most of the teachers use technology to prepare their lectures and classroom activities.



**Figure 4: (Histogram of use of technology by teacher for “preparation”)**

Five remaining technology uses are measured and displayed in the following figure. Student product use, instructional use of technology and accommodation use have been found positively skewed on large basis while technology use in grading shows a weak positive skewness. Teacher-directed use of technology for students during class or lecture time is also relatively normally distributed. In contrast to this, use of technology for professional communication such as professional e-mailing to colleagues, parents, administration and students has been found bi-modal. It implies that a major chunk of teachers is making frequent use of technology for this purpose while another larger population of teachers is showing no use of technology at all.



**Figure 5: (Histogram of Accommodation Use)**



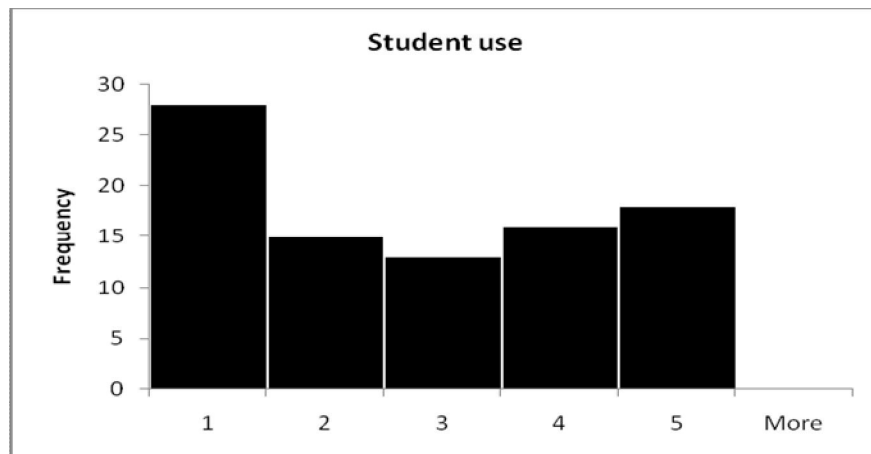


Figure 6 (Histogram of Student Use)

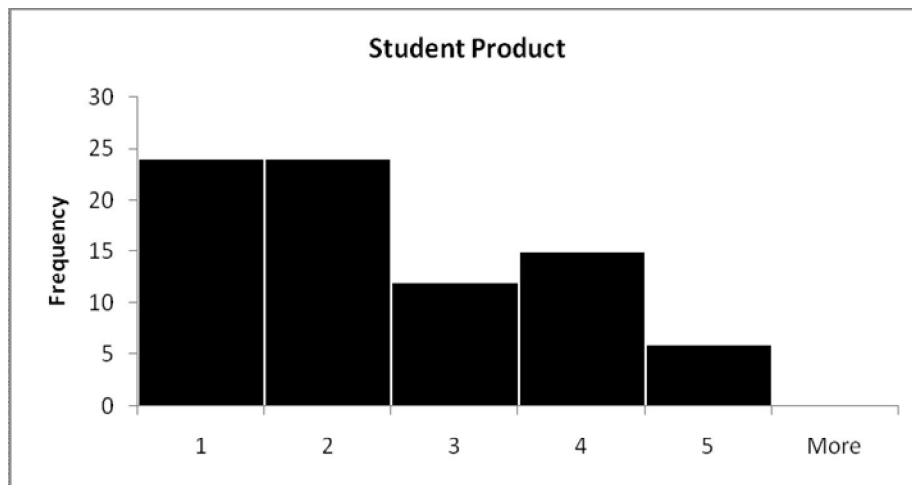


Figure 7 (Student Product as Technology Use)

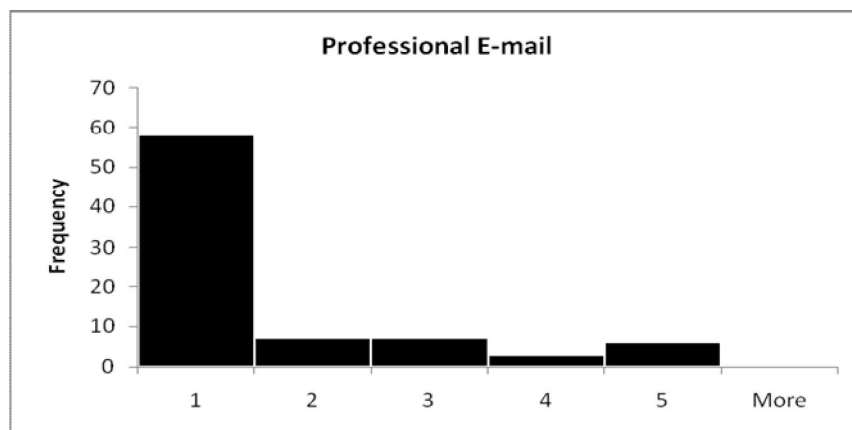
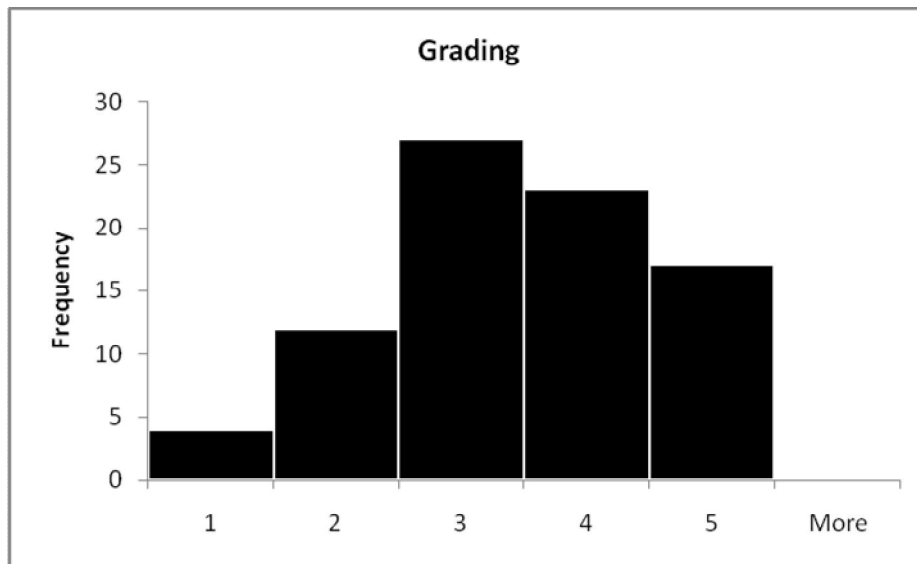


Figure 8 (Professional Email as Technology Use)



**Figure 9 (Histogram of Grading)**

In short, it can be said that use of specific measure to examine the technology use by teachers result in different consequences and considerable differences in frequency as well the method for technology use. Multiple measures approach results in clearer understanding as compared to the single composite measure when it comes to know that how technology is being used by teachers and to what extent teachers are making use of technology.

**Technology Uses and Correlation among these Uses**

Different uses of technology are interrelated and the multiple measure approach does not negate their correlation. Nonetheless, this approach accepts an enough degree of correlation among them. Pearson correlation coefficient method is used to examine the correlation among the seven technology uses which have been grouped in this study. These correlation coefficients have been presented in the following:

**Table 1: (Correlation among the seven uses of technology by teachers)**

|                           | <i>Preparation</i> | <i>Instructions</i> | <i>Accommodation</i> | <i>Student use</i> | <i>Student product</i> | <i>Professional email</i> | <i>Grading</i> |
|---------------------------|--------------------|---------------------|----------------------|--------------------|------------------------|---------------------------|----------------|
| <b>Preparation</b>        | 1                  |                     |                      |                    |                        |                           |                |
| <b>Instructions</b>       | 0.5690             | 1                   |                      |                    |                        |                           |                |
| <b>Accommodation</b>      | 0.542397           | 0.9899              | 1                    |                    |                        |                           |                |
| <b>Student use</b>        | 0.86257            | -0.21401            | -0.15671             | 1                  |                        |                           |                |
| <b>Student product</b>    | 0.65803            | 0.84792             | 0.87376              | 0.424              | 1                      |                           |                |
| <b>Professional email</b> | 0.90336            | -0.48942            | -0.41485             | 0.941              | 0.563                  | 1                         |                |
| <b>Grading</b>            | 0.662015           | 0.310506            | 0.2860               | 0.83043            | 0.667                  | -0.786                    | 1              |

Correlation presented in the above table show all as positive but moderate to weak relationship in some cases. A positive correlation show that a teacher who is using technology for one purpose is likely to use technology for another purpose, on average. Similarly, it is true for teachers who are not using technology for any purpose at all and become infrequent users for all the types. However, a moderate relationship demonstrates an average use of technology for each purpose. The median correlation is 0.26 and four uses are correlated to each other with more than 0.3 (i.e. correlation of accommodation, delivery, student products, student use and preparation).

Correlation suggests that each technology use is related to the other one and each teacher has a tendency to use technology with varying frequency among all types.

### Relationship between Technology Use and Improved Understanding

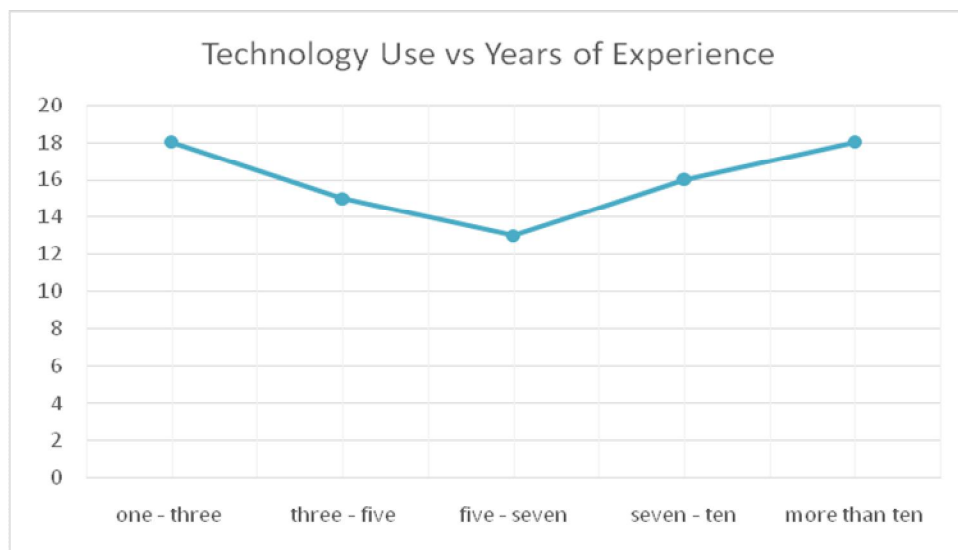
Besides the weak to moderate correlation among uses of technology, the analysis which has been done in previous section shows that: (1) each measure show a distinct use of technology and separate from the other ones and (2) the distribution and frequency of technology use ranges considerably different across the seven measures. In the light of these two facts, the following section is focused on the analysis of three aspects.

1. Teachers' experience in technology use with respect to the time length
2. Teacher's use of technology with respect to school level (i.e. high, middle and elementary school)
3. Teacher's use of technology with respect to subject area (mathematics, social studies, English, science and language arts).

Following analyses present the impact of single or multiple measures when used to understand technology use and its impact.

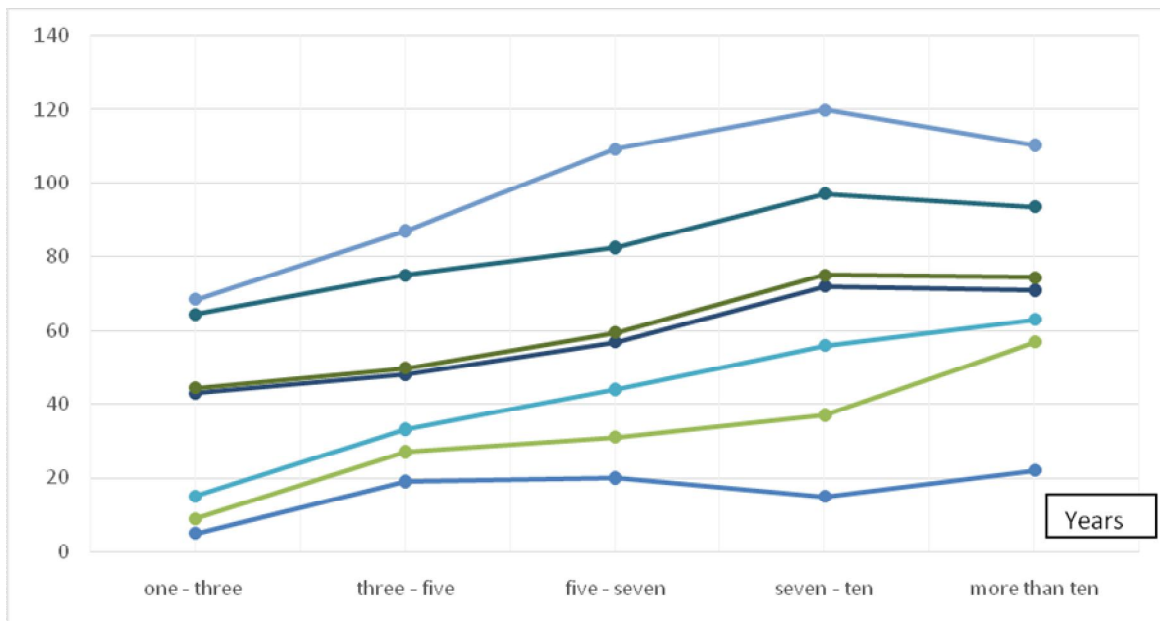
### Years of Teaching and Technology Use

It is believed that technology use will increase with the recruitment of new teachers who are comfortable at using technology as they are grown up in technological era. It is found, however, that frequency of use of technology does not vary with the teaching years of experience or their professional experience. Following figure shows the use of technology in relation to years of experience.



**Figure 10: (Comparison of technology use on general terms across the years of teaching experience)**

Above figure shows the results with single composite. The results change when the multiple measures are employed to analyze the use of technology. These changes can be seen clearly from the following figure. When multiple measures are employed, it can be found from the following figure that newer teachers are more frequent users of technology in preparation as well as accommodation. In contrast to this, more experienced teachers have been found less frequent users of technology. On the other hand, it has also been found that newer teachers are less frequent users of technology in report asking and delivery as compared to the more experienced teachers.



**Figure 11: (Comparison of teaching experience and frequency of use of technology by multiple measure)**

### Technology Use and School Type

On the basis of generic measure or single composite measure, the frequency of technology use has found similar between high, middle and elementary school teachers. On the other hand, multiple measure approach shows considerably different findings. Besides the use of technology in professional email, instruction and student products has found similar in all schools, teachers of elementary school have found more frequent users during class time than middle or high schools. However, teachers of middle and high schools are found more frequent users of technology in preparation than elementary schools.

### Technology Use and Subject Areas

Relationship of technology use has also studies with respect to the subject area where the results are less dramatic and show a little difference of technology use among different subjects such as mathematics, social studies, language arts and English. Through the analysis of teachers' use of technology using single composite measure, it has found that mathematics teachers are least frequent users of technology as compared to the rest of the subjects. Afterwards, multiple measures approach was administered to find the results and it was found that difference is larger than single composite measure in order to find the difference between mathematics teachers and others. Mathematics teachers do not use technology in preparation, however, they are evident of using technology for delivering instructions, grading and higher level of usage in student products. When different categories are examined separately, the results again change notably because of the correlation of different categories. English, science and social studies' teachers are found similar users according to the generic measures. They are found frequent users for accommodation (research) and grading purposes. Teachers of language arts and mathematics are found less frequent users than other three subject areas.

However, the major purpose of conducting this study was to examine the application of different approaches (single composite & multiple measures), different definitions and measures. These different applications by a researcher can considerably change the ultimate results, descriptions and results. Results are found less dramatic and less varying among years of experience, school type and subject areas when single composite method was employed. While, results changed considerably after the application of multiple measures and multi-dimensional definition of technology use which exhibited versatile perspectives and approaches to examine the technology use and its impact on teacher's improvement.

## Discussion

Governments have made huge investments in education systems and schools to raise the quality of education as well as to assist teachers in learning and knowledge delivering, effectively. It leaves researchers and governments interested in finding how many these technological investments have raised the quality of education and learning. In turn, leaders and managers of educational systems are trying to examine technology's impact on improvement and betterment of education at district, national and state levels. It has found in literature that various methods and measures have been using to measure the technology integration, frequency of use and the ultimate impact on leaning and education. These different methods and measures which are used to define technology and use of technology by teachers bring a considerable variation in the analysis and findings. Usually, researchers have used single composite measure or generic measures to examine the technology use. This study has particularly emphasized the difference which multiple measures approach brings in the research as multiple categories of technology use have studies instead of one i.e. frequency of use. On these bases, following aspects can be determined:

- Technology can be attributed to distinct categories and separate measures can be adopted to examine these categories.
- Though, these are distinct categories but there is a significant amount of correlation among all these categories which implies that interrelated categories can be studied together. It also implies that correlation must be found in order to study these technology uses together for better understanding.
- Distinct measures provide better understanding of technology use as compared to the generic measures.
- Multiple measures approach provide better understanding than single composite approach and better explain the correlation of different factors such as teacher tenure, subject area and school type.

The findings of this research are applicable for research in future about the technology integration, its impact, its success and teachers' characteristics which can be helpful in technology integration. Moreover, the study talks about the defining methods and analyzing approaches which can be greatly helpful for future researchers in order to find the best methods and approaches for more coherent and accurate results. For instance, if administration of a district wants to conduct a survey or to study the technology adoption pattern or technology utilization among school teacher, it is necessary to document the distinct technology uses and study them separately instead of simply measuring its genetic absence or presence. If administration wants to study the technology use to provide more resources or more investment, it needs to study and examine the specific types of technology use through an effective measuring method so that investments and resources can be utilized in an efficient way.

A general issue about the varied and complex nature of technology and its uses bring to bear the multi-faceted approach to measure teacher's use of technology. In common, it is near to impossible that a principle can evaluate a teacher or lecturer on the basis of technology use. However, it is possible that a teacher could be evaluated on the basis how he or she is using technology, in what ways and for what purposes? Types of technology can also be found and understood by its importance in teacher's work and task completion.

It has found that majority of teachers use technology implicitly which cannot be measured and evaluated through the management e.g. use of technology for professional communication, grading and lesson preparation. However, teacher's technology use in teacher-directed student use or instructional use can be measured effectively. Due to these facts, the traditional methods of research or data collection would fail in case of examining technology use in classroom environment or to evaluate a teacher's performance with respect to his or her technology use. Similarly, traditional methods of data collection or evaluated which are student-centered or student-reported would also be failed to capture the essence or pervasiveness of technology in educational system.

## Conclusion

The findings are also relevant to examine the relationship between student learning and technology use. Several studies have documented that technology integration helps in increasing student learning and knowledge gaining process, however, this study elaborates that teacher- directed use of technology is just one distinct category which does not necessarily implies the increase in student's learning. Moreover, teacher-directed use of technology has found less frequent than other categories such as preparation and professional email etc. it is important to note that multiple measure definition of technology and research methods results in more interesting and applicable results as well as helps in finding different categories in relation to each other. In addition, it is suggested that management or district administration needs to define distinct categories of technology before initiating a research or study about technology use.

In summarizing, it can be said that technology uses in education and learning system have been emerged since 1990. These technology uses are putting greater impacts on education and learning quality which can be studied by defining technology in a multiple ways. The complex and varied nature of technology and its purposes are difficult to study however; there is a significant correlation among them which can be evaluated through multiple measures approach for better and simplified understanding. It is necessary to understand that technology must be defined considering its versatile uses instead of studying simple generic absence or presence of technology.

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