Factors Influencing the use of Interactive Whiteboard

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Abstract

In 2012, the Kendriya Vidyalaya Sanghatan made an attempt to digitalize their teaching by launching e-classroom pilot project, which aimed at converting 500 classrooms of Kendriya Vidyalaya Schools into smart classrooms by installing smart board i.e. interactive whiteboards. The present study explored the use of interactive whiteboard by the teachers of Kendriya Vidyalaya within the scope of e-classroom pilot project and the factors influencing the use of interactive whiteboard taking UTAUT model as the theoretical framework. The use of interactive whiteboard is studied in terms of its usage for instructional preparation, instructional delivery and as a learning tool. The findings of the study substantiate that constructs of the UTAUT model that determine the use behaviour of technology are significantly correlated with the use of interactive whiteboard in the said context. Amongst all the factors Effort Expectancy and Facilitating Conditions emerged as the strongest determining factors towards the use of interactive whiteboard.

Keywords

Interactive Whiteboard, Kendriya Vidyalaya, Performance Expectancy, Effort Expectancy, Facilitating Conditions, Social Influence, Behavioral Intentions.

I. Introduction

Albert Einstein has aptly said that "technology has exceeded our humanity", today we apply technology in almost everything we do like for communication, transportation, getting information, writing, working at home or at office and in many more tasks that we perform. It had also evaded the boundaries of school and influenced the mode of teaching. Being inspired by the advancing technologies around the globe, Indian education system too slowly moved towards the infusion of these modern technologies into the educational setup. In 2010, the Committee for the use of Technological Aids in Kendriya Vidyalaya made a recommendation to set up smart classrooms by installing interactive whiteboard. The board of governors approved the recommendation in 2011 and the e-classroom project was launched in August, 2012. As a result 500 classrooms of Kendriya Vidyalaya had evolved from being the niche of blackboard and chalks to the interactive whiteboard (IWB) and stylus (MoM, 2011) [1]. The presented study titled as "A Study of the factors influencing the use of Interactive Whiteboard by the teachers in Kendriya Vidyalaya" explored the usage of this newly penetrated instructional technology and factors hindering its usage taking Unified Theory of Acceptance and Technology (UTAUT) as the theoretical framework.

A. Interactive Whiteboard & Teaching- Learning

Interactive Board is the fusion of two types of technologies i.e. graphic technologies (whose purpose is to project the content) and computer technologies (which are known for storing, processing and retrieval of information). BBC Active (2010) [2] defines interactive whiteboard as "an instructional tool that allows computer images to be displayed onto a board using a digital projector. The instructor can then manipulate the elements on the board by using his finger as a mouse directly on the screen. Items can be dragged, clicked and copied and the lecturer can handwrite notes, which can be transformed into text and saved".

Inan & Lowther (2009) [3] categories the use of any technology into education under three broad categories; used for instructional preparation, instructional delivery and as a learning tool. The wide variety of tools and application installed in the IWB software, enable its use for preparing the lessons, delivering the lessons and as a learning tool.

The interactive software is endowed with many applications and tools that help in preparing lesson such as savable screen (on which the lecture notes can be written prior to the lesson delivery or displayed notes could be saved), camera tool (which has the ability to take a snapshot of whatever is on the screen and save it for future reference) and gallery (that contains lots of ready to use teaching content) (Betcher & Lee, 2009) [4]. Apart from these most of the IWB manufactures have their own interactive resources and lesson sharing communities to help teachers in planning and sharing their digital resources (Rimes, 2011) [5].

IWB supports various types of media which makes it a proficient instructional device. It has screen to write, camera to capture snap, audio and video player, Flash for running interactive power point, interactive software for providing stimulation and many more. Therefore it can mix two or more media type during instructions, for example sound files could be linked to the words so that students can hear pronunciation or a video could be added demonstrating the shown concept and so on (Betcher & Lee, 2009 [4]; BECTA 2004 [6]) that enhances the quality of teacher's instructions and classroom interactions (Liang & Tsai, 2012 [7]). Along with facilitating multiple means of representation, it also support various ways of expressing these media type. Photographs can be zoomed in and out, audio can be stopped and started, video can be edited into relevant snippet, text can be manipulated and many more ways to deal with the content are offered by the tools of IWB software. On the go access to internet is another remarkable advantage of IWB which enable pooling of various digital resources on the web to the classroom (Betcher & Lee, 2009 [4]).

Giant interactive display of IWB can engage students to share their ideas and projects through word processing, presentations, databases, spreadsheets, and concept mapping (Brown & Adler 2008 [8]) or in educational games and stimulation activities at whole class level thus acting as a learning tool. IWB can also be use for feedback/evaluation by calibrating it with learner's response system (Coffee, 2012 [9]; Bell, 2002 [10]).

Use of interactive whiteboard in the context of this study is referred to the actual use of Interactive Whiteboard in instructional preparation, instructional delivery and as a learning tool by the teachers.

B. Theoretical Framework: UTAUT model

Venkatesh, Morris, Davis, and Davis (2003) [11] had reviewed and integrated eight models and theories to formulate the Unified

Theory of Acceptance and Use of Technology (UTAUT) model that explain the factors that lead to individual acceptance and use of any technology. Empirical comparison of the constructs from the eight models and theories, led to the identification of three core constructs; Performance Expectancy, Effort Expectancy, Social Influence that are direct determinants of technology acceptance (behavioral intention) and the behavioral intention along Facilitating Conditions determine use (behavior) of technology. In other words the use of any technology is determined by the Facilitating Conditions (the degree to which the teachers believes that the organizational and technical support is available to support the use of technology) and Behavioral Intention of the user (teachers) to use that technology which is influenced by user's Performance Expectancy (the degree to which teachers might believes that using the technology will enhance their job performances), Effort Expectancy (the degree to which the technology could be used easily or without much efforts by the teachers) and Social Influence (the degree to which the teachers perceives that important others expects that he or she should use the technology). It can be concluded that Performance Expectancy, Effort Expectancy and Social Influence indirectly determine the use of technology and Behavioral Intentions and Facilitating Conditions directly determine the use of technology. The model also suggests that the effect of these constructs on use behaviour is moderated by four other variables: age, gender, experience and voluntariness of use. UTAUT model established the relation between six variables as represented below:
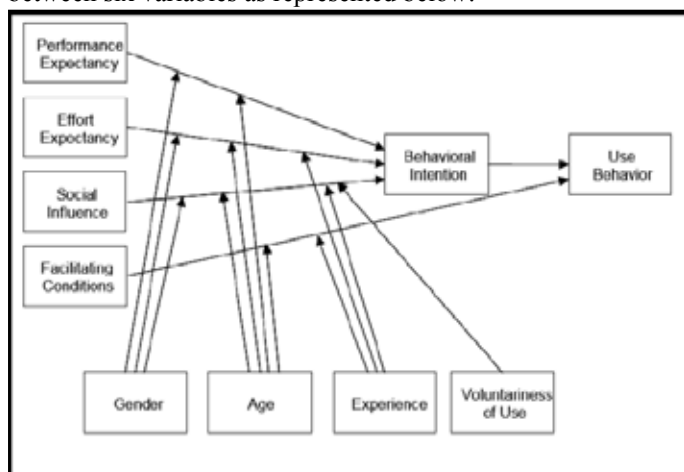

Fig. 1: UTAUT model

II. Purpose For The Study

The use of any technology in education depends on many factors as asserted by Programme of Action (PoA), 1992 [12], "all technology require supporting infrastructure, and unless that infrastructure like trained manpower, competent and willing teachers, school buildings etc., exists, no technology direct or distance is likely to succeed". Hence it is imperative to find the factors influencing the use of Interactive whiteboard within the scope of e classroom project so that the hindrances could be identified and removed before it would be launched on a large scale. The factors intervene the use of interactive whiteboard are taken from UTAUT model. The purpose of this study is to seek answer to the research question- Is there any influence of factors (Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions and Behavioral Intension) on the use of Interactive Whiteboards (in instructional preparation, instructional delivery and as learning tool) by the teachers in Kendriya Vidyalaya?

Following research objectives are investigated to answer the research questions
- To study the use of Interactive Whiteboard in instructional preparation, instructional delivery and as learning tool by the Teachers in Kendriya Vidyalaya.
- To find the difference in the use of Interactive Whiteboard with respect to gender and age.
- To study the factors (Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions and Behavioral Intension) influencing the use of Interactive Whiteboard by the teachers in Kendriya Vidyalaya.
- To find the difference in Performance Expectancy, Effort Expectancy, Social Influence and Behavioral Intension on the use of Interactive Whiteboard with respect to gender and age.
- To study the influence of factors (Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions and Behavioral Intension) on the use of Interactive Whiteboard.

To test the significance of study following null hypothesis are tested
Ho1: There is no significant difference in the use of Interactive Whiteboard by the teachers with respect to gender and age.
Ho2: There is no significant difference in Performance Expectancy, Effort Expectancy, Social Influence and Behavioral Intension on the use of Interactive Whiteboard with respect to gender and age.
Ho3: There is no significant influence of factors (Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions and   Behavioral Intension) on the use of Interactive Whiteboard by the teachers.

III. Methods

1. Research Design
The study adopted a correlational research design that aims to describe the influence of factors on the use of Interactive Whiteboard by the teachers of Kendriya Vidyalaya.

2. Variables for the Study
Constructs of UTAUT model; performance expectancy, effort expectancy, social influence, facilitating conditions and behavioral intention that influence the use behaviour of interactive whiteboard are taken as the independent variables for the study. Usage of Interactive Whiteboard by the teachers for instructional preparation, instructional delivery and as a learning tool are taken as the dependent variable for the study.

3. Participants and Settings
The Participants for the study are the sixty teachers of the Kendriya Vidyalaya schools who are using interactive whiteboard. The sample for the study is selected from the 5 kendriya Vidyalaya schools of Delhi region who have installed Interactive. After selecting the schools through purposive sampling, 12 teachers (6 males and 6 females) from each school who is using the interactive whiteboard technology are selected randomly (irrespective of the subjects and class) in such a way that 3 males and 3 females teachers from each schools belongs to the age groups above and below 35 years (stratified sampling). In total, the sample will

comprise of the 60 teachers out of which 30 are male (15 from each, above and below 35 years of age) and 30 are female teachers (15 from each, above and below 35 years of age).

4. Instrumentation and Data collection

The data is collected through two tools. Usage of interactive whiteboard is measured by a self constructed rating scale (Interactive Whiteboard Usage Scale) consisted of 30 items (based on review of literature) corresponds to use of IWB for instructional preparation, instructional delivery and as a learning tool. The reliability coefficient for the scale is 0.866. The validity of the scale is ensured by the experts. The scoring of the responses is done via summated rating method (Likert, 1932) [13] by assigning marks to each cell indicating frequency of use, 0 mark to 'never', 1 mark to 'rarely', 2 mark to 'sometimes', 3 mark to 'often' and 4 mark to 'always' for each statement. The measurement of the responses is done by analyzing each item measuring the aspect of IWB usage by counting the frequency (percentage) of responses under each rating category and then computing the average rating score for each statement, which is ordered to depict the most preferred use of IWB to the least preferred use of IWB for teaching (Bertram, n.d) [14].

Factors influencing the use of interactive whiteboard are measured by a Likert scale (Factors' Assessment Scale) adapted from the UTAUT questionnaire, consisted of 40 items categorized under PE, EE, SI, FC and BI. The reliability coefficients for the scale are 0.873, 0.869, 0.537, 0.740, and 0.692 for each category respectively. The scoring of the responses is done via summated rating method (Likert, 1932) [13] by assigning marks to each cell indicating the level of agreements, 1 mark to 'strongly disagree', 2 mark to 'disagree', 3 mark to 'can't say', 4 mark to 'agree' and 5 mark to 'strongly agree'. Marks for all the items of each sub-category are summated to get the total score of each construct for all the respondents depicting the level of agreement on the factors influencing the use of interactive whiteboard (Singh, 2013 [15]; Kothari, 2004 [16]). The measurement of the responses is done by analyzing each item of every sub-category, measuring factors influencing the use of IWB by counting the frequency (percentage) of responses under each rating category and then computing the summated scores for each individual via Likert scaling technique (Kothari, 2004) [16], to place all the respondents on a continuum ranging between two extreme responses i.e. strongly disagree to strongly agree. The content validity of tool is established by experts.

Investigator visited all the five schools (on different days) and with the permission of the designated authority, selected teachers, who are teaching with IWB. Both the tools are administered on all the selected 60 teachers from five schools. The gathered data is analyzed through descriptive and inferential statistics using statistical software; SPSS 19 and Microsoft Excel (2010).

IV. Results And Discussions

The major findings of the study are as follows:

- The mean usage of Interactive whiteboard is 61.87 (median 62) which illustrates that use of interactive whiteboard is neither very high nor low with majority of respondents using IWB ☐sometimes☐ for teaching-learning process (42%). The Table 1 presents the usage frequency of Interactive Whiteboard.

Table 1 : Frequency and percentage distribution of Interactive Whiteboard Usage

Dimension		Never	Rarely	Sometimes	Often	Always
Instructional Preparation	f	10	78	258	163	31
	%	2%	14%	48%	30%	6%
Instructional Delivery	f	46	261	359	198	96
	%	5%	27%	37%	21%	10%
Learning Tool	f	5	82	131	64	18
	%	2%	27%	44%	21%	6%
TOTAL	f	61	421	748	425	145
	%	3%	23%	42%	24%	8%

As evident from the table the percentage of respondents frequently using interactive whiteboard for instructional preparation (36%) is slightly higher than instructional delivery (31%), which is higher than its use as a learning tool (27%). In another study by by Trel & Johnson (2012) [17] majority of the teachers studied described themselves as average users of IWB.

- The Average rating for each use of the IWB for instructional preparation, instructional delivery and as a learning tool is compared in the table 2:

Table 2: Average rating of specific IWB functions

	Use of IWB	Average
INSTRUCTIONAL PREPARATION	Preparing Classroom Notes	2.31
	Create Activities	2.75
	Create Multimedia Resource	1.85
	Saving classroom notes	2.31
	Save Multimedia resource from Web	2.88
	Use content from Gallery	2.71
	Use activities & games from Gallery	1.96
	Visit online IWB communities for reference	1.53
	Screenshot materials from web-pages	1.78
INSTRUCTIONAL DELIVERY	Pen tools for writing or drawing	3.12
	Multi modal presentation of concepts	2.88
	Highlighter/ Spotlight	2.52
	Collating Objects on a single screen	2.07
	Opening Multiple files	1.8
	Hand recognition	1.55
	Screen shade/blind curtain	1.28
	Zoom/Enlarge	1.8
	Animate text/image	1.33
	Drag & Drop	1.73
	Colour Change	1.95
	Add textbox	1.47
	Adding annotations	1.42
	Virtual experiments & demonstrations	2.22
	Shared reading & writing	2.57
	Online resources for teaching	1.92

L E A R N I N G T O O L	Involving students in games and activities	2.77
	Presentations by students	1.88
	Collaborative work	1.92
	Students add points on screen	1.77
	Create digital worksheet/quiz	1.8

As evident from the above table IWB is mostly used for writing and drawing like a conventional classroom board could be used or for instructional preparation i.e. in saving content from the web. This is supported by the literature review of Smith et al, (2005) [18] in which they validate that the use of interactive whiteboard enable to prepare lesson in advance, store and reuse the lesson later. While delivering instructions via IWB the only frequently used interactive tool is spotlight for drawing attention. Other interactive tools that are meant to improvised teaching strategies like drag and drop, animation are least used. The similar findings were reported in a project by Hiller, Beauchamp & Whyte (2013) [19], where the teachers stated that they are most confident in using basic black/whiteboard features such as the pen tool, eraser tool, highlighter tool, and inserting images or diagrams. Trel & Johnson (2012) [17] also reported that the most frequently used features are those that are related to other ICT equipments like mouse functions, writing, saving lessons, virtual keyboard, and least used features are internet, hyperlinks and shading. The less explored aspect of IWB is to allow students to directly write on the board with the average rating of 1.77, this makes it evident that way IWB is used is creating a digital version of the conventional classroom as pointed by the Anderson (2010) [20] which further reinforce the concept of "sage on the stage".

- The percentage of teachers frequently using interactive whiteboard (23% often and 13% always) is more for female than for male (21% often and 2% always). The difference in the mean usage of interactive whiteboard with respect to gender is significant at 0.05 level

- The percentage of teachers frequently using interactive whiteboard in case of teachers belonging to age group above 35 is 32% (22% often and 10% always) and in case of teachers belonging to age group below 35 is 32% (25% often and 7% always). This shows that usage of interactive whiteboard for both the groups is almost similar. The difference in mean usage of interactive whiteboard with respect to age is insignificant at 0.05 level.

- Performance Expectancy which is described as the teachers' faith in the ability of interactive whiteboard were found to be favorable among the sample indicating that teachers believe that using interactive whiteboard for teaching will enhance their performance. Majority of teachers mentions that IWB reduces the preparatory time (98%), promotes conceptual understanding (81%) and enhance motivation among learners (97%). 70% of the teachers regard it better than conventional blackboard for teaching. Overall 59 respondents show favorable attitude towards performance expectancy of interactive whiteboard and only one respondent is uncertain towards the performance expectancy of interactive whiteboard. The study conducted by Shams & Ketabi (2015) [21] also found the positive attitude among the Iranian teachers towards IWB, as majority of the teachers believe that they can easily interact and communicate with students by using an IWB which kept their students engaged during a lesson and provides time efficiency and classroom management

during instruction. Teachers under Trel & Johanson (2012) [17] study also supported the use of IWB for designing visually attractive materials that enhanced their presentations, changed their pedagogical level and motivate, attract and engage students. Whitepaper (2006) [22] also asserted that IWB provides flexibility to the teachers while teaching so as to cater to the needs of all the learners and enhance students□ participation. Hodge & Anderson (2007) [23] also found that with gradual use IWB increased their classroom engagement, helps in developing ICT skills, increases conceptual clarity, enhance teaching by providing varied resources for planning daily lessons, reduces preparatory time and allows smother switching from one lesson to another.

- There is a significant difference in performance expectancy with respect to gender (at 0.05 level), female teachers agreement towards the performance expectancy is slightly more than male teachers. However there is no significant difference in the performance expectancy of teachers with respect to age. The difference in performance expectancy is also supported by the findings that use of IWB is more in case of female teachers than male teachers. As according to the model performance expectancy is directly related with the use behaviour.

- Majority of the teachers are uncertain about their effort expectancy towards the use of interactive whiteboard (39%). On the other hand 33% disagree and 28% agree towards the availability of knowledge and skills required to successfully integrate interactive whiteboard into teaching-learning process. However majority of the teachers mentions that they have received the training (56%) and special instructions (80%), this clearly indicate that the given professional guidance was not adequate to develop necessary competency to use interactive whiteboard. Analysis of the summated scores highlights that majority of the respondents (36) show disagreement towards effort expectancy and 24 respondents express agreement towards the effort expectancy towards the use of interactive whiteboard. The similar findings were reported in study by Hiller, Beauchamp & Whyte (2013) [18] where low self-efficacy was reported among teachers towards the use of IWB. In a study by Al-Faki & Khamis (2014) [24] the major difficulties reported under teacher's factor are; big gap between teachers' practice and pedagogical framework of the interactive whiteboard. As per the study teachers reported the difficulties in managing interactive whiteboard, lack of knowledge to troubleshoot problem, lack of competency, busy schedules. Korkmaz & Cakil (2012) [25] also highlighted that incompetency of teachers to use smart board is the main reason for low usage of IWB technology.

- There is no significant difference in the effort expectancy of teachers with respect to age and gender.

- Almost all the teachers agrees to the influence of significant others on their use of interactive whiteboard (53% somewhat agrees and 35% strongly agrees). The teachers mention that their students ask them to teach through IWB, principal and colleagues encourages and supports the use of interactive whiteboard. This substantiate that respondents decision to use interactive whiteboard is influenced by the expectations of significant others; principal, colleagues and students. Analysis of summated scores also show complete (60 respondents) show agreement towards the influence of others on their decision to use interactive whiteboard. This indicates that

the organization and colleagues support the teachers in using IWB.

- There is a significant difference in the social influence with respect to gender, with male teachers showing slightly more favorable inclination towards influences of significant others, and however there is no difference with respect to age.
- The findings points that majority of the teachers disagree to the availability of sufficient technical infrastructure and support that is required for seamless integration of interactive whiteboard. 88% of the teachers said that there is no interactive whiteboard in their classroom and hence they don't have freedom to access in the manner they want. Other shortcomings reported were lack of supporting resources (33%), lack of time to practice (57%), lack of technical assistance (63%) and time given as per timetable is not sufficient for teaching via IWB (67%). Though Majority of teachers said that they got training to use IWB but lack of supporting resource and time to practice minimize its effectiveness. The interpretation of summated scores also reflects the disagreement towards the availability of required facilities and conditions to integrate interactive whiteboard as a teaching tool in classroom practices as only 3 respondents out of 60 agreed that required facilities and conditions are available to foster the use of interactive whiteboard. In a study by Al-Faki & Khamis (2014) [24] it was also found that the lack of provision for periodical pedagogical support concerning interactive whiteboard, insufficient interactive learning materials (software), non-availability of sufficient technicians during technical fault occurs and limited use of the Internet in classrooms are the major difficulties. Jang & Tsai (2012) also cited similar reasons in their study for not using interactive whiteboard like lack of time to design teaching materials and limited sources. Korkmaz & Cakil (2012) [25] also identifies similar factors that hinder the use of interactive whiteboard; lack of suitable instructional and presentation material, teachers inability to fix technical problems and lack of adequate preparation time.
- All the teachers holds positive intentions towards the use of interactive whiteboard as they find this new instructional technology utilitarian and look forward to use it in future by designing teaching strategies around it. As per summated score analysis 59 respondents show favorable intentions towards the use of interactive whiteboard and respondent holds neutral attitude.
- The difference in behavioral intentions with respect to age and gender is insignificant.
- There is a positive correlation between factors and use behavior, which is found to be significant at 0.05 level. The highest correlation exists between effort expectancy and usage of interactive whiteboard with the coefficient of correlation (r) 0.334 and facilitating conditions (r=0.244). Social influence and Performance expectancy to an extent also influence the use of interactive whiteboard with the coefficient of correlation (r) 0.181 and 0.160 respectively. As per the analysis of the study the least influencing factor is the behavioral intention with the r value of .015.

V. Educational Implications

- The teachers in the study admitted that interactive whiteboard enhance the teaching effectiveness (performance expectancy) and also improves conceptual understanding among the learners. However there is no policy or scheme that aims to raise the penetration of interactive whiteboard in the Indian classrooms. Considering the benefits of this new interactive technology, policy maker could frame a policy for the same or incorporate it in any of the existing policies.
- Many teachers reported that they lack knowledge and skills required to successfully integrate interactive whiteboard into teaching-learning process instead of professional guidance and training. In order to enhance the effort expectancy more training sessions could be arranged for the teachers.
- Teachers also reported that they got no time for practicing what they had learnt in the training as the time table was structured in such a way that it left little scope to teach with interactive whiteboard or because of the excessive administrative. A principal could ensure that the time table provide adequate teaching time with interactive whiteboard and do not give extra administrative tasks during teaching time.
- Almost all the teachers disagreed to the availability of sufficient technical infrastructure as 88% of the teachers said that there is no interactive whiteboard in their classroom and hence they don't have freedom to access in the manner they want. So the management could allocate more interactive whiteboards. To overcome the additional cost, low price IWB such as Wiimote IR pen based IWB could be used. Along with it supporting resources like availability of electricity, internet and technical assistance must be provided.
- As could be concluded from the analysis teachers are using interactive whiteboard more for teaching than as a tool promoting self-learning among learners, this might bring back the notion of "sage on the stage". To avoid the creation of teacher-centered classroom, more interactive activities and games must be included in the lesson. Also more opportunities for peer teaching and presentations are to be provided.
- Teacher must also use more interactive tools available in the tool kit of interactive whiteboard and collate content from the web to enhance the conceptual understanding among learners.

VI. Conclusion

Almost all the teachers are using interactive whiteboard for teaching-learning process with mean of 61.87 which is slightly above mid-point. The findings of the study highlight that all the factors positively impact the usage of interactive whiteboards by the teachers in Kendriya Vidyalaya schools. In this context the effort expectancy and facilitating conditions emerged as the strongest determining factors towards the use of interactive whiteboard. In other words ability of teachers to use IWB with ease and availability of the technical and organizational support has the maximum influence on the use technology by teacher. Favorable performance expectancy and social influence will only enhance the use of IWB only when teachers have required competency and facilitating conditions. The behavioral intentions have the least influence on use of interactive whiteboard; this might be due to the fact that teachers are obliged to use interactive whiteboard under e-classroom pilot project as 61% of the teachers agreed that they use IWB because of e-classroom pilot project.

Acknowledgement

Studies, Faculty of Education, Jamia Milla Islamia for her support and guidance. I also thank Principals and teachers of Kendriya Vidyalaya schools for their time and co-operation in data collection without which this research would not have been possible.

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