

TEACHERS' ACCEPTANCE OF THE SMART BOARD IN PRIMARY EDUCATION SCHOOLS – QOE ANALYSIS

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ABSTRACT

In the last years governments have made considerable investments to empower the learning environments in the educational institutions with different technological solutions. Still the crucial factor for successful technology integration into the traditional classroom is the teacher and teacher's dedication to transform the teaching methodology. If the teachers fail to fully utilize the advantages of introduced technology, the value of whole undertaking is naturally reduced. This study explores the realistic use and impact of interactive smart board in the primary educational program; assess different didactical principals, while following fully user-oriented approach and evaluating the overall teachers' Quality of Experience (QoE). A survey-based methodology was used to collect feedback on teachers' subjective perception, while different variables are analyzed with a structural equation model to predict relevant factors which influence teachers' use of this technological resource available to them.

I. INTRODUCTION

There are different technological innovations that are widely recognized as potential learning tools with great motivational appeal, representing an interesting development in the field of education. The proper implementation of the technology can empower the learning environment while improving the conditions needed to optimize learning and promote the transfer of knowledge and skills. Still different studies have shown that a crucial factor of the technology integration into the classroom is the teacher [1]. The success of the technological change in the classroom is closely depended of the teacher's believes to change the standard pedagogical practice and didactical approach and make proper technology-integration decisions.

The Government of the Republic of Macedonia has already adopted global strategy for continuous investments in new

technological solutions in the field of education and their proper integration in the state curriculum. Its primary goal is to set a foundation for proper education, thus creating a society based on knowledge and citizens fully capable to utilized latest technological achievements and actively participate in local development. In this context, the Ministry of Education and Science of Macedonia has equipped 66 different primary education schools with the latest technological solutions which include smart boards (also known as interactive whiteboards - IWBs) and proper equipment, to inspire, engage and initiate different styles of teaching. Still this governmental investment in these educational institutions greatly depends of the teachers' acceptance of this technological solution. Teachers should be a catalyst for development of new teaching practice which facilitates students' active knowledge construction.

This study researches the teachers' acceptance of the smart board in the primary education schools, as one of the technological changes that are inevitable in the years to come. We explore the implementation of the pedagogical practices and didactical principals when the smart board is introduced in the learning environment, while analysing feedbacks from schools which have already integrated this solution. Since, we recognize the teachers as the crucial factor for proper development, we follow user-oriented approach, while exploring teacher' subjective expectations in terms of Quality of Experience (QoE) [2, 11]. Through the research we have identified different factors, coming from the standard didactical principals, which can influence the proper technology integration and predict the level of teacher's positive experience. These different factors, represented as observed variables are analyzed with a structural equation model to provide quantitative measurements for inner-correlation, which can be widely used for similar technological change in the primary education.

II. LITERATURE REVIEW

Different governments have been vigorously promoting the integration of information and communication technology (ICT) into the teaching plan in the last decade. These projects' major purposes are to assist teachers in acquiring various technologies enhanced teaching tools and materials, while constructing powerful learning environment. The smart board is a multifunctional device, which offers different possibilities which can be utilized in the classroom environment. This solution can be rather technologically simple for installation and integrations. Studies provide information that the technology was installed with minimum training or pedagogic introduction [3], so the focus for success is the teacher's acceptance afterwards in the learning environment. The technological tools offer different perspective, but researches already show that teachers are not integrating technology sufficiently in the learning practices [4, 5]. Even more, systematic approach is needed and different methodologies have to be developed for effective smart board use [6] in the classroom.

On the other hand, studies on didactics in its broadest definition refers to all kinds of research on teaching, or more precisely, on the teaching-studying-learning process [7]. Didactic models or textbooks may help, but they do not remove the teacher as a key player, which makes the educational decisions at the end crucial, when they need to be used in practices [8].

Researching the realistic use of the smart board in the primary education schools in Macedonia, we explore if this technology has been successfully integrated in the classroom. This approach isn't technologically oriented, but focuses on the teachers' view regarding this novelty in schools. Having in mind that we cannot ignore the didactical principals which guide teachers when they organize the class and perform their activities, we use them as base, which is upgraded with the referred technological tool. Additionally, like various models, which try to create unified theory of acceptance and use of technology (UTAUT) [9] or theory of planned behaviour (TPB) [10], during the research study we try to produce proper model which can predict teachers' experience regarding similar technological changes.

III. METHODOLOGY

In the recent years, numerous studies have described different success stories in integrating the latest ICT solutions in the educational field, but still there is little evidence of larger transformations in the classrooms. The literature emphasizes the necessity for teachers to modify their pedagogical

methodologies and teaching practices while integrating latest technological tools in the learning process. Furthermore, the ICT in the classroom is not easily sustained and upgraded after the transformation has been made [12].

In the article we research the integration of the smart board in primary education schools in Macedonia. Even though, the actually delivery and implementation of this technological solution was successfully finished through the governmental project, the practical usage and teachers' acceptance are the parameters which can illustrate the educational benefit of the whole project.

Our study tries to tackle these issues and help national plans for technology integration, while evaluating teachers' beliefs regarding these technological changes. We have researched the involved primary schools and their capabilities to transition, from the traditional priorities and conventional learning goals, into an approach that changes the way of teaching, while engaging teachers to use the smart board in the everyday learning process.

Recognizing the teacher as a key player in the acceptance of the smart board in the classroom, we try to distinguish different variables which should influence the positive level of teachers' QoE regarding this technological integration. Teachers are used to practice standard pedagogical approaches and didactical principals to fulfil their goals. We believe that these methods will remain the same in the future, but they will need to be upgraded while integrating the smart board for improvement of the learning process. Therefore the research variables are derived from the standard didactic principles; they have been evaluated after the integration of the smart board, while trying to predict the teachers' QoE.

For the purpose of gathering teachers' feedback, a survey was developed, which was distributed to all involved teachers in this project, so they could express their subjective opinion on different topics which include the research variables, while using the traditional blackboard and chalk or the smart board. They were able to grade different questions on a scale from 1 to 6, where 1 is strongly disagree and 6 is strongly agree on each question. The surveys were conducted on-line so all responses from different primary schools were collected in a central database for further analyses and results

A. Hypothesis

In the study we speculated that teachers' pedagogical beliefs can strongly influence their decisions on technology integration. The utilization of the smart board changes the way the lesson is planned, organized and delivered in practices.

The ultimate success of this technology integration will be achieved if higher level of teachers' positive OoE reached. Therefore, regarding our mentioned variables which should predict high QoE we have formulated several hypotheses which should be tested through the research data gathered from the teachers' feedback.

The integration of the smart board should increase efficiency in the learning process, and therefore we construct the following hypotheses:

H1: The preparation of the class and the realization of the educational goals are closely related with each other;

H2: The effectiveness in preparation and goals' realization in the class positively increase teachers' QoE from the smart board integration.

The smart board is a multimedia educational tool which introduces different possibilities, so we believe:

H3: The proper visualization of the content and the didactical principle for simplicity and proper presentation of

the obvious when closely related with each other, increase the quality of the class ;

H4: The educational tools which provide better visualization and simplification of the content increase their acceptance by the teachers' and their QoE.

H5: The possibilities of the smart board to better adapt the content for the intended students and the increased interaction during the class influence teachers' QoE.

B. Structural equation model

It is attempted to predict relationships among the mentioned variables which can influence positive teachers' use of this technology and QoE, while also testing the proposed hypotheses, we have constructed a structural equation model (SEM). During the study, SEM analyses were conducted to investigate the model fit regarding the teachers' feedback data set, and to support our claims and hypotheses. Fig.1 illustrates the proposed model, observed variables and their inner-correlation.

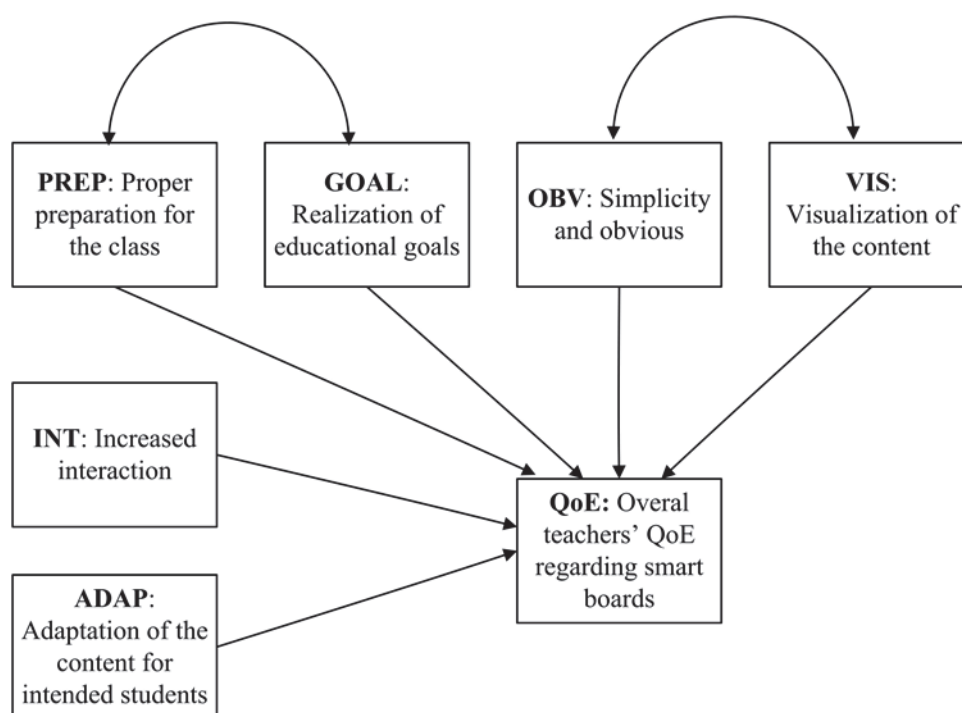


Figure 1: Proposed model illustrating observed variables and their relationship.

The illustrated observed variables basically represent standard pedagogical methodologies that teachers' were using even before the technological change. The introduction of the

smart board should enhance these principals, influence teachers' QoE and generally create improved educational process in the primary education.

To verify the proposed model, we have subjected the model to the produced data set and tested if the model fits the data. The model was analyzed for the necessary indicators in terms of reliability, validity, means, standard deviations, correlations, factor analysis [13] to support our claims, regarding factors which can influence positive teachers' QoE when the smart board or similar technological novelty is integrated in the primary education schools.

IV. DISCUSSION AND RESULTS

In the study we have investigated different factors which may influence of positive teachers' acceptance of the smart board in the primary education. We have collected teachers' feedback information through survey based methodology, which included questions on all relevant indicators and overall teachers' QoE.

The survey has been distributed to the group of teachers which were using the smart board for some time, to assist with the further refinement of the instrument. It was conducted completely anonymously, so teachers could freely express their opinion on each question.

We have received responses from 62 teachers, with average age of 42 years, 27.42% male and 72.58% female. These teachers work in primary schools in different cities and villages in Macedonia, so therefore our research has covered proper subset which included urban and rural learning environments. Furthermore, this data set was consistent with the proposed statistical hypothesis and could be further analyzed with the researched structural equation model.

Table 1 illustrates the usage of the smart board in the classrooms through these primary schools

Table 1: Smart board usage in the classrooms (n=62).

Usage type	Percentage [%]
Every day during the week	20.97
Two-three times a week	27.42
Once a week	48.39
Never used	3.22

These primary results show that the teachers have accepted this new technology and are using it to perform their teaching activities. Approximately one half of the covered subjects

used it once a week, while the rest, use the smart board more frequent in the classroom, which suggests positive acceptance of this new educational tool.

One of the goals of the research was to evaluate if the smart board have made a significant difference in the traditional classroom. Therefore we have analyzed the teachers' feedback and compared each research variable, which actually represents different didactical principal which teachers use to perform their tasks more efficiently. The gathered data set was compared for differences between the traditional based and smart board enabled classroom.

Table 2 gives the mean scores on each question, graded by the teachers on a scale from 1 to 6, where 1 is strongly disagree and 6 is strongly agree.

Table 2: Comparison between the mean score in the traditional/smart board enabled classroom (n=62).

Variable	Traditional	Smart board
PREP	3.00	5.75
GOAL	3.25	5.72
OBV	3.09	5.74
VIS	2.79	5.79
INT	3.19	5.79
ADAP	3.32	5.61
QoE	3.27	5.80

The presented statistical results illustrate high impact of the smart board usage on each of the research variables. The responses on each factor, coming from the standard didactical principals, show that this technology integration in the classroom has made significant difference represented through the teachers' perspective, while increasing the level of teachers subjective QoE.

The researched model produced positive indicators in terms of correlations, factor analyses and reliability, indicating proper model fit and alignment between the hypothesized model and the collected data set. Table 3 shows the regression weights in the model, while the paths between the variables reported $p < 0.05$, thus supporting each one of them and the validity of the proposed hypotheses (H1 to H5).

Table 3: Regression weights and correlations between variables in the proposed model.

Relationship	Estimate
PREP --->QoE	.075
GOAL --->QoE	.243
OBV ---> QoE	.030
VIS ---> QoE	.120
INT ---> QoE	.271
ADAP ---> QoE	.132
PREP <--> GOAL	.599
OBV <--> VIS	.584

While analyzing the effects, we can see high inner-connection between PREP and GOAL (H1) and OBV and VIS (H3). The teachers' positive QoE is mostly predicted by increased possibility for interaction (INT to QoE = .271) and the fulfilment of the educational goals (GOAL to QoE = .243), which supports H2 and H5. The other variables also influence teachers' QoE, with smaller values for correlation. This is logical since the overall teachers' QoE was extremely high (with mean score 5.80) when the smart board was used in the learning environment, with small values for deviations and further stronger links with the rest of the variables.

To summarize, all of the presented results have shown high level of teachers' acceptance of the smart board in the primary education classroom, while the teachers' positive QoE was highly increased compared with the traditional environment.

V. CONCLUSION

Since the integration of the smart board in the teaching systems are only in the beginning stage, teachers' habits of use and teaching efficacy need to be evaluated. The teacher is the crucial factor of the successful integration of this technological solution, so therefore we follow a user-oriented approach and research different factors which can influence teachers acceptance and QoE.

Following the governmental project for the implementation of the smart boards in different primary educational schools

across the country, we have researched the actual usage and impact in the classroom since the completion of the project. We have identified different variables which influence the learning process and teachers' experience in general and performed confirmatory factor analysis which should unveil the relative weights of these inter-correlated factors rather than merely providing lists of statistical information.

Furthermore, even though this article focuses on the utilization of the smart board, the proposed methodology, identified model and provided results can be used in similar efforts to promote and integrate latest technological solutions in the field of education.

REFERENCES

- [1] M. T. Romano, "Empowering teachers with technology: Making it happen", Lanham, MD: Scarecrow Press, 2003.
- [2] Wikipedia: Quality of experience (QoE). Available at http://en.wikipedia.org/wiki/Quality_of_experience.
- [3] D. Miller and D. Glover, "The professional development induction experience of secondary mathematics teachers using interactive whiteboard", *Learning, Media and Technology*, vol. 2, no. 3, pp. 173-191, 2006.
- [4] D. Reynolds, D. Treharne, and H. Tripp, "ICT - The Hopes and the Reality", *British Journal of Educational Technology*, vol.34, no.2, pp. 151-167, 2003.
- [5] P. A. Ertmer, "Teacher pedagogical beliefs: The final frontier in our quest for technology integration?", *Educational Technology Research and Development*, vol. 53, no. 4, pp. 25-39, 2005.
- [6] R. Geer and A. Barnes, "Cognitive concomitants of interactive board use and their relevance to developing effective research methodologies", *International Education Journal*, vol.8, no 2, pp. 92-102, 2007.
- [7] P. Kansanen,"Teaching as teaching-studying-learning interaction", *Scandinavian Journal of Educational Research*, vol. 43, no.1, pp. 81-89, 1999
- [8] F. Elbaz, "Teacher Thinking: A Study of Practical Knowledge", London: Croom Helm, 1983.
- [9] V. Venkatesh, M.G. Morris, G.B. Davis, and F.D. Davis, "User acceptance of information technology: toward a unified view", *MIS Quarterly* 27 (3), pp. 425-478, 2003
- [10] I. Ajzen, "The theory of planned behavior", *Organizational Behavior and Human Decision Processes* 50, pp. 179-211, 1991.
- [11] V. Menkovski, A. Oredope, A. Liotta, and A. Cuadra Sánchez, "Predicting Quality of Experience in Multimedia Streaming," *Proceedings of the 7th International Conference on Advances in Mobile Computing and Multimedia, Kuala Lumpur, Malaysia*: pp. 52-59, 2009
- [12] D.N. Hayes, S. Schuck, G. Segal, and J. Dwyer, "Net gain? The integration of computer-based learning in six NSW government schools", (No. 186365 294 9). University of Technology, Sydney, NSW, 2001
- [13] P. Holmes-Smith, "Introduction to structural equation modeling using AMOS 4.0 & LISREL 8.30", School Research, Evaluation and Measurement Services, Melbourne, Australia, 2000