A MODEL TO EXPLORE TURKISH TEACHERS' ICT INTEGRATION STAGES

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ABSTRACT
The aim of the study is to determine teachers' ICT integration stages according to CEO Forum's standards and factors affecting their integration. Teachers are expected to use ICT in their teaching practice. Hence, it is crucial that their integration stages and factors affecting it are examined. A survey method was employed for this study. A sample of 200 teachers was selected randomly out of 460 teachers working in primary schools in Uşak, Turkey. Researchers of this study developed an ICT integration questionnaire. Analysis of the data reveals that the teachers are in three different stages in ICT integration. A significant relationship is discovered between feelings of inadequacy in using ICT and exhibiting stage 1 behaviors. It is also clear that the ICT knowledge of teachers is the most important variable for the teachers who were at the third (the highest) stage of ICT integration. A model showing interrelations among factors influencing ICT integration behaviors were drawn for further studies to be tested.
Keywords: ICT, Teachers, Integration Stages, Attitudes, Self Inadequacy

INTEGRATING ICT INTO TEACHING

The study investigates the relationships among teachers' Information and Communication Technologies (ICT) integration stages, teachers' feelings of self inadequacy in using ICT and level of perceived knowledge in ICT usage and their attitudes towards the use of ICT in teaching and learning.

In the literature ICT integration stages manifest itself in five different consecutive stages; entry, adoption, adaptation, appropriation and invention (CEO, 1999). Teachers' quality of use of ICT in teaching and learning, professional development, administrative work, etc. determines their stages of integration. The stages, teachers' typical applications in the stages and possible factors affecting ICT integration are discussed in the literature. Despite this and its importance, there is not enough body of empirical research trying to determine teachers' actual ICT integration stages.

Integrating ICT into teaching for subject teachers has become an important issue in Turkey for the last decade. There is a pressure onto teachers coming from almost every part of the society; from policy makers, senior management, their peers and students (Altun, 2002). Thus, teachers are expected to use ICT in their teaching practice one way or another. Hence, it is crucial that ICT integration stages and factors affecting the stages need to be examined.

ICT Integration Stages

According to Comber, Lawson and Hargreaves (1998), it is important to identify teachers' integration stages because necessary policies can be introduced at any time when trying to enhance quality of teachers' ICT usage. They (1998: 372) also argue that "…previous attempts to foster an 'educational revolution' through the introduction of computers largely failed because teachers were uncertain about how ICT could be integrated into the curriculum…"

The implementation of an innovation has an array of levels (Hall, 1995). Although there are similar technology adoption models (Dawes, 2001; Comber *et al.*, 1998; Toledo, 2005), CEO Forum's standards are most commonly used to illustrate the levels of teacher ICT integration (CEO, 1999). CEO Forum suggests five consecutive stages of integration.

> Entry: Students Learning to Use Technology. At this stage, teachers are not themselves users of technology. If students are using technology, they are using it in ways determined by someone other than the teacher without participation from the teacher.
> Adoption: Teachers Use Technology to Support Traditional Instruction. Teachers are beginning to use technology, usually to enhance their own productivity, mandated either by the school or through their own initiative. They experience an advantage doing traditional tasks with a new tool and begin to see the power of the tool for other applications…
> Adaptation: Technology Used to Enrich the Curriculum. Teachers begin to use technology in ways that are connected to the curriculum, and in ways that are already familiar. …Teachers at the adaptation stage tend to direct students to inquiry rather than allowing student-directed learning experience.
> Appropriation: Technology is Integrated, Used for its Unique Capabilities. … In the classrooms (of teachers) at this stage, technology begins to reveal its potential to produce improvements in learning, as students master higher-order thinking skills, and more complex concepts and skills than they would have encountered without technology…
> Invention: Discover New Uses for Technology. At this stage, teachers are defining classroom environments and creating learning experiences that truly leverage the power of technology to involve students in tasks that require higher-order thinking skills as well as mastering basic concepts and skills.
> CEO Forum (1999:14-15).

Teachers should be equipped with the necessary skills and knowledge in order to use ICT. They should also be trained to learn how to integrate information and communication technologies is a vital issue for educators to tackle. Therefore, teachers not only have to be able to handle ICT, but also have to be able to transfer skills and knowledge into the classroom, which requires that their ICT training has to have an element of education and pedagogy (Lawson and Comber, 2000).

As skills are important for teachers to be able improve their teaching and their students' learning experiences, knowledge is the pre-requisite as the basis on which skills are developed (Demiraslan and Usluel, 2008). The knowledge of teachers on how to best operate ICT on its own is not enough for an effective integrate in the classroom. Nevertheless, it would have been impossible to further any teacher in his/her ability to use ICT without a sound knowledge on how to operate ICT and how to improve teaching and learning in his/her subject area (Tanti and Moran, 2009). ICT integration attempts in the developed world has evolved in three phases; equipping schools with ICT, training teachers and student on how to operate ICT, and current (the last) phase is where teachers are taught how to utilize ICT in their specific area of expertise (Robinson, 1997).

Teachers are more likely to use ICT in teaching and improve their skills if their ICT training is meaningful for their individual needs (Lawson and Comber, 1999). Hence, any training intents to integrate ICT into classroom settings has to be provided by the trainers who are competent in teaching technology and curriculum needs. Moreover, it is important to note that teachers may be at different levels of technology integration stages (Acun, 2003).

Teachers at the higher-level of technology integration stages are more likely to utilize the benefits of ICT in their teaching. When teachers realize the potential for improving learning through the effective use of technology, and when their competencies in ICT are improved they become competent technology users. Only then they start to change the way they teach (Altun, 2002).

Studies on ICT identify some important points about having training in ICT: that it should be appropriate to classroom use, hands-on practice, provide on-the-spot help and provide opportunities to work and share with other teachers. Training must also be timely and appropriate for both teacher professional development and school resource development (SOIED, 1999; Acun, 2003). These, however, are not only factors affecting ICT integration. Their attitudes, feeling of adequacy/inadequacy, self efficacy and administrative support are also important when trying to further teachers in their ICT integration stages (Alev, Altun and Yiğit, 2009; Katic, 2008; Akkoyunlu and Kurbanoğlu, 2004; Jimoyiannis and Komis, 2007).

The role and importance of attitudes and beliefs in education is a very well documented area in educational research (Schiefele, 1991). This is also true when it comes to studying the relationship between attitudes and the usage (or lack of usage) and quality of ICT in education (Zhao and Bryant, 2006; Ertmer, 1999; Jedege, 2008). Although, there are contradicting research findings on the relationship mentioned above, it is safe to say that literature shows attitudes are significant factors in integration and diffusion of ICT in schools (Kzenek and

Christensen, 2008). Research dealing with the issue suggests that positive attitudes toward ICT might have a positive effect on ICT integration in terms of both quantity and quality of usage by teachers and students a like (Yavuz and Coşkun, 2008).

As in positive attitudes, feeling of adequacy could be an important factor for teachers to be willing to utilize ICT in and out of classroom for educational purposes. Studies show that teachers who are further in their careers (nearing to the retirement), tend to feel inadequate and have more negative attitudes towards ICT most probably because of the difficulty in acquiring new knowledge and skills on how to integrate ICT (Binghimlas, 2009, Koehler and Mishra, 2009).

Accesses to ICT, technical and administrative support are crucial too. Having appropriate hardware and software, an ICT integration policy, technical support and future improvements appear to be the characteristics of successful schools in terms of ICT integration (Kennewell *et al.*, 2000). Hence, informed by the literature, this study includes attitudes, feeling of inadequacy, level of ICT knowledge of teachers and administrative support as the factors that might be affecting teachers level of ICT integration,

IMPORTANCE OF THE STUDY

The present study contributes to theory by providing insights into teachers' actual ICT integration stages. The level of teachers' ICT integration and quality of their use determine whether or not they create any added values to teaching practice. Studies examining the issue of ICT integration in teaching and learning mostly concentrate on the factors affecting the integration on a holistic approach. That is; integration stages models and models explaining the factors that are affecting the integration do not concentrate on the individual teachers as the unit of analysis. Rather, they describe certain characteristics of ICT integration stages in terms of teachers' behaviors, students' behaviors, arrangement of classroom environment, quality or lack of administrative support, ect (Alev, Altun, and Yiğit, 2009; Katic, 2008; Jimoyiannis and Komis, 2007, Leng, 2008).

These and many other variables are important factors affecting the integration. Nevertheless, trying to determine the individual teacher's integration stage with this design of this current research is unique, and has it advantages over other studies. Hall (1995) argues that implementation of a change in any innovation has to be assessed at the individual level. The present study attempts to identify at which stage the teachers are in ICT integration on an individual basis, and then investigates factors affecting their integration stages.

METHOD

Research Question

The main research questions formulated for the study are:
What are the teachers' ICT integration levels in each stage?
How are knowledge, attitudes, feeling of self inadequacy of teachers, and administrative support related to the level of ICT integration stages?

Population and Sample

The population of the study consists of 460 primary (4-8 grades) school teachers working in the public school system of Uşak, Turkey. Grades in primary schools were divided into three stages, the first stage is 1 to 3, the second stage is 4 to 5 and the third stage is 6 to 8. Since the most of ICT usage is intensified in the last two stages, our sample was drawn from the second and the third stages. Instruments were distributed to a random sample of 200 teachers in 37 primary schools over the course of five days. The number of instruments returned was 149.

Depended and Independent Variables

The study utilized the integration stages as depended variables. The integration stages described in the literature are most probably contingent upon teachers' attitudes towards ICT usage, their feeling of self inadequacy and their perceived level of knowledge about ICT usage. Hence, in this study attitudes, knowledge and self inadequacy were treated as independent variables to explain the variance in teachers' ICT stages. Such treatments of variables as in this study is not very common. The study also includes gender, years of experience, and administrative support as background or demographic independent variables.

Procedures

To measure teachers' integration stages, attitudes, self inadequacy, knowledge, and administrative support, a set of item pools were generated for every and each of the variables. The items in all instruments were subjected to a factor analysis spontaneously. A varimax rotation was used to extract factors. The varimax rotation in factor analysis revealed seven dimensions. After operational definitions have been formulated for each dimension, a

score on each dimension was calculated for each respondent by adding teachers' responses grouped under each dimension. The score was divided by the number of items in the respected dimension. This procedure yielded a score on each dimension for each teacher. Likert type scaling was used across all items. For items in ICT integration stages, self inadequacy and administrative support, teachers were asked to rate their behaviors on the following scale: (1) Never, (2) Seldom, (3), Occasionally, (4) Often, (5) Always. For items in attitudes scale, teachers were asked to rate their attitudes on the following scale: (1) Never feel like this, (2) Seldom feel like this, (3) Occasionally feel like this, (4) Often feel like this, (5) Almost always feel like this. Teachers were asked to rate their knowledge about ICT on the following scale; (1) have no knowledge, (2) have little knowledge, (3) have some knowledge, (4) have a great deal of knowledge. Resulting factor structure is shown in the table 1. As shown at the bottom of the table 1, reliabilities (Crombach's Alpha) of each dimension were very high.

Table 1 Factor analysis of items in the instruments

	Dimensions						
	Inadequacy	Knowledge	Stage3	Attitudes	Stage2	Stage1	Administration
	inadeq8(.79)	knowled9(.81)	stage25(.76)	attitu8 (.80)	stage7 (.75)	stage1(.72)	administ1(.80)
	inadeq3(.79)	knowled1(.79)	stage24(.72)	attitu11(.77)	stage8 (.74)	stage6(.69)	administ4(.78)
	inadeq1(.78)	knowled10(.77)	Stage18(.69)	attitu9 (.75)	stage10(.74)	stage2(.65)	administ2(.62)
	inadeq2(.77)	knowled8(.75)	stage22(.67)	attitu13(.70)	stage14(.63)	stage4(.49)	
	inadeq9(.71)	knowled6(.74)	stage13(.67)	attitu5 (.67)	stage12(.60)		
	inadeq7(.69)	knowled7(.73)	stage23(.67)	attitu3 (.62)	stage9 (.59)		
	inadeq6(.63)	knowled4(.65)	stage19(.66)	attitu7 (.60)	stage15(.57)		
	inadeq4(.61)	knowled3(.58)	stage20(.61)	attitu12(.55)			
Variance	11.85	11.42	10.20	9.86	8.35	5.51	4.31
Cumulative Variance	11.85	23.28	33.48	43.34	51.69	57.20	61.52
Reliability	.92	.91	.86	.86	.85	.74	.65

Note: The numbers in parentheses are factor loadings under their respective dimension.

CEO Forum's a-five-stage ICT integration model was used for the study. However, items generated to measure teachers' ICT integration in five different stages converged under three dimensions in factor analysis as shown in table 1. Content and meaning of items in each dimension were examined and named accordingly. Dimensions were named as Stage 1, Stage 2 and Stage 3. Items in the first stage comprise such characteristics of people's showing basic skills and having little knowledge of ICT. They use ICT because their students use them. The second stage items reveal that teachers started to use ICT in their daily life, and to make their everyday school operation easier and smoother in such applications as typing lesson plans, worksheet and keeping students' registry. Items in the third stage show that teachers started to manipulate existing ICT applications and software for their subject teaching. They started to use the Internet and e-mail to enrich their teaching and students' learning experiences but still rely mostly upon conventional classroom environments. The CEO Forum classification of stages is somehow reduced to three stages in the present study. That is; stages of 2 and 3 in CEO Forum's classification (adoption and adaptation) converge into one in our research and stage 5 (innovation) behaviors were not displayed at all by the teachers involved in this study.

Analysis

Stepwise regression techniques were used to explain variance in level of ICT integration stages. To explain variances in each stage, attitudes, self inadequacy, knowledge, administration support, gender, years of experience were entered into the model as independent variables. Variances accounted for by the remaining independent variables are explained. Using the stepwise regression results, a path model for integration was generated for to be tested in further studies.

RESULTS

Findings suggest that teachers tend to score high on entry stage (mean=4.11), followed by stage two (mean=3.63) and stage three (mean=2.15). These mean that it becomes harder to show integration behavior as stages becomes higher. This is theoretically sound. Table 2 shows descriptive statistics related to major variables.

Table 2 Descriptive Statistics (n=149)

	Mean	Std. Deviation
Stage3	2,15	,85
Stage2	3,63	,95
Stage1	4,11	,78
Teachers' Feeling of Self Inadequacy	2,06	,83
Teachers' Knowledge	2,96	,56
Teachers' negative attitudes towards ICT	1,67	,75
Lack of administrative Support	2,24	,91
Years of Experience	12,76	9,14

Correlation analysis was carried out to explain the relationships among dependent and independent variables.

Table 3 Correlations among Variables (n=149)

	Experience	Stage 3	Stage 2	Stage 1	Inadequacy	Knowledge	Attitudes	Administrative
Experience	1,00							
Stage3	,09	1,00						
Stage2	-,26	,29	1,00					
Stage1	-,19	,10	,31	1,00				
Inadequacy	,29	-,14	-,48	-,53	1,00			
Knowledge	-,03	,43	,37	,39	-,44	1,00		
Attitudes	,19	,12	-,32	-,38	,44	-,10	1,00	
Administrative	,11	-,01	-,13	-,17	,22	-,15	,17	1,00

Note: Correlations larger than .17 (absolute value) are significant at .05 level

Correlations among variables as show in table 3 reveal that stages have low or moderate relationships among themselves. This suggests that each stage's behavior is relatively independent of each other. Mastering in one stage does not guarantee graduating into the next stage. As stage 1 behaviors are more likely to be related to teachers' self inadequacy ($r=-.53$, $p<.01$). Stage 3 behaviors are more likely to be related to teachers' ICT knowledge ($r=.43$, $p<.01$). Similarly stage 2 behaviors are more likely to be related to teachers' feeling of self inadequacy ($r=-.48$, $p<.01$). Moreover, while negative attitudes towards technology are related to stage1 and 2 behaviors ($r=-.38$ and $r=-.32$, respectively, $p<.01$ for both), they are not related to stage 3 behaviors. These results imply that for stage 3 negative attitudes and self inadequacy do not explain teachers' behaviors. Behaviors in stage 3 appear to be dependent on teachers' level of knowledge in ICT. Thus, it is important to improve teachers' know-how on ICT to further teachers in stage 3 behaviors rather than working on their attitudes.

Negative attitude is not directly related to teachers' knowledge on ICT and yet self inadequacy is related to both knowledge and attitudes. This may imply that self inadequacy is a mediating variable between ICT knowledge of teachers and their attitudes towards ICT. The effect of level of knowledge on attitudes towards ICT is contingent upon and runs through self adequacy. For knowledge to have any negative or positive impact on attitudes, level of self inadequacy is an important mediator. In-service training will not have any effect on teachers' attitudes towards ICT unless their feeling of self inadequacy is improved. This is an interesting and important finding. Any knowledge based activity that intends to help teachers integrate ICT into teaching in stages 2 and 3 has to tackle with their feeling of adequacy.

Level of lack of perceived administrative support is found to be related to only stage 1 behaviors, which means that teachers already reached up to stage 2 and 3 does not concern with the lack of administrative support. For those who are at the second and third stage are not influenced by administrative support. This might be mostly because they internalized those behaviors and became self sufficient in dealing with small technical problems, etc. However, one should not disregard that administrative support is important for the teachers at the first stage. Additionally, it is a fact that passing from stage 1 through stage 3 depends on reaching to stage 2. Nevertheless stage 1 does not necessarily guarantee to reach stage 2. A tendency has been discovered as the year of experience increases, perceived inadequacy and negative attitudes increase. Similar tendency occurs for displaying stage 1 and 2 behaviors.

A difference between male and female teachers is observed for stage 3 behaviors and attitudes towards ICT. On average male teachers (mean=2.35) more frequently exercise stage 3 behaviors than female (mean=1.92) teachers (p<.001). Male teachers (mean=1.82) tend to have more negative attitudes towards ICT than female (mean=1.50) teachers (p=.01).

Stepwise regression procedures were used to examine the contribution of negative attitudes, self inadequacy, knowledge, years of experience and gender to each stage of teachers' ICT integration. It seems that negative attitudes and self inadequacy did not account for a significant change in explaining the variance in teachers' ICT integration for stage 3 behaviors. It is found that a teacher is more likely to exhibit stage 3 behaviors when he/she has high level of knowledge on ICT and when he/she reaches stage 2. Additionally, male teachers are more likely to reach stage 3 than female teachers.

Table4 Stepwise Regression for Predicting Variables Affecting Stage3 Behaviors

	β	Std Error	Std. β	t	*p*
Constant	.654	.400		1.634	.104
Knowledge	.492	.118	.325	4.162	.000
Gender	-.417	.124	-.246	-3.360	.001
Stage2	.179	.070	.201	2.572	.011

$R^{2=}$.26; Adj.$R^{2=}$.24; F=16.89 p<.001

When stepwise regression method is used a linear combination of level of ICT knowledge, level of stage 2 behaviors and gender, altogether, explained 26 percent of variance in stage 3 behaviors (F=16.89, p<.001). All other variables did not contribute an increment into the variance in stage 3 behaviors above and beyond the contribution of these variables. The highest unique contribution belongs to level of teachers' knowledge followed by gender and stage 2 behaviors.

Table5 Stepwise Regression for Predicting Variables Affecting Stage 2 Behaviors

	β	Std Error	Std. β	t	*p*
Constant	3.043	.558		5.448	.000
Self Inadequacy	-.455	.089	-.398	-5.107	.000
Knowledge	.357	.133	.210	2.681	.008
Gender	.319	.134	.168	2.384	.018

R^2= .29; Adj.R^2=.28; F=19.81 p<.001

Stepwise regression revealed that 29 percent of variance in stage 2 behaviors is explained by the linear combination of level of knowledge, feeling of self inadequacy and gender (F=19.81, p<001). All other variables did not contribute an increment into the variance in stage 2 behaviors above and beyond the contribution of these variables. The highest unique contribution belongs to level of teachers' self inadequacy followed by level of ICT knowledge and gender of teachers. Contrary to the findings in the significant correlation between stage 1 and 2, stepwise regression suggests that these two stages are not directly related. Feeling of inadequacy and level of knowledge seems to moderate this finding. It seems that further studies need to be conducted to uncover mediating variables unknown in this model.

Table 6 Stepwise Regression for Predicting Variables Affecting Stage1 Behaviors

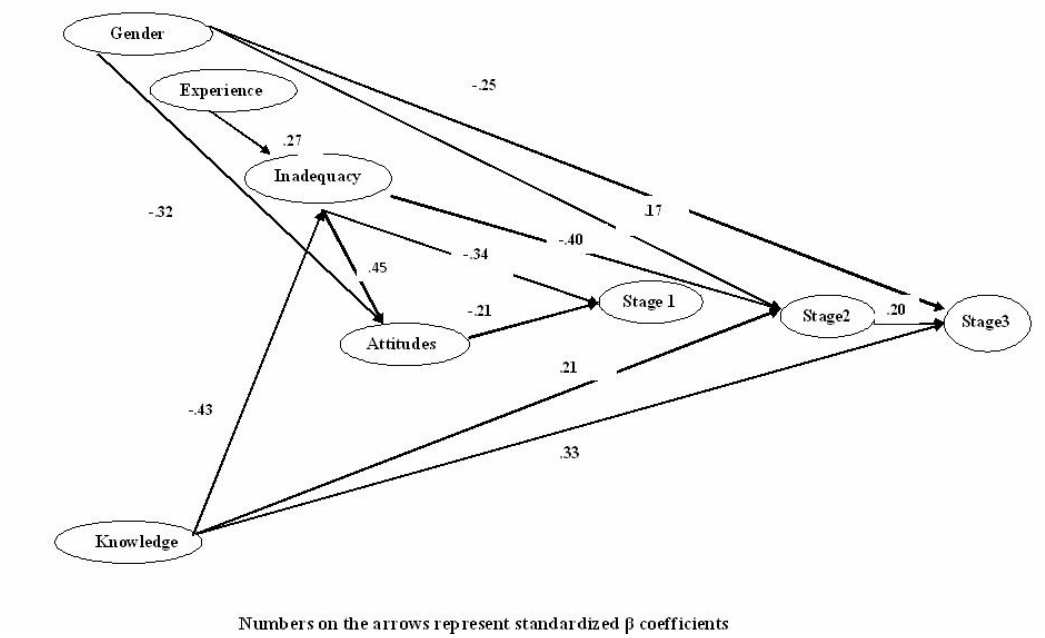
	β	Std Error	Std. β	t	*p*
Constant	4.244	.398		10.675	.000
Self Inadequacy	-.316	.078	-.338	-4.043	.000
Teachers' Knowledge	.299	.105	.215	2.851	.005
Teachers' Attitudes	-.221	.078	-.213	-.826	.005

R^2=.34; Adj.R^2=.33; F=25.27 p<.001

Stepwise regression revealed that 34 percent of variance in stage 1 behaviors is explained by the linear combination of self inadequacy, level of knowledge and negative attitudes towards ICT usage (F=25.27, p<001). All other variables did not contribute an increment into the variance in stage 1 behaviors above and beyond the

contribution of these variables. The highest unique contribution belongs to level of teachers' self inadequacy followed by level of ICT knowledge and negative attitudes.

The model resulting from stepwise regressions showing the relationships among variables that explain the variances in level of ICT integration stages is generated to be tested in further studies. Male participants in gender variable were coded as 1, and females as 2 in the model. The attitudes variable represents negative attitudes towards ICT.



Numbers on the arrows represent standardized β coefficients

CONCLUSION

This study suggests that in Turkish context a five-staged ICT integration requires a new classification. In CEO Forum's classification stages, informed by the findings of this study, somehow need to be adjusted into 3 stages. That is, adoption and adaptation stages converge into one in our research and innovation stage behaviors were not exhibited by the teachers involved in this study. Teachers have different and distinguishable levels of ICT integration stages. Every stage requires different set of applications and behaviors. This is an indication of relative independence of each stage's behavior. Acquiring enough skills and knowledge in one stage does not secure reaching up to the next stage. Advancing from the lowest integration stage to the highest one does not necessarily follow a linear path.

Knowledge is the most important variable in showing stage 3 behaviors while self inadequacy is the most important variable for exhibiting stage 2 behaviors. Any attempt aimed at improving teachers' stage 3 behaviors has to deal with their knowledge rather than concentrating on improving their attitudes. Self inadequacy does not have a direct effect on stage 3 behaviors.

Although self inadequacy has a relationship with knowledge and attitudes, negative attitudes are not related to knowledge. This might be an evidence of self inadequacy's possible role in being a mediating variable between ICT knowledge and attitudes. For knowledge to have any negative or positive impact on attitudes, level of self inadequacy must be lessened. According to the model shown above any effort trying to improve teachers' attitudes is not likely to have a direct impact unless their feeling of self adequacy is improved. Any knowledge-based activity that intends to help teachers integrate ICT into teaching in stage 2 has to nourish their feeling of adequacy. Stage 1 and 2 are not directly related. Administrative support or lack of it seems to be not an issue for those who are at the second and third stage. This might be mostly because teachers displaying stage 2 and 3 behavior are self sufficient in dealing with small technical problems, etc. In contrast, administrative support is imperative for the teachers at the first stage. Additionally, it is a fact that passing from stage 1 through stage 3 depends on reaching to stage 2. Nevertheless stage 1 does not necessarily guarantee to reach stage 2. There must be some paths between stage 1 and stage 2. Further studies need to be conducted to uncover mediating variables unknown in this model. Moderating and mediating variables to explain variances in all stage behaviors needs to be discovered in further studies. There is some evidence of as to which variables to be included for the further

research with a similar approach to integration stages of teacher with similar data collection instruments and analysis procedures. Ease of use, social desirability and prestige, usefulness studied in the literature (Davis, 1989; Akbulut, Kesim and Odabasi, 2007; Shen *et* al, 2006) are among the variables which could be considered as the variables to be considered for further studies.

REFERENCES

Acun, I. (2003). *Changing History and Geography Teaching with ICT: the Impact of the Internet*, Unpublished Ed.D Thesis, University of Leicester, England.

Akbulut, Y., Kesim, K. and Odabasi, F. (2007). Construct validation of ICT indicators measurement scale (ICTIMS). *International Journal of Education and Development using Information and Communication Technology (IJEDICT).* 3 (3), 60-77.

Akkoyunlu, B. ve Kurbanoğlu, S. (2004). Öğretmenlerin bilgi okuryazarlığı öz-yeterlik inancı üzerine bir çalışma. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, 27, 11-20.

Alev, N., Altun, T. and Yiğit, N. (2009). Perceptions of Pre-Service Science Teachers About the Use of ICT in Educatıon. *Proceedings of IETC2009*, Ankara, Hacettepe University.

Altun, T. (2002). *Factors Influencing Teachers' Change in Classroom Practice due to Introduction of ICT in Turkey*, Unpublished EdD Thesis, University of Nott'ham, UK.

Binghimlas, K. A. (2009). Barriers to the successful integration of ICT in teaching and learning: A Review of literature. *Eurosia Journal of Matematics, Science and Technology Education.* 5 (3), 235-245.

CEO Forum on Education and Technology (1999). *School Technology and Readiness Report on Professional Development: A link to better learning,* Retrieved from http://www.ceoforum.org/reports.cfm

Comber, C., Lawson, T. and Hargreaves, L. (1998). From familiarisation to adaptation: Teachers' responses to the introduction of ICT into the classroom. *Proceedings of IN-TELE 98*.

Davis, F. D. (1989). Perceived usefulness, perceived ease-of-use, and user acceptance of information technology. *MIS Quarterly*, 13, 319-340.

Dawes, L. (2001). What stops teachers using new technology? In Leask, M. (Ed.), *Issues in teaching using ICT* (pp.61-80). London: RoutledgeFalmer.

Demiraslan, Y. and Usluel, Y. (2008). ICT integration processes in Turkish schools: Using activity theory to study issues and contradictions. *Australasian Journal of Educational Technology.* 24 (4), 458-474.

Ertmer, P. A. (1999). First and second order barriers to change: strategies for technology integration. *ETR&D,* 47 (4), 47-61.

Hall, G. E. (1995) 'The Local Educational Change Process and Policy Implementation' in Carter, D.S.G, and O'Neill, M.H (Eds.), *International Perspectives on Educational Reform and Policy Implementation* (pp. 101-125). London: The Falmer Press.

Jedege, P. O. (2008). ICT attitudinal characteristics and use level of Nigerian teachers. *Issues in Informing Science and Information Technology.* 5, 261-266.

Jimoyiannis, A. and Komis, V. (2007). Examining teachers' believes about ICT in education: implications of a teacher preparation programme. *Teacher Development,* 11 (2), 149-173.

Katic, E. K. (2008). Pre-service teachers' conceptions about computers: an ongoing search for transformative appropriations of modern technologies. *Teachers and Teaching,* 14 (2), 157-179.

Kennewell, S., Parkinson, J., and Tanner, H. (2000). *Developing the ICT capable schools.* London: RoutledgeFalmer.

Koehler, M. J. and Mishra, P. (2009). What is pedagogical technological content knowledge. *Contemporary Issues in Technology and Teacher Education.* 9 (1), 60-70

Kzenek, G. and Christensen, R. (2008). The importance of computer attitudes and competencies in primary and secondary schools. In J. Voogt & G. Kzenek (eds.). *Internationa Handbook of Information Technology in Primary and Secondary Education* (pp.321-328). New York: Springer.

Lawson, T. and Comber, C. (1999). Superhighways technologies: personnel factors leading to successful integration of information and communication technology in schools and colleges. *Journal of Information Technology for Teacher Education,* 8 (1), 41-53.

Lawson, T. and Comber, C. (2000). Introducing ICT into schools: blurring boundaries. *British Journal of Sociology of Education,* 21 (3), 419-433.

Leng, Wee, Ng (2008). Transformational Leadership and Integration of ICT into Teaching, *The Asia Pasific Educational Researcher,* 17 (1), 1-14.

Robinson, B. (1997). Getting ready to change: the place of change theory in the information technology education of teachers. In D. Passey and B. Samways (eds.). *Information Technology: Supporting change through teacher education*(pp.40-46). London:Chapman & Hall.

Schiefele, U. (1991). Interest, learning and motivation. *Educational Psychologist,* 26 (3&4), 299-323.

Shen, D., Laffey, J., Lin, Y. and Huan, X. (2006). Social influence of perceived usefulness and ease-of-use of course delivery systems. *Journal of Interactive Online Learning,* 5 (3), 270-282.

SOIED (1999). *Teachers' ICT skills and knowledge needs*, *final report*. Retrieved from http://www.scotland.gov.uk/library/ict/append-section1.htm

Tanti, M. and Moran, W. (2009). Warts and All: Integration ICT in Teacher Training. *The International Journal of Learning.* 16 (8), 641-655

Toledo, C. (2005). A five-stage model of computer technology integration into teacher education curriculum. *Contemporary Issues in Technology and Teacher Education,* 5 (2), 177-191.

Yavuz, S. and Coskun, A. E. (2008) Sınıf öğretmenliği öğrencilerinin eğitimde teknoloji kullanımına ilişkin tutum ve düşünceleri. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi.* 34, 276-286.

Zhao, Y. and Bryant, F. L. (2006). Can Teacher Technology Integration Training Alone Lead to High Levels of Technology Integration? A Qualitative Look at Teachers' Technology Integration after State Mandated Technology Training. *Electronic Journal for the Integration of Technology in Education,* 5, 53-62.