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Perceived importance and manageability of teachers toward the factors of integrating computer technology into classrooms

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In this study, the perceived importance and manageability of teachers on the factors in technology integration were assessed among 407 elementary and secondary schoolteachers. A questionnaire containing 28 items focusing on environmental, personal, social and curricular factors related to technology integration was used. Two sets of data resources gathered from the questionnaire for obtaining teachers' responses toward the factors of integrating technology into classrooms include: (1) the importance rating for each factor, and (2) the manageability of each item. Factor analysis was first conducted to test the reliability of the questionnaire. From the analysis, four items were dropped and 24 items were selected and regrouped. Cramer's *V* analyses among the selected 24 items revealed that teachers' perceived importance ratings were related with their manageability in some of the factors for integrating computers into classrooms. Relationships between teachers' use of computers and their perceived importance among the four main factors were also reported.

Introduction

Technology integration has been defined as educators' use of technology to enhance instruction and to create rich environments to help each individual student develop a depth of understanding and critical thinking skills (Washington State, Office of Superintendent of Public Instruction, 2002). As technological developments accelerate in educational settings, integrating computer technology into academic learning aims to help students gain more opportunity and interest in exploring learning content (Wright, 2001). Although teachers believe that the use of computer technology is a useful tool for teaching and learning, uncertainty exists when teachers try to cope with a new teaching tool and a new teaching philosophy that only a few of them have learned to apply (Kiridis *et al.*, 2006).

Factors influencing computer technology integration among schoolteachers have been frequently discussed in the literature (Zhao, 1998; Wright, 2001; Kiridis *et al.*, 2006). Related

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issues have been categorized into four categories in a previous study (ChanLin *et al.*, 2006): environmental, personal, social, and curricular aspects. From the *environmental* aspect, hardware, software and school administrative support are perceived by teachers as indispensable elements for integrating technology into classrooms (Shayo *et al.*, 2000; Styron & Disher, 2003). *Personal* issues, such as teachers' perceptions of the implementation of computer technology into classrooms, are often derived from their experiences, personal beliefs, and professional development (Zhao, 1998; Kanaya *et al.*, 2005). Teachers must be willing and able to use technology effectively in their teaching to realize the benefits that the technology can offer (Luan *et al.*, 2005). Also, issues in the *social* dimension of learning emphasize the importance of communities in supporting the use of technology and sharing experiences among teachers for probing the analyses of pedagogy and student work for integration (Wiske *et al.*, 2001; Clark, 2005). The *curricular* issues related to meaningful use of computer technology in specific instructional settings are often of most concern to teachers (Robertson, 2000). Enrichment of experience and facilitation of teachers and students in their involvement and appreciation is a key to curriculum implementation (Barak & Dori, 2005).

There is a consensus among educators and various social communities that current educational practices need to prepare students to thrive in an ever-changing technological society (Wilson & Notar, 2003; Siegle, 2004). Teachers who are willing to spend time in using computers are more likely to gain confidence in using computers. Access to technologies increases teachers' opportunities for successful teaching experience (Ross *et al.*, 1999). Technology adoption is seen as an intentional behavior to reflect the disposition and involvement of teachers in technology integration (Sugar *et al.*, 2004).

The introduction of new computer technologies has been based on various assumptions about the nature of technology integration and its relationship to improve teaching and learning (Prain & Hand, 2003). Nevertheless, the adoption of computers in teaching is a complex innovation in which many obstacles need to be overcome (Akbaba-Altum, 2006). The analysis of teachers' perceptions, their involvement and the manageability of the factors influencing their use of computer technology become important in understanding the relationship between how these factors are perceived and managed. This paper reports on a research study that sought, among various aspects (environmental, personal, social, and curricular), to analyze: (1) how each of these factors was perceived by teachers as important for the integration of computer technology into the classroom; (2) whether teachers perceived each factor as manageable; (3) whether teachers' perceived importance was related to manageability of each factor; and (4) whether different computer use was related to perceived importance of environmental, personal, social, and curricular factors.

Method

Participants were teachers from 21 volunteer elementary and secondary schools at Taipei County, Taiwan. These teachers taught from Grade 1 to Grade 9 levels, for various subject areas, ranging from language arts, health and physical education, social studies, arts and humanities, social studies, science and technology, mathematics, and integrative activities. A questionnaire containing 28 items focusing on environmental, personal, social, and curricular factors affecting technology integration was used in this study. The items used to construct the scale

were adapted from previous research (ChanLin, 2003; ChanLin *et al.*, 2006), and modified to reflect a school teaching context. Classification of the items into four categories was based on an 85% agreement reached after two iterations by three researchers in an earlier study. The questionnaire was used to assess teachers' perceived importance of these factors and whether teachers considered these factors manageable.

In the *environmental* aspect, factors used in the questionnaire included computer facilities, budget support, access to a computer at home, support and management of resources and manpower, allocation of time for use of computer lab, in-service training, and incentives policy. *Personal* factors included in the questionnaire were personal beliefs about teaching, personal experience in using technology, personal lifestyle, interest in using computers, interest in the teaching domain, support from the family, and interest in personal growth.

In the *social* aspect, the following factors were included: support from peers, attitudes of authorities, students' learning attitude, parents' reactions, resource support from community, technology trend, and social change and value. For *curricular* issues, the following factors were used: curricular objectives, skills and need for literacy enhancement, assessment of students' performance, adoption with the existing teaching strategies, teaching load, appropriateness of the learning subjects, ease of use and control of technology in classroom, level of integration and achievement of better learning.

The questionnaire used a Likert scale, ranging from 'Strongly disagree' (1 point) to 'Strongly agree' (5 points), to indicate agreement on the factors that were important to teachers' approach to integrating computer technology into classrooms. In addition, teachers also marked 'Yes' or 'No' for each questionnaire item to reflect whether they considered the factor manageable. From teachers' agreement of importance on the 28 questionnaire items, factor analysis was conducted to confirm factor structure for the items used.

Results

In total, 407 sets of data were solicited and obtained from volunteer teachers who were willing to fill out the questionnaire. Among these teachers, 134 were from primary schools and 273 were from secondary schools, with working experience ranging from 1 to 30 years. The weekly amounts of time spent on computers by these teachers are listed in Table 1. Teachers' time involvement was categorized into More-, Medium-, and Less-frequent based on the hours spent on computers.

Two sets of data resources gathered from the questionnaire for obtaining teachers' responses toward the factors of integrating technology into classrooms include: (1) the importance rating for each factor (obtained from the five-point Likert scale), and (2) the manageability of each item (obtained from frequency count of 'Yes' for manageable factors). Factor analyses using

Table 1.   Time of involvement for using computers among teachers ($n = 407$)

Type of user	Time spent (x hours per week)	n	%
Less-frequent user	$x < 10$	171	42.0
Medium-frequent user	$10 \leq x < 20$	120	29.5
More-frequent user	$x \geq 20$	116	28.5

Principle Component Analysis was employed to confirm the reliability of the test items. Quartimax rotation extracted 24 items and dropped four items from the original items set (testing for correlation coefficients of .5 of greater). The final factor structure was changed and listed in Table 2. Cramer's *V* was also used to determine how teachers' perceived importance rating of these factors related to their manageability (Table 3). To observe the relationship between time of involvement in computer use and teachers' perceived importance in each category, correlation analyses were also conducted (Table 4).

Curricular factors

All of the curricular factors obtained importance rating above 4.0, including 'Skills and need for literacy to be enhanced', 'Adoption with existing teaching strategies', 'Curricular objectives

Table 2.   Factor loadings and alpha value for each factor

Category	Loadings	Alpha
Curricular		.885
1. Skills and need for literacy to be enhanced	.739	
2. Adoption with existing teaching strategies	.731	
3. Curricular objectives should be achieved	.705	
4. Teaching load: time and effort to prepare classes	.669	
5. Nature of the learning subject: use of technology and its relation to learning	.665	
6. Control of using technology: easy or difficult to be handled	.644	
7. Assessment of students' performance	.639	
8. Personal experience in using technology	.565	
9. Personal beliefs about teaching	.520	
Environment		.841
10. Support and management of resources and manpower	.798	
11. Budget support	.736	
12. Allocation of time for using computer lab	.702	
13. Opportunity for in-service training	.670	
14. Access to a computer and the Internet at home	.668	
15. Incentives policy	.617	
16. Computer facilities (hardware and software)	.512	
Social		.740
17. Technology trends and social change	.687	
18. Attitudes of authorities (principle or supervisors)	.682	
19. Social value of using computer technology	.670	
20. Support from peers (working companions, coworkers, colleagues)	.557	
Personal		.710
21. Interest in the teaching domain	.711	
22. Interest in personal growth	.691	
23. Support from the family	.691	
24. Interest in using computers	.685	

should be achieved', 'Teaching load', 'Nature of the learning subject', 'Control of using technology', 'Assessment of students' performance', 'Personal experience in using technology', and 'Personal beliefs about teaching'. All of these items were perceived by the great majority (>70%) as manageable (Table 3). Chi-square analysis revealed a significant relationship between computer use and mean importance rating in the curricular category ($\chi^2 = 81.436$, Cramer's $V = .316$, $p < .05$) (Table 4). However, the resulting effect size of the interaction was small and should be view cautiously.

The analysis of Cramer's V value between the importance rating and manageability in each factor revealed a substantial relationship in the following items: 'Personal experiences in using technology' (Cramer's $V = .394$, $p < .001$) and 'Personal belief about teaching' (Cramer's $V = .360$, $p < .001$); a moderate relationship in the following items: 'Curricular objectives should be achieved' (Cramer's $V = .324$, $p < .001$), 'Skills and need for literacy to be enhanced' (Cramer's $V = .251$, $p < .001$), and 'Adoption with existing teaching strategies' (Cramer's $V = .216$, $p < .01$); and a low relationship in the following items: 'Control of using technology' (Cramer's $V = .178$, $p < .05$) and 'Assessment of students' performance' (Cramer's $V = .177$, $p < .05$) (Table 3).

Environmental factors

Among environmental factors, 'Computer facilities' obtained the highest importance rating (4.36 ± 0.73). The rest of the items in environmental issues were rated below 4.0. Most environmental factors were not considered by the majority as manageable factors except for 'Allocation of time for using computer lab' (54% of respondents considered this manageable) and 'Opportunity for in-service training' (59% considered this manageable) (Table 3). Chi-square analysis revealed a significant relationship between computer use and mean importance rating in the environmental category of factors ($\chi^2 = 78.187$, Cramer's $V = .310$, $p < .05$) (Table 4). However, the resulting effect size of the interaction was small and should be view cautiously.

The analysis of Cramer's V value between the importance rating and manageability of each factor in the environmental category revealed a moderate relationship in the following items: 'Budget support' (Cramer's $V = .265$, $p < .001$), 'Opportunity for in-service training' (Cramer's $V = .255$, $p < .001$), 'Incentives policy' (Cramer's $V = .224$, $p < .001$), and 'Allocation of time for using computer lab' (Cramer's $V = .215$, $p < .001$). A low relationship was found in 'Support and management of resources and manpower' (Cramer's $V = .197$, $p < .01$) (Table 3).

Social factors

For the social aspects, importance ratings of the following factors were all above 4: 'Technology trends and social change', 'Attitudes of authorities', 'Social value of using computer technology', and 'Support from peers'. Most social factors were not considered by the majority of respondents as manageable, except for 'Support from peers' (59% of respondents considered this manageable) (Table 3). Chi-square analysis revealed no significant relationship between computer use and mean importance rating in the social category of factors ($\chi^2 = 29.362$, Cramer's $V = .190$, $p > .05$) (Table 4). The analysis of Cramer's V value between the importance rating and manageability of each factor in the social category revealed only a low relationship in 'Support from peers' (Cramer's $V = .187$, $p < .01$) (Table 3).

Table 3.   Importance rating and manageability for factors in technology integration ($n = 407$)

Questionnaire item	Importance ratings (mean ± SD)	Manageability		Cramer's V	p
		n for 'Yes'	% of total		
Curricular factors					
1. Skills and need for literacy to be enhanced	4.18 ± 0.65	349	86	.251	.000★★★
2. Adoption with existing teaching strategies	4.14 ± 0.65	337	83	.216	.001★★
3. Curricular objectives should be achieved	4.12 ± 0.65	349	86	.324	.000★★★
4. Teaching load: time and effort to prepare classes	4.16 ± 0.85	288	71	.185	.08
5. Nature of the learning subject: use of technology and its' relation to leaning	4.18 ± 0.68	317	78	.085	.576
6. Control of using technology: easy or difficult to be handled	4.06 ± 0.70	292	72	.178	.013★
7. Assessment of students' performance	4.03 ± 0.68	361	89	.177	.014★
8. Personal experience in using technology	4.23 ± 0.70	369	91	.394	.000★★★
9. Personal beliefs about teaching	4.35 ± 0.63	377	93	.360	.000★★★
Environment factors					
10. Support and management of resources and manpower	3.69 ± 0.98	174	43	.197	.004★★
11. Budget support	3.81 ± 0.98	146	36	.265	.000★★★
12. Allocation of time for using computer lab	3.78 ± 0.93	219	54	.215	.001★★
13. Opportunity for in-service training	3.89 ± 0.86	239	59	.255	.000★★★
14. Access to a computer and the Internet at home	3.73 ± 0.99	125	31	.131	.138
15. Incentives policy	3.52 ± 0.88	175	43	.224	.001★★
16. Computer facilities (hardware and software)	4.36 ± 0.73	195	48	.124	.189
Social factors					
17. Technology trends and social change	4.10 ± 0.69	130	32	.108	.312
18. Attitudes of authorities (principle or supervisors)	4.03 ± 0.72	150	37	.150	.058
19. Social value of using computer technology	4.12 ± 0.65	125	31	.055	.875
20. Support from peers (working companions, coworkers, colleagues)	4.20 ± 0.64	239	59	.187	.007★★
Personal factors					
21. Interest in the teaching domain	4.20 ± 0.67	374	92	.114	.263
22. Interest in personal growth	4.10 ± 0.72	357	88	.257	.000★★★
23. Support from the family	3.71 ± 0.89	272	67	.236	.000★★★
24. Interest in using computers	4.30 ± 0.72	369	91	.091	.502

★$p < .05$; ★★$p < .01$; ★★★$p < .001$.

Table 4. Relationship between mean importance ratings and computer use

| | Computer use | | |
Factor	χ^2	Cramer's V	p
Curricular	81.436	.316	.034★
Environmental	78.187	.310	.027★
Social	29.362	.190	.295
Personal	39.897	.222	.040★

★$p < .05$.

Personal factors

Most personal factors were rated as relatively highly important (>4.0) and considered by the great majority (>80%) as manageable, including 'Interest in the teaching domain', 'Interest in personal growth', and 'Interest in using computers'. Chi-square analysis revealed a significant relationship between computer use and mean importance rating in the personal category of factors ($\chi^2 = 39.897$, Cramer's $V = .222$, $p < .05$) (Table 4). However, the resulting effect size of the interaction was small and should be view cautiously. The analysis of Cramer's V value between the importance rating and manageability of each factor in the personal category reveals a moderate relationship in 'Interest in personal growth' (Cramer's $V = .257$, $p < .001$) and 'Support from peers' (Cramer's $V = .236$, $p < .001$) (Table 3).

Discussion

Results from this study indicated a highest importance rating among teachers regarding the hardware and software facilities in their schools. The on-going investment on hardware and software in schools is always essential to promote technology integration (Wilson & Notar, 2003). Most of the investments made for developing the information technology infrastructure in many local school districts and classrooms are still of concern to a majority of teachers.

It has been suggested that in technology integration, teachers' perception in using computer technology might be related to how they involve technology integration in the classroom (Moore & Benbasat, 1991). From our study, a low relationship between computer use and mean importance ratings in the curricular, environmental, and personal categories revealed limited support for the assertion about the interrelationship between computer use and teachers' perception. Technology adoption is seen as an intentional behavior to reflect teachers' disposition and involvement in technology integration (Sugar *et al.*, 2004). In addition to frequency of computer use, other indicators might be needed to reflect teachers' involvement.

From curricular aspects, all factors were considered important and manageable. Teachers with more frequent use of computers more likely perceived higher mean importance ratings in curricular factors. However, more evidence is needed to draw this conclusion. Teachers' perceived importance rating and manageability are more related among the following curricular factors: skills and need for literacy to be enhanced, adoption with existing teaching strategies,

curricular objectives, personal experience in using technology, and personal beliefs about teaching. These findings are consistent with the arguments in other literature, where teachers indicate their concerns for curricular objectives for integrating technology into their classrooms, curriculum design for supporting knowledge generation, and use of teaching strategies for fostering cognitive processes among students (Robertson, 2000; Goos *et al.*, 2003; Beaver & Moore, 2004).

From the environmental aspect, teachers who were concerned more about support and management of resources and manpower, budget support, allocation of time for using computer lab, in-service training opportunity, and incentive policy, were more likely to manage these factors. It is noted that teachers who are concerned more about students' experiences in the practical use of computers are more apt to manage environmental support and resources for academic interest (Jackson, 2005). Training and incentive opportunities might encourage teachers' action in managing and adoption of technology use in the classroom. However, meaningful application of computer technology in their classrooms is essential for encouraging teachers to exploit various opportunities in technological skill development (Williams *et al.*, 2000). Successful implementation of training and incentives is closely related to individual teacher's needs and experiences (Gray, 2001).

From the social aspects, technology trends and social change, attitudes of authorities, social value of using computer technology, and support from peers were considered important factors. However, most of these social factors were not perceived manageable by the majority of respondents. The importance of communities in supporting the use of technology and sharing experiences has been addressed in the literature (Wiske *et al.*, 2001; Clark, 2005). However, these social factors are not considered to be easy to manipulate by individuals. From a community, on-going support from colleagues is definitely an important incentive to provide some help in developing and building teachers' experiences and competence in integrating technology into classrooms (Luan *et al.*, 2005). It is also noted that teachers isolated from support by their colleagues may be less willing to use technology and less capable of managing the social issues (Smith & Robinson, 2003).

Although the results of this study showed no or a low relationship between teachers' concerns and their manageability of these social factors, it is not deniable that teachers must be supported in collaborating with other educators for educational changes to occur. For technology to become successfully integrated into teaching practice, faculty members should be exposed to group interaction supported by technology. An open atmosphere within a school society may inspire teachers to employ innovative teaching approaches.

Most personal issues obtained a high importance rating and were manageable by the majority of respondents. A moderate relationship between teachers' perceived importance and manageability was found in teachers' interest in personal growth and support from the family. As noted, the influence from teachers' beliefs, experiences, and interests indicates the need for developing their ability and confidence in the use of technology (Prain & Hand, 2003). Similar concerns have been addressed in the literature regarding teachers' personal factors related to the actual technology integration practice. As discussed in several studies, the internal factors about teachers' willingness to change from current experiences are critical in integrating technology into classrooms (Zhao, 1998; Storm & Storm, 2002; Kiridis *et al.*, 2006). When teachers are willing to develop the necessary skills and abilities in coping with the technological world, they are more

likely to spend more time and effort in technology integration. The more experiences they acquire while integrating technology into their lifestyles, the more confident they are likely to feel when using the technology.

Conclusion

Integrating computer technology into teaching involves complex issues inter-related with curricular, environmental, social, and personal factors. It is strongly agreed by most of the teachers that, of the environmental issues, hardware and software are the essential elements. There is a need to prepare educators who recognize the importance of cognitive abilities they lack themselves, and understand ways to nurture the long-term development of technology literacy. In order to get the teachers trained, the skills and attitude necessary for the meaningful application of computer technology in their classrooms is essential. Flexible curricula and more effort on systematic planning and training in various curricular design/implementation are important. These issues are at the heart of whether and to what extent teachers should be involved in technology integration.

Along with the technological trend, most schools face major challenges to keep pace with technological advances. Since teachers thought most social factors were difficult to manage, appropriate experiences for collaborating with peers and their community would be needed to help them obtain connection with and support from others.

From the descriptive aspect, this study identifies that teachers' perceived importance and views on manageability are related to several factors covered in environmental, personal, social, and curricular categories. From the prescriptive aspect, the results of this study provide implications for planning and implementation of technology use in teaching and learning. Fostering changes in learning and teaching requires environmental, social, and curricular support. Future implementation focusing on strategic planning for coping with these factors is also needed.

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Note on contributor

Lih-Juan ChanLin is Professor of the Department of Library & Information Science at Fu-Jen Catholic University, Taiwan. Her research group conducts studies into various aspects of integrating computer technology into classrooms for supporting teaching and learning.

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