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Exploring the effect of support and cooperation on teacher's ICT integration

Shihkuan HSU[a*]
[a]*Center for Teacher Education, National Taiwan University, ROC*
skhsu@ntu.edu.tw

Abstract: Teacher's ICT integration is a complicated process with many influencing factors. Among them, school support plays an important role. The school support factor includes both administrative and peer support. In the past, school support factors were often regarded as equal and calculated accordingly; however, other relationships may exist. To explore other possibilities, a large sample of teachers' ICT integration in Taiwan was drawn to analyze the factors. The initial correlation analysis showed that many factors correlate with teachers' ICT integration positively, including administrative support and peer cooperation. The regression of the factors, however, showed that administrative support contributes to teacher's ICT integration negatively. To explore the relationship further, SEM models were tested. The result of the SEM analysis suggests that administrative support on ICT integration is mediated by the peer cooperation. The results of this study reveal the importance of the direct impact of teacher's peer cooperation on their ICT integration, but also stresses the importance of the mediated effect of administrative support.

Keywords: Teacher ICT integration, administrative support, peer cooperation, large-scale survey, SEM analysis

1. Introduction

Teacher's technology integration at school is influenced by many factors. Previous research has suggested several facilitating and inhibiting factors for ICT integration in personal, technical, and school cultural areas (Cuban, Kirkpatrick, & Peck, 2001; Inan & Lowther, 2010; Mueller, et al., 2008). Among them, school culture is often regarded as an important factor, but it is difficult to measure. School culture broadly includes school atmosphere, school support in administration and technology, openness to change, and opportunity for teachers' professional development. In a study of both school and teacher characteristics, Tondeur, Valcke, and van Braak (2008) found that school culture, such as school ICT-related policies, plans, support, and training influence teachers' use of computers for instruction. Similarly, in a multilevel study by Hsu and Kuan (2013), it was found that in addition to teacher-level factors such as teacher's beliefs, there are school-level factors such as administrative support and teachers' peer cooperation which have a significant influence on teachers' ICT integration.

1.1 Administrative support

School administrative programs reflect school culture and influence teachers' ICT integration. According to Cuban and colleagues (2001), the factors that prevented teachers from using technology sometimes could be administrative arrangements, such as scheduling training sessions during the class periods. The support from school administrators for teachers to use technology can go beyond technology purchases to include interpersonal aspects such as encouraging teachers' technology-infused lessons and fostering professional development groups and communities within schools. In a study that implemented a TPACK model to help science teachers to develop ICT-integrated lessons, Jimoyiannis (2010) found that the need to prepare students for the final exams, the inherent school resistance toward change, and the need to conform to the established school culture and instructional practices could hinder their development of ICT-integrated lessons.

1.2 Teacher cooperation

Even before research confirmed its importance, teachers' professional development has been regarded as one of the most important factors in ICT integration by policy makers (Culp, Honey & Mandinach, 2005). In the complicated process of learning how to develop ICT-integrated lessons, teachers can help each other in getting ideas about integrating subjects with technology (Jang, 2008), solving technological problems (Mueller, et al., 2008), and serving as role models for ICT integration (Hadyn & Barton, 2007). It is especially interesting to note that teacher's peer help can grow and evolve as they work tougher as a community. Researchers have observed, when teachers work as a group, it is possible that within three years, teachers can transform from "a loose association of peers involved in vastly different development projects with different tools, to a community of designers involved in a common endeavor" (Ching & Hursh, 2014, p. 72).

1.3 Mediation studies

In the past, the effects of administrative support and teacher cooperation are often treated as parallel or equal factors. However, there are advantages to analyzing the relationships among these factors more carefully. Using a model including direct and indirect influences the path of influences can be revealed. For example, in the study by Inan and Lowther (2010), the overall support from school has a greater combined direct and indirect impact on teacher's technology integration compared to computer availability or technical support. In Inan and Lowther's study, the impact of school support may not be significant if viewed only as a direct effect. Therefore, administrative support and peer cooperation may serve as useful indicators for studying school support to teacher's integration of technology. In this paper, the relationship between administrative support, peer cooperation, and teacher's ICT integration will be analyzed and clarified.

2. Methods

2.1 The data set

The data set used in this study comes from a large-scale survey from grade 1-9 teachers in Taiwan (n=5,938) (Hsu, 2014). The teachers' technology integration score is measured based on six subscales including preparation, production, communication, instruction, development, and issues (Hsu, 2010). School administrative support contains six items including school overall plan for technology integration, administrators' praise of teacher's effort on technology integration, and provision of hardware and software, as well technical support for technology integration. Peer cooperation includes five items such as cooperating with teachers of similar subject area or technology coordinator to create technology-integrated lessons, having seen excellent examples of ICT integrated lessons, and having joined professional group to improve technology integration. The means, standard deviation, and factor loadings are listed in Table 1. The internal consistencies of both scales are high, with the Cronbach's Alpha of support subscale being .85 and the cooperation scale being .79.

Table 1: Support and cooperation items.

Construct	Items	Mean	SD	Factor Loading
Support	（6 items）			
P3_3_1	There is an overall plan at school to gudie teachers' ICT integration	2.78	0.01	.682
P3_3_2	The hardware and software provided by school is sufficient for teachers' ICT integration	2.91	0.01	.734
P3_3_3	School administrators praise teachers for their ICT integration efforts	3.02	0.01	.775
P3_3_4	School actively promotes awaeness or provides strategies	3.00	0.01	.561

	for internet addiction or other computer misuse			
P3_3_5	Administrators help new teachers to get familiar with the school's technological environment	2.98	0.01	.854
P3_4_3	I can usually find someone in school to help me solve technolgoy-related problems	3.08	0.01	.454
Cooperation	（5 items）			
P3_4_1	I often discuss ICT integration with teachers in my disciplinary area	2.65	0.01	.633
P3_4_2	I often work with technology coordinators to integrate ICT into lessons	2.47	0.01	.706
P3_4_4	I can usually find someone outside school to help me solve technology-related problems	2.70	0.01	.517
P3_4_5	I have seen other teachers demonstrate excellent ICT-integrated lessons	2.87	0.01	.466
P3_4_6	I have participated in associations that facilitate educational technology professional development	2.49	0.01	.762

2.2 The analyses

To explore the relationship of school support to teacher's ICT integration, support and cooperation factors as well as several other influences, the factors were examined using correlation analyses. All of the factors showed a positive correlation with the ICT integration score. Thus, it was assumed that all the factors contribute to the score positively. Therefore, a linear regression was performed. However, the results of the regression showed some unexpected results. Further possibilities of the relationship were then proposed. Several SEM models that examine latent variables were tested for the mediation relationships among the factors (Muthén, 2002).

3. Results

3.1 Correlational studies

All the ten factors correlated positively with teacher's ICT integration score from over 6,000 teachers. The correlational results suggested that all these factors potentially influence teacher's ICT integration in a positive way when examined separately and individually (Pearson *r*, administrative support=.348; peer cooperation=.540; both p<.000).

3.2 Linear regression

The results of the linear regression revealed that administrative support has a negative coefficient with the dependent variable teacher's ICT integration. The result was quite curious because it is strange to think that the encouragement of school administrators and their implementation strategies have a negative effect on teachers in terms of their efforts using technology for lessons (see Table 2). On the other hand, the peer cooperation factor showed a strong positive effect on teacher's ICT integration. In fact, it was the strongest factor.

Table 2: Linear regression of factors influencing teacher's ICT integration.

Independent variables	Beta
Teacher's beliefs in technology to improve teaching	0.220***
Teacher's beliefs in technology to improve learning	0.01
Administrative support for technology integration	**- 0.060*** **
Peer cooperation in technology integration	**0.404*** **
Sex (1=male, 2=female)	0.097***

Year of teaching	-0.064***
School level (1=elementary, 2=secondary)	0.008
Access to computers and projects in the classroom	0.080***
Stability of Internet access	0.040**
The hours of professional training in technology integration in the last three years	0.177***
R	0.402
Adjusted R	0.401

3.3 The SEM models

Two SEM models were examined to find the best explanation for the impact of administrative support and peer cooperation. Model 1 placed administrative support as independent variable and cooperation as mediator. Model 2 placed cooperation as independent variable and administrative as mediator. Three fit indexes were chosen for model evaluation, including RMSEA, SRMR, CFI. To facilitate the interpretation, the rule of thumb for fit indexes proposed by previous studies was used. For example, Browne and Cudeck (1992) suggested that RMSEA $\leq$ .08 may indicate a fair fit; Hu and Bentler (1999) proposed that SRMR $\leq$ .08, CFI $\geq$ .95 can assist for evaluating model fit.

The results of the indexes suggested that Model 1 (see Table 3 and Figure 1), where administrative support factor was mediated by the peer cooperation in terms of its effect on ICT integration, was a good model, but not the other one. Model 1 had a better model fit than Model 2, which proposed the opposite relationship where peer cooperation is mediated by the administrative support (see Table 3 and Figure 2). Therefore, it was concluded that cooperation has a strong direct impact on teacher's ICT integration, while administrative support may not have a strong effect on the ICT integration, but it has an indirect impact on teachers ICT integration and it was mediated by the peer cooperation.

Table 3: Two SEM models for support and cooperation on ICT integration.

	Chi-square	df	RMSEA	SRMR	CFI
Model 1	16.015	1	0.05	0.012	0.997
Model 2	1326.262	1	0.47	0.111	0.723

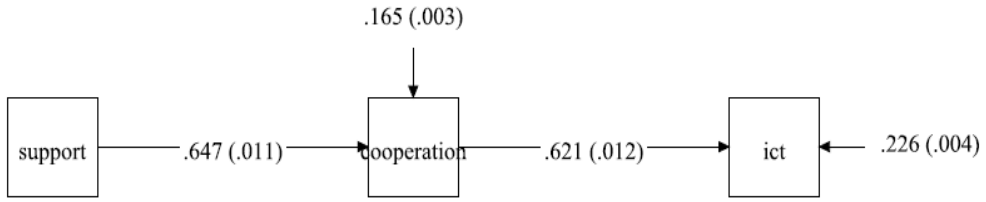

Figure 1. Model 1: Peer cooperation as mediator.

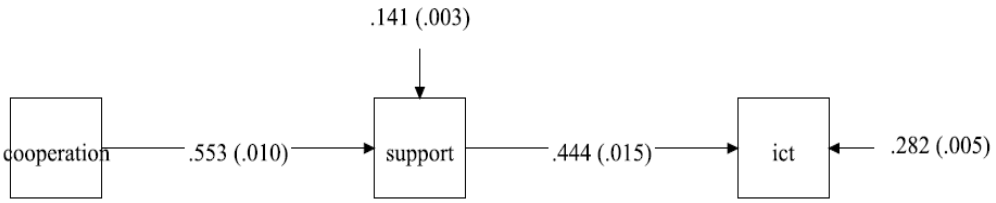

Figure 2. Model 2: Administrative support as mediator.

4. Discussion

The results revealed the importance of school cultural variables for teacher's ICT integration, including administrative support and teachers' peer cooperation. The influencing power of teacher cooperation was very strong in the regression model. The results confirmed the previous qualitative studies (Hadyn & Barton, 2007) and policy makers' intuitive observations (Culp, Honey & Mandinach, 2005) that teacher cooperation which is often fostered within a community can be extremely important to the success of teacher's ICT integration.

From first glance at the results from the regression, however, it may seem odd that administrative support has a negative impact on teacher's ICT integration, a finding which goes against with the previous results (Hsu & Kuan, 2013; Tondeur, Valcke, and van Braak, 2008). It is helpful to test the relationship of the factors of support, cooperation, and ICT integration with a SEM model that can examine the direct and indirect relationships of the factors. The results of the SEM analyses suggested that school administrative support indeed has a strong impact on teacher's ICT integration, but that effect has to be mediated by teachers' peer cooperation.

The interpretation with this unique finding may be partially explained by the results of Ching and Hursh (2014) which suggested that the teachers working in a group initially established by school administrators can grow into a community of designers with the same goal in a few years. In other words, groups started by administrative edict may turn into bonafide communities which provide help to members. This present study found that cooperation among teachers, whether in the same subject or from a technical support coordinator, was a strong predictor of teacher's ICT integration. It is possible that teacher's active participation in a professional development of ICT integration can be encouraged by the school administrators. The impact of the school administrators, therefore, can only be realized and mediated by the cooperation of teachers. It is therefore suggested that school administrators can support teachers' ICT integration effort by creating and sustaining teachers' ICT cooperative groups and which may in turn grow into a professional community for ICT integration.

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