THE RELATIONSHIP AMONG PRINCIPALS' TECHNOLOGY LEADERSHIP, TEACHING INNOVATION, AND STUDENTS' ACADEMIC OPTIMISM IN ELEMENTARY SCHOOLS

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ABSTRACT

This study empirically investigates the relationships among principals' technology leadership, teaching innovations, and students' academic optimism by surveying elementary school educators across Taiwan. Of the total 1,080 questionnaires distributed, 755 valid surveys were returned for a 69.90% return rate. Teachers were asked to indicate the effectiveness of technology leadership, teaching innovation, and students' academic optimism. The study used structural equation modeling with prospective data to test for model fit. The findings indicated that principals' technology leadership positively affects teaching innovation, which in turn directly affects students' academic optimism. Principals' technology leadership also positively influences students' academic optimism. The results suggest that principals should implement effective technology leadership in order to accelerate teaching innovation in school operations, thereby have a positive impact on student attitudes.

KEYWORDS

Academic Optimism, Technology Leadership, Teaching Innovation.

1. INTRODUCTION

Technology has changed our lives. Driven by a global trend of digitalization, the fashion of digital learning has being transforming. In an era with advanced information technology, technology products have made a significant impact on school operations, teachers' teaching, and students' learning, and a school leader's technology literacy is progressively valued and emphasized. Hallinger & Heck (2010) pointed out that school leadership may affect students' learning outcomes. The leadership of a school principal has the power of continuously enhancing the quality of education, the development of a school and students' learning. Furthermore, the leadership of a school principal could boost teachers' teaching skills, improve the way of learning, and make a positive impact on students' learning. A school leader should actively introduce resources to school, boost students' willingness to learn and teachers' teaching in the process of teaching. The integration of supporting education technology may be utilized to assist teaching successfully.

Also, the core of school education should be teaching. Teachers should be brave enough to face problems of teaching and put forward necessary strategies for revolution to ensure the quality of teaching, enhance students' participation in learning, and improve students' learning outcomes. The better concepts and skills of teacher teaching innovation are accompanied with better school effectiveness. Aside from teachers' self-initiated introspection and regeneration, a school principal should play the role of a teaching innovation exponent and encourager, who constantly encourages teachers to have a bold attempt to innovate norms of teaching, perfect heir teaching skills, make more effective student learning, and in turn improve school effectiveness. Students would have more successful learning experiences if students face challenges along the way of learning with an optimistic attitude. Such positive energies are able to motivate students to make more efforts to learn. Hsieh & Hsiao (2013) pointed out that shall students be willing to endeavor to achieve an

academic achievement goal set by school teachers or parents, a school campus would be full of teachers who are enthusiastic about teaching and students who are diligent in studying. Such school atmosphere would prompt teachers' faith in students' ability to learn, students' higher motivation to learn, and students' better academic achievement. In light of the above statement, this study aims to explore the correlation between principal technology leadership, teacher teaching innovation, and student academic optimism in primary schools.

2. LITERATURE REVIEW

2.1 Principals' Technology Leadership

As the leader of a school, a school principal should be literate in information technology so that school staff can also make good use of technology in teaching, create a teaching environment which facilitates students' motivation to learn, and achieve the goal of being a highly-acclaimed school. The above statement has expounded on the importance of principal technology leadership. Ray (1992) pointed out that exceptional technology leadership calls for excellent people skills, communication skills, and technology skills. Bailey (1997) mentioned that a school leader should make use of leadership skills to assist an organization to utilize fast-changing technology for a good cause. Anderson & Dexter (2005) suggested that technology leadership refers to a school's more effective use of information technology in decision-making, policy-making, and actions. Principal technology leadership can facilitate changes in a school as well as incorporate and utilize diverse solutions in learning, teaching, and school administration (Afshari, Bakar, Luan, Samah, & Fooi, 2008).

Schmeltzer(2001) further pointed out that a technology leader has to know how to use technology to improve teaching, develop strategies to help teachers incorporate technology into teaching, as well as form a technology team and a support system to continuously promote an entire organization's use of new technology. Creighton (2003) proposed that a school principal's important tasks include planning and carrying out innovative technology strategies, assist teachers to perceive and understand the importance of teaching and technology, and integrate technology into curriculum and teaching in order to improve the effectiveness of teaching. Hsieh & Hsiao (2013) believed that a school principal should possess information technology literacy, the ability to integrate resources, and the ability to visualize a future scene of technology in a well-planned manner. In addition, a school principal has to utilize leadership skills to encourage school teachers and non-teaching staff to undergo training in order to have better information technology skills, develop skills in applying technology in administration and teaching, create a communal and supportive school environment, and bring school administration, teaching, and students' learning and performance to the best possible status.

Flanagan & Jacobson (2003) pointed out that effective technology leadership can positively facilitate students' learning and prompt a school's technology renovation projects. According to a study of Chang (2012), principal technology leadership could enhance teachers' technology literary and directly encourage teachers to incorporate technology with teaching while teachers' technology literacy has a direct impact on the effectiveness of teaching. With respect of measurable sub-dimensions of principal technology leadership, we segment principal technology leadership into five sub-dimensions: "vision, plan, and management", "member development and training", "support of technology and basic infrastructure", "assessment and research", "interpersonal relationship and communication skill" after studying and systemizing relevant research (Chin & Chang, 2006; Chang & Wu, 2008; Hsieh & Hsiao, 2013).

2.2 Teaching Innovation

Teaching innovation refers to teachers' use of diverse and vivacious teaching methods coupled with miscellaneous contents of teaching to stimulate students' inner interest in learning, cultivate students' positive attitudes of learning, and enhance students' ability to learn in the process of teaching. Nie, Tan, Liau, Lau, & Chua (2013) pointed that teachers who receive commands from a leader would endeavour to better their efficacy and beliefs in teaching, change their teaching methods, and adopt active teaching innovation to let students acquire more useful knowledge. Teaching can also be more effective when teachers materialize

thoughts into real actions, improve existing teaching methods, or use new methods and instruments. Undoubtedly, teaching beliefs have a direct impact on the effectiveness of teaching as the foremost function of teaching beliefs is to guide and determine the presentation of teaching behaviors. For that reason, the presentation of a teacher in the action of teaching is reflective of the teacher's teaching beliefs, which directs the teacher's teaching behaviors and in turn affects decisions and judgments of innovative teaching strategies (Pu, 2011).

According to Fan & Chang (2013), teaching innovation is acquiring knowledge by making good use of technology, adopting new teaching beliefs, employing diverse and vicarious teaching methods, making changes in the content of teaching, teaching methods, methods of assessment, or software and hardware facilities to enhance students' interest in learning and students' learning outcomes while adhering to teachers' teaching goals and considering students' needs. Blitz, Van Rooyen, Cameron, Pickworth, & Du Toit (2010) mentioned that teachers should have knowledge of their own styles of teaching, constantly reflect on the process of teaching, contemplate on the existing knowledge and seek to go beyond it, use theories and beliefs of innovative teaching as the foundation, accommodate to students' different levels, choose appropriate teaching scenarios, make use of different teaching strategies skilfully, constantly improve and revolutionize the process of teaching, adopt new teaching equipment and teaching props, and incorporate multidimensional assessments to develop a comprehensive and systematic innovative teaching model.

Teaching innovation, which is revolution and changes in learning, not only affects teachers' teaching but also students' learning. Therefore, students would get different learning methods when teachers change their thoughts about and methods of teaching. In this study, we segment the dimension of teacher teaching innovation into four sub-dimensions: "innovative teaching beliefs", "innovative teaching content", "innovative teaching method", and "innovative teaching assessment" after studying relevant literature.

2.3 Students' Academic Optimism

Academic optimism is a complex variable involving the concepts of efficacy, trust, and academic emphasis, and these concepts are important features which can be used to describe a school's academic success (McGuigan & Hoy, 2006). A number of studies have looked into teachers' academic optimism (Chang, Hsu, & Yen, 2011; Hoy, Tarter, & Woolfolk-Hoy, 2006) and pointed out that teachers' academic optimism has a positive impact on students' learning achievement.

As rising importance has been attached to the concept of academic optimism, a number of researches have applied the concept of academic optimism on students learning, i.e. students' academic optimism. In a study of Smith & Hoy (2007), it was substantiated that academic optimism had a positive impact on primary school students' grades at school. Research of Beard, Hoy, & Woolfolk-Hoy (2010) also suggested the close correlation between academic optimism and students' learning achievement. When students are sure about school's important functions on their daily life, they start to put school and school-associated goals on an important position (Finn, 1989). A study of Klem & Connell (2004) pointed out a positive correlation between students' participation and academic achievement regardless of students' race, gender, and socioeconomic status. Lee (2012) also pointed out that enhancing students' participation is conducive to improving impoverished students' learning outcomes. Therefore, reinforcing students' attention on learning and keeping students' optimistic beliefs in learning are important factors that affect students' learning outcomes.

After examining students' identification with their school, their trust in teachers and emphasis on academics, Tschannen-Moran, Bankole, Mitchell, & Moore (2013) concluded that these three elements contribute to students' academic optimism and have a crucial effect on student learning. In this study, we segment students' academic optimism into the same three dimensions: students' identification with their school, students' trust in teachers, and students' academic emphasis.

2.4 Development of a Theoretical Model

2.4.1 The Impact of Principals' Technology Leadership on Teaching Innovation

According to relevant studies, there is significantly positive correlation between principal technology leadership and teacher teaching innovation whether as a whole or on each sub-dimension (Chang, 2011;

Chang & Wu, 2008; Hsieh & Hsiao, 2013). Also, there is significant correlation between principal technology leadership and teacher teaching innovation (Wu & Yang, 2009). As such, this study reasons that principal technology leadership has a significant and positive impact on teacher teaching innovation.

2.4.2 The Impact of Teaching Innovation on Students' Academic Optimism

According to relevant studies, there is significantly positive correlation between teacher teaching innovation and student academic optimism (Lee, 2012; Ngidi, 2012). Judging from the above statement, we can tell that there is a close relationship between teacher teaching innovation and student academic optimism whereas effective improvements in teachers' curriculum planning and teaching delivery are likely to trigger students' willingness to learn. As such, this study reasons that teacher teaching innovation has a significant and positive impact on student academic optimism.

2.4.3 The Impact of Principals' Technology Leadership on Students' Academic Optimism

According to relevant studies, there is significantly positive correlation between principal technology leadership and student academic optimism (Chang & Wu, 2008; Hsieh & Hsiao, 2013; Chang, 2011). For that reason, a school principal's technology leadership is the key for students' progress, effective learning, and getting an advantage over competitors. As such, this study reasons that principal technology leadership has a significant and positive impact on student academic optimism.

2.4.4 The Relationship among Principals' Technology Leadership, Teaching Innovation, and Students' Academic Optimism

With reference to the perspective of Baron& Kenny (1986), this study believes in the possible existence of a mediating effect between principal technology leadership, teacher teaching innovation, and student academic optimism. In specific, principal technology leadership has an indirect and positive impact on student academic optimism through the mediating effect of teacher teaching innovation. Based on an examination of the literature, We hypothesize the model (see Figure 1) that principals' technological leadership directly influences teachers' teaching innovation and students' academic optimism. Furthermore, teachers' teaching innovation directly influences the students' academic optimism. More important, principals' technological leadership, as mediated by teachers' teaching innovation, can affect students' academic optimism will be tested.

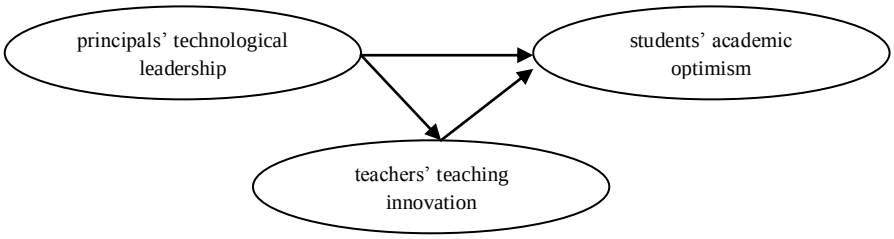

Figure 1. Hypothesized conceptual model

3. RESEARCH METHOD

3.1 Research Subjects

With public primary school teachers in Taiwan as research participants, this study adopts the stratified sampling method to perform questionnaire survey on the research participants. Among the 1,080 distributed questionnaire copies, 755 valid questionnaire copies are collected, a valid response rate of 69.90%. Among respondents of the valid questionnaire copies, 39.2% are male teachers, 49.5% are teachers with a master's degree, and 37.9 % are teachers who also perform school clerical and administrative duties.

3.2 Research Variables

3.2.1 Principals' Technology Leadership

The scale of Hsieh & Hsiao (2013) is employed to measure principal technology leadership. Among the scale's 19 question items, there are five questionnaires items about "vision, plan, and management", three question items about "member development and training", four question items about "support of technology and basic infrastructure", four question items about "assessment and research", and three question items about "interpersonal relationship and communication skills". Results of second-order confirmatory factor analysis reveal that the model's goodness of fit statistics including root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), and comparative fit index (CFI) are .059, .024 and .97 respectively, and all question items' standardized factor loadings are between .80 and .91, indicating good reliability and validity of the principal technology leadership measuring instrument.

3.2.2 Teaching Innovation

The scale of Fan & Chang (2013) is employed to measure teacher teaching innovation. Among the scale's 21question items, there are five question items about "innovative teaching beliefs", five question items about "innovative teaching content", five question items about "innovative teaching methods", and six question items about "innovative teaching assessment". Results of second-order confirmatory factor analysis reveal that the model's goodness of fit statistics including root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), and comparative fit index (CFI) are .066, .036 and .95 respectively, and all question items' standardized factor loadings are between.73 and .85, indicating the good reliability and validity of the teacher teaching innovation measuring instrument.

3.2.3 Students' Academic Optimism

The scale of Tschannen-Moran et al. (2013) is employed to measure student academic optimism. Among the scale's 25 question items, there are 10 question items about "students' identification with a school", eight question items about "students' trust in teachers", and seven question items about "students' academic emphasis". Results of second-order confirmatory factor analysis reveal that the model's goodness of fit statistics including root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), and comparative fit index (CFI) are .063, .035 and .95 respectively, and all question items' standardized factor loadings are between .71 and .87, indicating the good reliability and validity of the student academic optimism measuring instrument.

3.3 Data Analysis

The scale of this study is an adaptation of the 5-point Likert scale, and a variable's higher score indicates the variable's stronger positive attributes. The data analysis is carried out by performing descriptive analysis on means and standard errors of each variable's sub-dimensions, using Pearson product-moment correlation to understand the strength of correlation, and using structural equation modeling to examine the correlation of variables.

4. RESEARCH RESULTS

4.1 Descriptive Statistics and Relevant Analysis

The means of principal technology leadership statistics fall between 3.62 and 3.91, with "member development and training" having the greatest mean (M = 3.92, SD = 0.74). The means of teacher teaching innovation statistics fall between 3.87 and 4.11, with "innovative teaching content" having the greatest mean (M = 4.11, SD = 0.55). The means of student academic optimism statistics fall between 4.05 and 4.30, with "students' trust in teachers" having the greatest mean (M = 4.30, SD = 0.53). Besides, the sub-dimensions of

each variable all have significantly positive correlation, with correlation coefficients between .31 and .81(see Table 1).

Table 1. Descriptive statistics and relevant analysis

	T1	T2	T3	T4	T5	I1	I2	I3	I4	O1	O2	O3
T1	—											
T2	.76	—										
T3	.81	.79	—									
T4	.77	.74	.81	—								
T5	.71	.69	.74	.76	—							
I1	.52	.53	.54	.58	.49	—						
I2	.42	.48	.46	.47	.38	.68	—					
I3	.45	.46	.46	.49	.39	.66	.75	—				
I4	.44	.42	.47	.51	.43	.65	.67	.79	—			
O1	.40	.45	.46	.46	.41	.57	.58	.57	.57	—		
O2	.33	.38	.37	.35	.31	.50	.60	.58	.56	.71	—	
O3	.44	.45	.46	.46	.41	.57	.60	.60	.60	.75	.72	—
continuous												
M	3.71	3.91	3.81	3.62	3.69	3.88	4.11	3.93	3.87	4.05	4.30	4.06
SD	.74	.72	.71	.73	.79	.57	.55	.57	.55	.50	.53	.51

4.2 Structural Equation Modeling Analysis

In this study, structural equation modeling is adopted to examine the theoretical model, and the maximum likelihood method is adopted to estimate coefficients(see Figure 2). Results of the analysis reveal that the structural model involving principal technology leadership, teacher teaching innovation, and student academic optimism has a $\chi 2$ value of 246.84 (df = 51). Also, the model's goodness of fit statistics including root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), and comparative fit index (CFI) are .071, .037 and .98 respectively, indicating a good model fit.

In terms of the structural coefficients, the standard structural coefficient between principal technology leadership and student academic optimism is .09 ($t = 2.48$, $p<.05$), indicating principal technology leadership's significantly positive impact on student academic optimism. In addition, the standard structural coefficient between principal technology leadership and teacher teaching innovation is .63 ($t = 15.83$, $p<.05$), indicating principal technology leadership's significantly positive impact on teacher teaching innovation. Furthermore, the standard structural coefficient between teacher teaching innovation and student academic optimism is .74 ($t = 16.27$, $p<.05$), indicating teacher teaching innovation's significantly positive impact on student academic optimism.

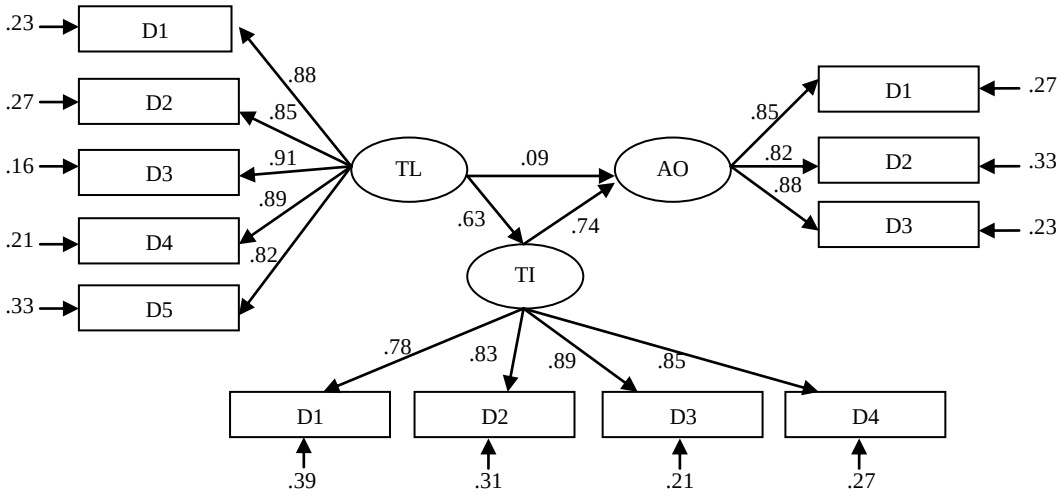

Figure 2. Final structural equation model

Following the above results, this study further examines the mediating effect of teacher teaching innovation on principal technology leadership's impact on student academic optimism. Adopting the Sobel test to test the significance of the mediating effect reveals a z-value of 10.46, indicating the presence of the mediating effect. As mentioned earlier, principal technology leadership could have an indirect impact on student academic optimism through the mediating effect of teacher teaching innovation. Nevertheless, given that principal technology leadership itself also has a significant impact on student academic optimism, teacher teaching innovation merely has a partial mediating effect on the relationship between principal technology leadership and student academic optimism.

5. CONCLUSION AND DISCUSSION

According to results of this study, principal technology leadership has a positive impact on student academic optimism, which is identical with results of the study of Hsieh & Hsiao (2013) yet the impact is not less powerful. Relatively speaking, principal technology leadership has an indirect and positive impact on student academic optimism through the mediating effect of teacher teaching innovation. An indirect mediating effect value of .47 indicates that teacher teaching innovation could have a more powerful impact on student academic optimism through the antecedent impact of principal technology leadership.

As this study indicates, principals as technological leaders must develop and implement vision and technology plans for their schools, encourage the technological development and training of teachers, provide sufficient technological infrastructure support, and develop an effective school-evaluation plan. Through technological leadership, teachers can display more teaching innovation, and promoted student' learning attitude and achievement.

The study uses structural equation modeling to test the relationships among principals' technological leadership, teaching innovation, and students' academic optimism. Worth mentioning, principal technology leadership as a concept at organizational level, for this reason that we suggest use multilevel analysis to test the effect of principals' technological leadership in future research.

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