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The interactive effects of personal traits and guided practices on preservice teachers' changes in personal teaching efficacy

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ABSTRACT

Personal teaching efficacy is associated with a teacher's effectiveness in the classroom. To enhance this efficacy in a computer-simulated training program, both personal traits and guided practices need to be considered concurrently. In this study, it was hypothesised that the interactive effects from the coupling of personal traits with guided practices would be a reliable predictor of the degree of improvement in personal teaching efficacy during computer-simulated training. One hundred and seventy-eight preservice teachers completed an interactive teaching experience via the Computer Simulation for Teaching General Critical-thinking Skills in which guided practices were integrated via specially designed teaching sequences and loops. The findings suggest that intrapersonal intelligence, critical-thinking dispositions and a judicial thinking style are related to self-awareness, analytical learning and reflective thinking and that in this study, these personal qualities seemingly interacted with guided practices, which resulted in reflective teaching and mastery experience. This, in turn, may very well have brought about improvement in the preservice teachers' personal teaching efficacy during the computer-simulated teaching.

Introduction

Recently established is the close association between teacher efficacy and their commitment to teaching, their adoption of innovations and their use of effective classroom strategies (Albion, 2001; Aguirre & Speer, 2000; Kulinna & Silverman, 2000). It is not surprising, therefore, that teacher efficacy has become an important indicator of teachers' professional development. On the question of how to best help preservice teachers to become efficacious, some researchers (Bandura, 1997; Yeh, 1997) have suggested that guided practices should be incorporated into their training, while others (Harry, Brown & McCullogh, 2001; Lange & Burroughs-Lange, 1994) have advocated that a greater emphasis should be placed on the nurturing of certain personal traits, especially those that involve the monitoring and development of the cognitive processes required in teaching situations. When discussing such important personal traits, I define them as positive traits. Combining the above approaches for the enhancement of

teacher efficacy, this study postulates that during training sessions, positive personal traits together with guided practices should have interactive effects on teacher efficacy during training sessions. To confirm this proposition, this study used a computer-simulation program because computers have been widely recommended as an effective vehicle for teacher training (Drazowski & Holodick, 1998; Schrum & Dehoney, 1998; Yeh, 2004).

Personal teaching efficacy in critical-thinking instruction

Teacher efficacy comprises teaching efficacy and personal teaching efficacy (Gibson & Dembo, 1984). Teaching efficacy refers to a teacher's belief that his or her ability to bring about change is limited because of external factors. Against this, personal teaching efficacy refers to a teacher's belief that he or she does have the competence and skills to bring about student learning, and very importantly, evidence has been found that personal teaching efficacy is a stronger predictor of teacher effectiveness than is teaching efficacy (Yeh, 1997). Besides this, several researchers (Flammer, 1995; Zimmerman, 1995) have suggested that teacher efficacy needs to be studied in specific contexts, and more recently, some researchers have strongly subscribed to the notion that the teaching of critical thinking should be taken as the new teaching standard (Birman, Desimone, Porter & Garet, 2000). These issues have been the motivation for the present study, which focuses on personal teaching efficacy within the context of critical-thinking instruction.

Based on theoretical inquiry and empirical findings (Gadzella & Masten, 1998; Halpern, 1998; Paul & Elder, 2001), the construct of personal teaching efficacy in critical thinking consists of three elements: critical-thinking skills, critical-thinking dispositions (CT-dispositions) and prerequisite knowledge. The first element involves the use of such cognitive and metacognitive skills as analysis, the identification of assumptions, interpretation, inference, induction, deduction and evaluation (Halpern, 1998; Paul & Elder, 2001). The second element, CT-dispositions, stimulates an individual to apply critical-thinking skills, as well as to find questions, evaluate problems and seek reasons (Norris & Ennis, 1989). As for the third element, prerequisite knowledge pertains to the knowledge of and experience in the topic or issue being discussed (Paul & Elder, 2001). Because all three of these elements are essential to the making of a good critical thinker, personal teaching efficacy within the context of critical-thinking instruction is defined in this study as having the necessary confidence to be able to help students obtain the critical-thinking components of critical-thinking skills, CT-dispositions and prerequisite knowledge.

Personal traits, guided practices, and changes in personal teaching efficacy Personal teaching efficacy is related to reflective teaching, goal setting and the use of analytical strategies (Bandura, 1995). It has been argued that direct mastery experience is a powerful prerequisite for the creation of a strong sense of efficacy (Bandura, 1995), and one effective way to obtain mastery experience is reportedly through well-guided practices (Yeh, 1997). Accordingly, to strengthen personal teaching efficacy, guided practices and the positive personal traits that contribute to reflective teaching and mastery experiences should be considered concurrently when conducting teacher training. Whether intrapersonal intelligence, CT dispositions or thinking styles should be included amongst these influential traits is of considerable concern in this study.

Intrapersonal intelligence is the ability of individuals to know themselves and to understand their own

moods, feelings, intentions and motivations (Shepard, Fask & Osborne, 1999). Research findings have reported that intrapersonal intelligence is linked to a person's ability to reflect upon and regulate his or her thoughts and behaviours (Armstrong, 2000; Campbell, Campbell & Dickinson, 1999; Furnham, Tang, Lester, O'Connor & Montogomery, 2002), and it comprises a sense of self-awareness that goes beyond the strict demands of strategy selection and outcome evaluation in the problem-solving process (Mitina & Kuz'menkova, 1999). All of these characteristics are essential to learning and professional development.

Returning to CT-dispositions, these refer to attitudes, commitments and tendencies toward thinking critically (Norris & Ennis, 1989). The key features of this element of critical thinking include open mindedness, intellectual curiosity, reflective thinking and the ability to be analytical and systematic in problem solving (Facione & Facione, 1994; Paul & Elder, 2001). More specifically, CT-dispositions include: (1) a willingness to engage in and be persistent when confronted with a complex task; (2) the habitual use of plans and the suppression of impulsive behaviour; (3) flexibility or open mindedness; (4) a willingness to abandon nonproductive strategies in an attempt to self-correct; and (5) an awareness of the social realities that need to be overcome so that thoughts can become actions (Halpern, 1998). Such dispositions may very well contribute to the continual reconstruction of professional knowledge and teaching behaviours, and by virtue of these, a teacher's personal teaching efficacy is very likely to improve.

Another personal trait of concern here is thinking style (Sternberg, 1997). Individuals with a judicial style prefer to evaluate procedures and to analyse and appraise existing rules; they like activities that exercise judicial functions. Second, people with a legislative style prefer to do things their own way and build their own structures when deciding how to approach a situation or tackle a problem; they prefer creative and constructive planning-based activities. Contrast people with these two thinking styles with those with an executive style who prefer prestructured tasks and favour activities that are already well defined. A great deal of research (Chang, 1998; Sternberg, 1997; Zhang, 2001) has led to the same conclusion that especially the judicial thinking style, as well as the legislative style, albeit to a lesser degree, is closely associated with effective teaching approaches and teaching efficacy.

Hypothesis

To recapitulate the research mentioned above, preservice teachers with positive personal traits are more capable of learning to think both analytically and reflectively, and therefore, it was expected that it should be easier for them to master teaching skills from guided computer-simulated training. On these grounds, it was proposed in this study that personal traits would interact with guided practice sessions and, as a result, bring about changes in preservice teachers' personal teaching efficacy via the mechanisms of reflective teaching and mastery experience in a computer-simulated training program. More to the point, it was expected that preservice teachers with a high level of intrapersonal intelligence, strong CT-dispositions and a tendency to think judicially or legislatively would significantly improve their personal teaching efficacy in critical-thinking instruction via a computer-simulated training program with guided practice sessions. Conversely, it was anticipated that those with a low level of intrapersonal intelligence, weaker CT-dispositions and an executive thinking style would not benefit as much.

Method

Participants

The participants were 127 female (71.3%) and 51 male (28.7%) preservice teachers enrolled in a two-year teaching program in southern Taiwan. With a mean age of 23.90 years (SD = 3.67), the group was composed of 108 undergraduates (60.7%) and 69 graduates (39.3%).

Instruments and instructional design

The Computer Simulation for Teaching General Critical-Thinking Skills (CS-TGCTS) (Yeh, 2004), developed with Visual Basic 6.0 provided the interface for the interactive teaching in this study. To be more specific, it simulated a classroom setting in which a teacher was interacting with 12 students face to face. The CS-TGCTS consisted of two consecutive simulations with integrated guided practices, each taking about two hours to complete. The guided practice design, the most important treatment in this study, is clearly visualised in the sequences and loops in both simulations (see Figure 1). The main part of the first simulation consisted of four sessions: (1) collecting background information; (2) doing inventories of personal teaching efficacy and personal traits; (3) conducting classroom teaching; and (4) providing the design to enhance self-awareness and reflective teaching. This design included personalised bar charts depicting the actual usage rate of effective teacher behaviours and research-based literature on teaching critical thinking. The components of effective teacher behaviours were: (1) providing students with advance organisers; (2) providing students with review sessions; (3) keeping students focused on tasks or discussions; (4) giving ample time for thinking; (5) allowing a variety of student answers; (6) giving cues when students could not answer correctly; (7) giving positive feedback; (8) monitoring the students' learning process; (9) asking higher-order questions; (10) asking extended questions; (11) requesting explanations for answers; and (12) encouraging cooperative learning and conducting discussions.

The second simulation consisted of classroom teaching and a debriefing session. The classroom teaching session incorporated four main teaching activities: (1) arranging students' seating; (2) giving students an advance organiser; (3) teaching the lesson content; and (4) evaluating student performance. Guided practices were emphasised in this part, particularly in the session for lesson teaching. In this teaching session, the participants were required to go through the teaching and discussion of 25 issues that were designed to improve students' critical-thinking skills. Obviously, the aim of this part of the instructional design was to provide participants with the necessary scaffolding to master teaching skills step by step and, further, to strengthen their personal teaching efficacy. Figure 2 illustrates classroom teaching. The CS-TGCTS simulation also provided measurements of the participants' intrapersonal intelligence, their CT-dispositions and their thinking styles. The instruments employed were the Inventory of Personal Teaching Efficacy in Critical Thinking (IPTE-CT), the Questionnaire of Intrapersonal Intelligence (QII), the Inventory of Critical Thinking Dispositions (ICTD) and the Inventory of Thinking Styles (ITS). All instruments are Likert-type inventories.

The IPTE-CT consisted of two factors: 'efficacy in enhancing dispositions and skills' and 'efficacy in improving prior knowledge'. The Cronbach's a coefficient for all items (20 test items) was .89 (Chen, 2001). The test items included statements such as 'I believe that I can make students active critical thinkers through my classroom teaching'. The test item response options ranged from 1 to 6, with totally disagree receiving 1 and totally agree receiving 6. The QII, adapted from Armstrong's checklist of intrapersonal intelligence, contained only one factor, and its Cronbach's a coefficient was .80 (7 items) (Chu, 2001). The item response options ranged from totally disagree (1) to totally agree (6). Two

examples of the items were 'I can deal with frustration,' and I frequently participate in conferences or discussion groups to better understand myself.

The ICTD was comprised of four factors: (1) systematicity and analyticity; (2) open-mindedness; (3) intellectual curiosity; and (4) reflective thinking. The item response options, ranging from 1 to 6 points, were never (1) to always. (6) One example was 'I try to maintain rational and logical thinking when I am dealing with a complex problem'. The Cronbach's a coefficients for all items (20 items) was .88 (Yeh, 1999). The ITS, which was adapted from the Sternberg-Wagner Thinking Styles Inventory, included three thinking styles: judicial, legislative and executive (Li, 1999). Examples of the test items were 'I like to solve problems in my own way' and 'I like work that requires dealing with details'. The Cronbach's a coefficients for all 15 items combined and for the three thinking styles were .80, .69, .62 and .61. The item response options ranged from never (1) to always. (5)

Procedures

As one part of their class requirements, all of the preservice teachers who had enrolled in Educational Psychology and Teaching Higher-order Thinking in the Classroom had to take the CS-TGCTS simulation. The main treatment in the CS-TGCTS was guided practices. Because a similar simulation but with guided practices excluded was difficult to construct and because the main focus of this study was on understanding whether participants with varying degrees of positive personal traits would benefit differently from the CS-TGCTS program, no control group was required. All participants received a brief introduction to the simulation and a 10-minute demonstration by a research assistant. They then began the first teaching simulation without any time limit imposed after the practice session. One week later, the participants returned for their second teaching simulation, again with no time limit imposed. The one-week interval was necessary because of the participants' schedules and the limited availability of the computer laboratory.

Results

Effects of personal traits on changes in personal teaching efficacy

It was proposed that preservice teachers with positive personal traits should be more likely to master teaching skills (ie, to employ more positive teaching behaviours) from a guided teacher training and, further, to enhance their personal teaching efficacy. To verify this proposition, I conducted the Repeated Measures Analysis of Variance to test the effects of the guided practices on the mastery of teaching skills before testing their effects on the enhancement of personal teaching efficacy. The results indicate that those with high intrapersonal intelligence and CT-dispositions showed greater improvement in teaching skills than those with low intrapersonal intelligence and CT-dispositions. Moreover, those who had the judicial and legislative thinking styles demonstrated a greater improvement in teaching skills than those who did not (Yeh, in press). These findings gave me the confidence and motivation to continue the following analyses.

The Mixed Designs via Repeated Measures Analysis of Variance was performed to test the effects of the independent variables (intrapersonal intelligence, CT-dispositions and thinking styles) on the dependent variable (changes in personal teaching efficacy). All of the analyses included two variables: one between-subjects variable which is referred to as Group and one within-subjects variable which is referred to as Test (pretest vs. posttest score on personal teaching efficacy). While intrapersonal

intelligence and CT-dispositions were categorised into 'low' and 'high' groups based on their respective mean score, thinking style was individually grouped into judicial, legislative or executive based on the highest score amongst the three styles. Forty participants were not classified on thinking style because their style was unclear.

The first Repeated Measures ANOVA did not yield a significant Group (low vs. high intrapersonal intelligence) × Test (pretest vs. posttest personal teaching efficacy) interaction effect (A = .996, p = .421) but did yield significant main effects for Test and Group, Fs (1, 174) = 24.419, 13.592, ps < .001 (see Table 1). Comparisons of the estimated marginal means provided solid evidence that the preservice teachers had a higher level of personal teaching efficacy on the posttest than on the pretest. Also clear was that those with a higher level of intrapersonal intelligence showed a greater improvement in personal teaching efficacy than did those with a lower level of intrapersonal intelligence.

In line with the first analysis, the second analysis did not yield a significant Group (low vs. high CT-dispositions) × Test (pretest vs. posttest personal teaching efficacy) interaction effect (Delta = .993, p = .262) but did reveal significant main effects for Test and Group, Fs (1, 174) = 25.153, 34.830, ps < .001 (see Table 1). In this regard, the preservice teachers again demonstrated enhanced personal teaching efficacy on the posttest compared with that on the pretest, and equally important, those with a higher level of CT-dispositions had a stronger sense of personal teaching efficacy than did their counterparts with a lower level of CT-dispositions.

Table 1: Main effects of Group and Test on changes in personal teaching efficacy

Variable	N	M	SD	F	P
Intrapersonal intelligence					
Group					
Low	87	4.54	.44	13.592	.000
High	89	4.81	.52		
Test					
Pretest	176	4.57	.59	24.419	.000
Posttest	176	4.78	.55		
CT-dispositions					
Group					
Low	95	4.49	.49	25.153	.000
High	81	4.90	.42		
Test					

Pretest	176	4.57	.59	34.830	.000
Posttest	176	4.78	.55		
Thinking style					
Group					
Executive	44	4.66	.43	1.611	.203
Legislative	59	4.65	.48		
Judicial	35	4.83	.58		
Test					
Pretest	138	4.59	.59	20.234	.000
Posttest	138	4.80	.53		

The final analysis did not yield a significant Group (judicial, legislative and executive thinking style) × Test (pretest vs. posttest personal teaching efficacy) interaction effect (A = .994, p = .677) nor a main effect of Group, F(2, 135) = 1.611, p = .203. However, it did yield a significant main effect for Test, F(1, 135) = 20.234, p < .001 (see Table 1), highly indicative that the preservice teachers had better personal teaching efficacy on the posttest than on the pretest.

The predictive power of personal traits on personal teaching efficacy

Two discriminate analyses were used to verify whether or not the independent variables effectively predicted group membership with respect to personal teaching efficacy in the pretest and posttest. By design, all of the variables were entered into the equations. The analyses of both the pretest and posttest scores resulted in two discriminant functions. In the pretest and posttest analyses, when both functions were used, the effect was significant, Delta = .780, X[sup2](10) = 42.498, p < .001 and A = .748, X[sup2](10) = 49.644, p < .001, respectively.

In the pretest, the first function explained an overwhelming 97.7% of the variance (rho = .464), while the second explained a mere 2.3% (rho = .080). Similarly, in the posttest, the first function explained a powerful 92.2% of the variance (rho = .482), whereas the second explained only 7.8% (rho = .159). These findings strongly suggest that the second function was not important in either analysis, but the structure matrices in the first function are clear indications that CT-dispositions and the judicial thinking style, and to a slightly less degree, intrapersonal intelligence, were the most crucial personal qualities that seemed to have determined the preservice teachers' improvement in personal teaching efficacy (see Table 2). Worth noting too is that the findings reveal that collectively all of these variables had the capacity to predict group membership vis-avis personal teaching efficacy, with the correct classification rate of 46.0% in the pretest and 55.1% in the posttest (see Table 3).

Discussion and Conclusions

Guided practices and the enhancement of personal teaching efficacy

Pajares (1992) put forth the claim that teachers' beliefs are formed early and tend to self-perpetuate, persevering even when the teachers are greatly challenged with respect to their teaching performance. These beliefs consist of affective components capable of arousing emotions, cognitive components representing knowledge and behavioural components that are activated when taking action is required. In light of this, it follows that personal teaching efficacy must be hard to change and that successful teacher training to transform such teachers' beliefs must simultaneously involve teaching practices, teacher knowledge and student outcomes in specific domains.

The significant Test (pretest vs. posttest) effects in this study suggest that the instructional design of the CS-TGCTS was effective in strengthening the preservice teachers' personal teaching efficacy. To be more precise, guided practices that led to reflective teaching and mastery experiences substantially contributed to the preservice teachers' improvement in personal teaching efficacy within the context of critical-thinking instruction during the simulated teaching.

Table 2: Standardised canonical discriminant function coefficients and structure matrices

	Standardised canonical discriminant function coefficients		Structure matrix	
	Function 1	Function 2	Function 1	Function 2
Pretest				
CT-disposition	.410	.439	.799	.220
Judicial style	.492	-.148	.779	.059
Intrapersonal-intelligence	.405	-.803	.749	-.495
Legislative style	-.172	.211	.465	.206
Executive style	.173	.694	.386	.678
Posttest				
CT-disposition	.881	-.140	.971	-.098
Judicial style	.094	-.612	.597	-.026
Intrapersonal-intelligence	-.016	-.350	.490	-.246
Legislative style	.035	1.178	.389	.298

Executive style	.204	.267	.483	.683

Note. In both the pretest and the posttest, the first two canonical discriminant functions were used in the analysis.

Table 3: Classification results from discriminant analyses

	Predicted group membership			
	Group 1	Group 2	Group 3	Total
Pretest				
Group 1 (original)	30 (63.8%)	10(21.3%)	7 (14.9%)	47 (100.0%)
Group 2 (original)	38 (43.7%)	23 (26.4%)	26 (29.9%)	87 (100.0%)
Group 3 (original)	8 (19.0%)	6 (14.3%)	28 (66.7%)	42 (100.0%)
Posttest				
Group 1 (original)	35 (79.5%)	2 (4.5%)	7 (15.9%)	44 (100.0%)
Group 2 (original)	30 (34.9%)	34 (39.5%)	22 (25.6%)	86 (100.0%)
Group 3 (original)	6 (13.0%)	12 (26.1%)	28 (60.9%)	46 (100.0%)

Note. Of the original grouped cases, 46.0% were correctly classified in the pretest compared with

55.1% in the posttest.

In this study, guided practices within the flow of the teaching activities were integral parts of the CS-TGCTS program, and as the evidence shows, the four-hour training session seems to have provided the minimum practices required to bring about change in the personal teaching efficacy of the preservice teachers. This finding is highly consistent with earlier claims that guided practices are essential for achieving mastery experiences and that mastery has a powerful impact on teacher efficacy (Albion, 2001; Bandura, 1997).

Interactions between traits and practices and improvements in personal teaching efficacy

The initial hypothesis that intrapersonal intelligence, CT-dispositions and thinking style would contribute to preservice teachers' improvement in personal teaching efficacy in computer-simulation training is supported in this study. The findings also give credence to the notion that although intrapersonal intelligence, CT-dispositions and the three thinking styles (indeed) correctly predict group membership with regard to personal teaching efficacy, CT-dispositions and the judicial thinking style are comparatively much more important.

Personal teaching efficacy is one of the most important characteristics of an expert teacher, and an expert teacher uses practical thinking styles that involve active, sensitive, deliberate and reflective engagement in teaching situations (Sato, Akita, & Iwakawa, 1993). Such practical thinking styles are, in essence, the integration of intrapersonal intelligence, CT-dispositions and the judicial thinking style. Intrapersonal intelligence is linked to a person's self-awareness, reflective thinking, ability to analyse performance and change and his or her strategic processing in teaching practices (Shepard et al, 1999). CT-dispositions, at least partially, lead to expending concerted mental effort and cognitive monitoring to the learning of how to analyse complex classroom situations (Sears & Parson, 1991). Added to this, the judicial thinking style has positive effects on teaching confidence and analytical instruction (Sternberg, 1997). These traits make it clear how they contributed to the preservice teachers' expert thinking, professional growth and to their improvement in personal teaching efficacy in the computer-simulated training.

Worth bearing in mind is that a change in beliefs has been attributed to the interactive effects between practice and reflection in teaching (Tillema, 2000). Collier (1998) has, in fact, indicated that for teacher growth, the building of a high level of self-awareness on the part of teacher trainees before they participate in student teaching is critical not only to their learning of reflective teaching, but also to the development of their ability to become thoughtful practitioners. Similarly, Totone, Sherman and Palmer (1998) have affirmed that increasing self-awareness and encouraging mindful learning are two effective ways to foster reflective teaching. For these reasons, the guided practice sessions and personalised bar charts for teaching behaviours in this study were provided in the simulation program, and these must have, at a to a certain extent, triggered the preservice teachers' self-awareness and capability for reflective teaching, thereby maximising the effectiveness of the computer-simulation program as a tool for nurturing personal teaching efficacy. The findings in this study, therefore, also support Wellington's (1995) assertion that only when reflections on self-learning in a critical way are encouraged can new technology enrich teacher-education courses.

Conclusions

For the most part, most of the population--from cognitive theorists and business executives to citizens and community leaders--have been embracing schools that instruct students on how to solve problems and think critically. This study used a simulation program with guided practice sessions to help preservice teachers become more efficacious in teaching critical thinking. The significant changes in the preservice teachers in this study substantiate the claim that a computer-simulation program with well-designed guided practices can provide an effective interface for enhancing personal teaching efficacy. In addition, on the weight of the evidence here, it seems clear that personal traits and the mechanisms that foster improvements in personal teaching efficacy need to be thoroughly understood in order to maximise the effectiveness of such teacher training. Finally, this study concludes that the three teacher traits studied

here do interact with guided practices and, indeed, do lead to changes in personal teaching efficacy via two mechanisms--reflective teaching and mastery experiences. It is recommended that further studies address how the development of other teacher traits and mechanisms may contribute to teacher growth via computer-based training.

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ADDED MATERIAL

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Figure 1: Flow chart of the instructional design in the CS-TGCTS simulation

Figure 2: Screen exemplifying a classroom teaching session