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The roles of teacher efficacy in instructional innovation: its predictive relations to constructivist and didactic instruction

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Abstract Constructivist instruction has been implemented in the current instructional innovation in Singapore. Large scale survey study was conducted to examine the roles of teacher efficacy in implementing the innovative constructivist instruction. The results showed that the positive correlation between teacher efficacy and constructivist instruction was stronger than the correlation between teacher efficacy and didactic instruction. The study suggests that policy makers and school leaders should try to improve teacher's efficacy beliefs so that innovative instruction could be effectively implemented by school teachers.

Keywords Teacher efficacy · Constructivist instruction · Didactic instruction · Instructional innovation

1 Introduction

In this era where global knowledge base is growing exponentially, Singapore's competitive edge lies in equipping its people with the skills and competencies of the twenty-first century. Since 1997, Thinking School, Learning Nation (TSLN) has prepared our learners for a more competitive and innovation-driven future. Under this ability-driven approach to education, student-centered constructivist instruction (Chua 2009; Ministry of Education, Singapore 2009; Tan 2006) that develops students' skills and abilities to manage complex situations and learn independently and continuously is encouraged. School curriculum has been

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redesigned to allow students to think, explore, innovate, and reflect so as to develop new mindsets and skills to cope with complexity and ambiguity.

It is increasingly recognized that the prevalent teacher-centered didactic approaches to instruction may not harness and maximize students' potential to be active, creative, and reflective self-directed learners in an innovation-driven and rapidly changing world. Alternatively, the student-centered constructivist approaches to instruction have been suggested in educational innovations worldwide (e.g., Guthrie et al. 2000; Hacker and Tenent 2002; Newmann et al. 1996b; Partnership for 21 Century Skills 2009). This recommendation is supported by a number of empirical studies which showed the strengths of using constructivist instruction in improving students' strategy use, motivation, as well as achievement (e.g., Guthrie et al. 2000; Newmann et al. 1996b; Nie and Lau 2010).

In practice, however, compared to didactic instruction, constructivist instruction, as innovation in instruction, has not been used frequently by teachers (Luke et al. 2005). This is not surprising because instructional innovation can be treated as a challenge to teachers who are used to teach in the traditional didactic ways. Self-efficacy theory (Bandura 1997) explained the role of self-efficacy in influencing the behavior when facing challenges. Therefore, the aim of the current study is to use Bandura (1997) theory to explain the role of teacher efficacy in influencing the implementation of constructivist instruction in instructional innovation.[1] This study will provide useful evidence-based information on how to enhance constructivist instruction in practice.

1.1 Implementing constructivist instruction: the challenge for teachers in instructional innovation

Psychological theories of learning have long influenced instructional practices. In the last few decades, constructivism, as a dominant theory of learning, has received a great deal of attention in instructional reforms all over the world. Using constructivist notions of knowing and learning, many educators suggest that instruction should engage students in knowledge construction in real-world situations, carrying out socially negotiated tasks. These notions encourage instructional innovations to move away from the didactic, teacher-centered, and knowledge transmission approach toward the student-centered, knowledge construction approaches. To date, a variety of instructional reform programs reflecting constructivism have been proposed, for example, authentic instruction (Newmann et al. 1996a), reciprocal teaching (Brown and Palincsar 1989; Hacker and Tenent 2002; Palincsar and Brown 1984), and concept-oriented reading instruction (CORI) (Guthrie et al. 1998, 1996, 2000, 2004). Although these instructional models differ from each other in actual practices, a common underlying theme is that students are treated as active learners, social learners, and creative learners (Perkins 1999). Some overlapping features of instructional practices across various constructivist-oriented programs that we have reviewed included (1) emphasis on deep understanding of knowledge, (2) substantive and elaborated communication, and (3) making connections with real-world situations (Brown and Palincsar 1989; Hacker and Tenent 2002; Newmann et al. 1996a; Palincsar and Brown 1984; Guthrie et al. 1998, 1996, 2000, 2004).

However, it is a challenge for teachers to adopt a more constructivist instruction if they have been utilizing more traditional didactic approaches. Teachers tend to view themselves as authoritative figures who design academic tasks that typically involve memorization, drill,

[1] The current instructional innovations are mostly guided by constructivism; therefore, constructivist instruction is considered as innovative instruction in educational practices and the two terms have been used interchangeably in the current study.

and practice (Hickey et al. 2001; Shuell 1996; Smerdon et al. 1999; Smith et al. 2001). Based on a classroom observation study in Singapore, there is a suggestion that didactic instruction is still being widely practiced in classrooms despite reform efforts (Luke et al. 2005). Clearly, it is a challenge for teachers to implement innovative instructional practices in classrooms as they experience a shift in their role in these learning environments.

1.2 Teacher efficacy and implementing instructional innovation

Bandura's (1997) self-efficacy theory explains the role of self-efficacy in managing challenging tasks. Because implementation of instructional innovation is considered as a challenging task for teacher, the current research adopts Bandura's (1997) theory to explain the role of teacher efficacy in implementing instructional innovation.

Self-efficacy is defined as people's beliefs about their capabilities to produce a designated level of performance (Bandura 1994). Self-efficacy theory posits that a critical factor that contributes to individuals' commitment to a task is their perception that they have the capability to successfully achieve it because self-efficacy beliefs determine how people feel, think, motivate, and behave. Bandura (1994) also states that self-efficacy plays a major role in determining how challenges are approached. People with high self-efficacy view challenging tasks to be mastered rather than to be avoided. They set challenging goals and maintain strong commitment to them. They sustain their efforts in the face of failure and attribute failure to insufficient effort or deficient knowledge and skills which are acquirable.

Consistent with the general formulation of self-efficacy, teacher efficacy is defined as a judgment of the teacher's capabilities to bring about desired outcomes of student engagement and learning (Tschannen-Moran and Woolfolk Hoy 2001). Based on Bandura (1997) self-efficacy theory, teacher efficacy affects a teacher's motivation to organize and execute courses of action required to successfully accomplish a specific teaching task in a particular context; hence, teachers' efficacy partly determines how teaching and learning activities are structured in their classrooms (Bandura 1997). Most importantly, similar to the roles of self-efficacy in facilitating instructional innovation, teacher efficacy may also play a major role when teachers face challenges in classroom teaching. Teachers with high efficacy may view challenging tasks in teaching (e.g., instructional innovation) to be mastered rather than to be avoided. They maintain strong commitment to challenging tasks. One of the challenging tasks that teachers face is instructional innovation which requires them to adopt newer evidence-based instruction to replace more traditional beliefs and ways of teaching that may not be supported by research.

Research has provided consistent support for Bandura's teacher-efficacy theory, and has indicated that teacher efficacy is strongly related to teacher behaviors and student outcomes (Allinder 1994; Friedman and Kass 2002; Saklofske et al. 1988; Woolfork and Hoy 1990). In particular, a number of studies have found relations between teacher efficacy and attitude toward instructional innovations. For example, Guskey (1988) found that teacher efficacy was related to their attitude toward implementing the new instructional practices. Furthermore, Ghaith and Yaghi (1997) reported that personal teaching efficacy was positively correlated with teachers' attitude toward implementing cooperative learning as a new instructional practice. However, these studies provided limited information in that they only linked teacher efficacy beliefs with attitudes rather than behaviors. Through interviews, Cantrell and Callaway (2008) found that high implementers of literacy instruction exhibited a higher level of efficacy for literacy teaching, whereas low implementers exhibited a lower level of efficacy for literacy teaching. Hence, one purpose of this study was to confirm the link between self-efficacy and innovating teaching behaviors via the use of a large-scale quantitative survey approach.

1.3 Research objectives and hypotheses

The first objective of this study was to replicate Luke et al. (2005) classroom observation findings that school teachers in Singapore used more didactic instruction rather than constructivist instruction. We hypothesized that primary school teachers in Singapore are more likely to adopt didactic rather than constructivist approaches in their teaching (Luke et al. 2005).

The second objective was to examine whether teachers with high levels of efficacy might respond more effectively to challenges in instructional innovations, thus utilizing constructivist instruction more frequently compared with didactic instruction. We hypothesized that the relationship between teacher efficacy and the use of constructivist instruction would be stronger compared with the relationship between teacher efficacy and the use of didactic instruction. Investigating the relations between teacher efficacy and different instructional practices can help in providing data for evidence-based instructional innovations.

1.4 Significance of the current study

The present investigation would contribute to our understanding of teacher efficacy and instructional innovation in a number of ways. First, the study would enrich our understanding on the relations between teacher efficacy and different instructional practices, and thus provide evidence-based information for facilitating instructional innovations. Second, the current study focuses on the use of innovative instruction rather than attitudes toward implementation of innovative instruction. Third, while previous studies have focused on mastery learning and cooperative learning, the present study will examine constructivist instruction which underpins most current educational innovations. Fourth, the large-scale survey study would increase the generalizability of the findings, thus complementing previous studies that were based on interviews.

2 Method

2.1 Participants and procedures

The sample consisted of teachers from 40 primary schools in Singapore. The schools were drawn by stratified random sampling. The population of 172 primary schools in Singapore were first divided into three strata, based on their aggregate prior achievement; top third (i.e., the top 57 achieving schools), middle third (58 schools), and bottom third (57 schools). Fourteen schools were then randomly selected from each of the strata. One school from the top stratum and one from the middle stratum dropped out of the study, leaving a total of 40 schools in the final sample. All full-time teachers from each participating school were invited to participate in the survey. An online invitation with the URL link of the survey was sent to each teacher of the participating schools. For teachers who did not participate with the first invite, reminders were sent to seek their help and cooperation. The total number of teachers responding to the questionnaire was 2139, giving an overall response rate 85%. The sample consisted of 81.7% females. The age of the teachers ranged from 21 to 68 with a median age of 33. The median number of years in the teaching profession was 6 with a maximum of 46 years and a minimum of half a year. 43.1% held a bachelor degree, whereas 1.4% possessed a master degree. English is the medium of instruction in Singapore.

2.2 Measures

Teacher efficacy scale was adapted from the Ohio State Teacher Efficacy Beliefs Scale (OSTES) developed by Tschannen-Moran and Woolfolk Hoy (2001). It comprised 11 items on teacher efficacy for classroom management, instructional strategies, and student engagement.

Constructivist instruction scale was adapted from the work of Hamilton et al. (2003), Mullis (2000), Newmann et al. (1996a), Nie and Lau (2010), and Smerdon et al. (1999). The 11-item scale measured teachers' use of standards, such as higher order thinking, in-depth exploration of knowledge, substantive conversations, connectedness to the real world, elaborated communication, and knowledge integration and creation.

Didactic instruction on 5-item scale was adapted from Nie and Lau (2010), and it comprised a list of teaching approaches including asking students to remember information, drill, and practices, and locating information from textbooks, etc.

Thorough instrumentation work was done before adapting existing scales from the literature to the research context of the present study. These include one interview with school teachers to review each item in the questionnaire and two pilot surveys to test the factorial validity and reliability of each scale. Three key factors were taken into consideration during the revision of the items in the survey. These were, namely, the relevance of the items to teachers' experiences in Singapore context; and the clarity of the items through simplification in the wording used and the standards of psychometric quality for the scales of the selected items.

Cronbach's alphas of the self-report scales used in the present study were .92 for self-efficacy scale, .90 for constructivist instruction, and .77 for didactic instruction. The scales showed good factorial validity. Three-factor confirmatory factor analysis was conducted, and showed good model-data fit: $\chi^2(61, N = 2139) = 1763.36$, TLI = .949, CFI = .954, RMSEA = .046. The items and their factor loadings are listed in Table 1. All the items on the survey were rated on 5-point Likert-type scales (1 = strongly disagree to 5 = strongly agree or 1 = never to 5 = always).

3 Analysis and results

3.1 Preliminary analysis

The means and standard deviations for teacher efficacy, constructivist instruction, and didactic instruction are presented in Table 2. The mean for didactic instruction was substantially higher than that for constructivist instruction. A paired t-test was carried out to test the mean differences and $t = 39.54(df = 2138, p < 0.01)$, which showed that didactic instruction was more frequently used compared with constructivist instruction.

3.2 Structural equation modeling

As the constructs in the current study were all latent constructs, structural equation modeling was conducted to analyze the predictive relations between self-efficacy and two types of instructional practices. The model to be tested and the results are presented in Fig. 1. For the sake of clarity, measurement models were omitted from the figure. They were, however, included in all the analyses. The results showed that teacher efficacy was a significant

Table 1 Factor loadings for items of teacher efficacy, constructivist instruction and didactic instruction

Scales and items	Factor loading
Factor 1: teacher efficacy	
Sub-factor 1: efficacy for instruction	.89
How well can you use analogies to illustrate difficult ideas?	.71
How well can you explain difficult concepts so that your students can understand?	.83
How well can you use the best teaching strategies to suit the learning needs of your students?	.83
How well can you construct questions that stimulate critical thinking?	.77
Sub-factor 2: efficacy for classroom management	.72
How well can you manage misbehaving students?	.85
How well can you establish effective classroom management procedures?	.95
How well can you establish class rules in order to create a conducive learning environment?	.93
Sub-factor 3: efficacy for motivation	.88
How well can you make your students value learning?	.76
How well can you motivate the students who have no interest in their studies?	.83
How well can you rebuild the confidence of failing students in their ability to learn?	.81
How well can you make your students understand the importance of education for their future?	.75
Factor 2: constructivist instruction	
How often do you ask your students to evaluate information (make judgments based on criteria and standards)?	.61
How often do you ask your students to explore an idea in depth?	.68
How often do you ask your students to discuss ideas with their classmates?	.62
How often do you ask your students to apply ideas in your subject to everyday life?	.66
How often do you ask your students to elaborate on answers?	.61
How often do you ask your students to work on long-term projects?	.67
How often do you encourage your students to challenge or question existing ideas?	.76
How often do you ask your students to perform tasks that require organizing and integrating knowledge?	.78
How often do you encourage answers that are original?	.65
How often do you ask your students to create new knowledge (put elements together to form a coherent whole; re-organize elements into a new pattern)?	.80
How often do you focus your lesson on what is personally meaningful to your students, rather than what is in the syllabus?	.52
Factor 3: didactic instruction	
How often do you ask your students to remember information (retrieve relevant knowledge from memory)?	.41
How often do you ask your students to do worksheets or workbooks?	.35
How often do you ask your students to drill and practise on basic facts or procedures?	.46
How often do you ask students to read or underline textbooks?	.85
How often do you ask students to locate information from textbooks?	.88

Table 2 Means and standard deviations

	Variable	Mean	Standard deviation
1	Teacher efficacy	3.59	0.57
2	Constructivist instruction	3.40	0.59
3	Didactic instruction	3.97	0.56

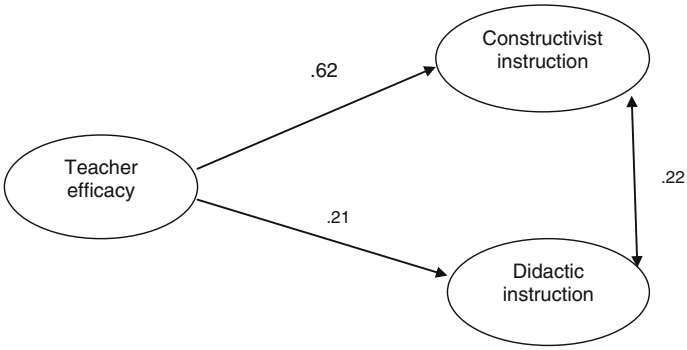

Fig. 1 Teacher efficacy predicted constructivist and didactic instruction

predictor of constructivist instruction ($\beta = 0.62$, $p < .01$), and it explained 39.0% variance of constructivist instruction. Self-efficacy was also a significant predictor of didactic instruction ($\beta = 0.21$, $p < .01$), but it only explained 4.6% of the variance of didactic instruction. Although self-efficacy significantly predicted both constructivist instruction and didactic instruction,[2] the strength of the prediction is different in terms of the effect size measures (variance explained). Teacher efficacy had a large effect size in the prediction of constructivist instruction, whereas, it only has a small effect size in the prediction of didactic instruction.[3]

To further examine whether teacher efficacy was a stronger predictor to constructivist instruction than to didactic instruction, equality of two regression coefficients was tested, and two models were compared. In model 1, the two regression coefficients (a and b) were freely estimated. In model 2, the two regression coefficients were set equal to each other (a = b). The model-data fit for model 1: $\chi^2(61, N = 2139) = 1763.36$, TLI = .949, CFI = .954, RMSEA = .046. The model-data fit for model 2: $\chi^2(60, N = 2139) = 1904.47$, TLI = .944, CFI = .949, RMSEA = .048. Comparison between Model 1 and Model 2 showed that $\Delta\chi^2(1, N = 2139) = 141.11$, $p < .001$. Thus, it rejected that the two regression coefficients (a and b) were equal and it further supported our hypotheses that the relations between teacher efficacy and constructivist instruction was stronger than that between teacher efficacy and didactic instruction.

[2] The significance test is sensitive to sample size.

[3] 2% variance reduction is regarded as a small effect size, 13% as a medium effect size, and 26% as a large effect size (Cohen 1988).

4 Discussion

4.1 The use of constructivist and didactic instruction

Our findings showed that teachers used didactic instruction more frequently than constructivist instruction. The finding of this large scale survey study is consistent with the findings that were reported through classroom observation in limited classrooms (Luke et al. 2005). The different methods showed convergent findings and thus supported the validity of the results. It is challenging for teachers to adopt constructivist instruction over didactic instruction as it requires teachers to change their teaching approaches and mindset. Moreover, if teachers work within an education system that places a great deal of emphasis on examinations, the instruction comfortably adopted by most teachers might be the didactic approach whereby students are tasked to memorize a vast amount of information to prepare for examinations.

4.2 Teacher efficacy and instructional innovation

Teachers' tendency to hold on to didactic instruction represents a challenge in educational innovation that often seeks to increase the implementation of constructivist instruction. The results of the present study highlight an important factor that may facilitate this transformation. Consistent with Bandura's self-efficacy theory (1994, 1997), the results showed that the relation between teacher efficacy and constructivist instruction was stronger than the relation between teacher efficacy and didactic instruction. These findings are consistent with Ghaith and Yaghi (1997) study on teacher efficacy and teachers' attitude to instructional change. They found that teacher efficacy was a strong determinant of teachers' willingness to adopt new practices. Our findings also concurred with Fullan (2001) conceptualization of the process for curricular change implementation, where he designated teacher efficacy as a key success factor.

Thus, this research supports the claim that teacher efficacy does influence the implementation of innovative instruction. Teachers with a higher sense of efficacy would tend to adopt constructivist instruction more frequently. Based on the empirical results, therefore, the increase use of constructivist instruction could be encouraged through ways that elevate or enhance teacher efficacy.

4.3 Implications for policy and teacher training

With the shift in education emphasis (Sharpe and Gopinathan 2002), it no longer suffices for teachers to maintain their traditional practices and beliefs because if they do so, they would not be fulfilling the mission of preparing children for the future. Although many programs and activities have been initiated to facilitate the use of constructivist instruction, there are still many obstacles in implementing new instructional approaches. The current research strengthened our understanding of the conditions and antecedents of the choice and use of instructional practices. Specifically, the results show that teacher efficacy is related to instruction adoption of teachers. It revealed that teachers with higher teacher efficacy would be more likely to adopt a constructivist rather than didactic instruction. Hence, in order to promote learning that is beyond rote memorization of facts toward a system that facilitates students' thinking, understanding, and communication, which are advocated in constructivist instruction, schools should look into ways to enhance teacher efficacy. The findings would

have implications for structuring professional development activities to have a dual-focus on facilitating instructional skills as well as fostering teacher efficacy.

Bandura (1997) proposed that self-efficacy could be enhanced through mastery experience, vicarious experience, and social persuasion which happened mostly in the interactive activities within school organization. School leaders could set up proper structures and processes and provide necessary resources to promote professional development and professional excellence of teachers. The establishment of Professional Learning Communities (PLCs), development of mentoring framework and the use of strong inquiry-based collaborative tool, like Lesson Study, will enhance teachers' expertise and morale and impact on their efficacy. However, more empirical studies are needed to explore the effective approaches to promote teacher efficacy.

4.4 Limitations

Several limitations of this study are important to note. First, the correlational nature of the study does not allow us to infer causal relations. The replication of this research with experimental studies would help us clarify the causal nature of the relations. Second, the cross-sectional design would only capture the relations of complex processes at a particular point of time. Future research can employ a longitudinal design to track teachers' beliefs and behaviors overtime which would help us shed light on the processes involved. Third, the study relied on self-reported measures as a primary source of data. The uses of multiple methods would serve to strengthen our interpretations of these results. Fourth, the current study only examined one important predictor of constructivist instruction and didactic instruction. Future research can employ other theories and explore more predictive variables related to the implementation of instructional innovation.

5 Conclusions

This study demonstrated the strong positive relations between teacher efficacy and constructivist instruction, i.e., higher teacher efficacy more frequent use of constructivist instruction. Therefore, to promote the use of constructivist instruction, policy makers and school leaders should try to improve teacher's efficacy beliefs so that innovative instruction could be effectively implemented by school teachers. The constructivist correlation and didactic instruction are not exclusive but related, and the balanced use of different instructional approaches may be important in practice.

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References

Allinder, R. M. (1994). The relationship between efficacy and the instructional practices of special education teachers and consultants. *Teacher Education and Special Education, 17*, 86–95.

Bandura, A. (1994). Self-efficacy. In V. S. Ramachaudran (Ed.), *Encyclopedia of human behavior* (Vol. 4, pp. 71–81). New York: Academic Press.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.

Brown, A. L., & Palincsar, A. S. (1989). Guided cooperative learning and individual knowledge acquisition. In L. B. Resnick, (Ed.), *Cognition and instruction: Issues and agendas* (pp. 393–451). Hillsdale, NJ: Erlbaum.

Cantrell, S. C., & Callaway, P. (2008). High and low implementers of content literacy instruction: Portraits of teacher efficacy. *Teaching and Teacher Education, 24*, 1739–1750.

Chua, S. K. C. (2009). Futuristic schools: "Little Red Dot" strategies in a globalised economy. *International Journal of Learning, 16*, 393–404.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.

Friedman, I. A., & Kass, E. (2002). Teacher self-efficacy: A classroom-organisation conceptualisation. *Teaching and Teacher Education, 18*, 675–686.

Fullan, M. (2001). *The new meaning of educational change* (3rd ed.). New York: Teachers College Press.

Ghaith, G., & Yaghi, H. (1997). Relationship among experience, teacher efficacy, and attitudes towards the implementation of instructional innovation. *Teaching and Teacher Education, 13*, 451–458.

Guskey, T. R. (1988). Teacher efficacy, self-concept, and attitudes toward the the implementation of instructional innovation. *Teaching and Teacher Education, 4*, 63–69.

Guthrie, J. T., Van Meter, P., Hancock, G. R., Alao, S., Anderson, E., & McCann, A. (1998). Does concept-oriented reading instruction increase strategy use and conceptual learning from text? *Journal of Educational Psychology, 90*, 261–278.

Guthrie, J. T., Van Meter, P., McCann, A. D., Wigfield, A., Bennett, L., Poundstone, C. C., Rice, M. E., Faibisch, F. M., Hunt, B., & Mitchell, A. M. (1996). Growth of literacy engagement: Changes in motivations and strategies during concept-oriented reading instruction. *Reading Research Quarterly, 31*, 306–332.

Guthrie, J. T., Wigfield, A., Barbosa, P., Perencevich, K. C., Taboada, A., Davis, M. H., Scafiddi, N. T., & Tonks, S. (2004). Increasing reading comprehension and engagement through concept-oriented reading instruction. *Journal of Educational Psychology, 96*, 403–423.

Guthrie, J. T., Wigfield, A., & VonSecker, C. (2000). Effects of integrated instruction on motivation and strategy use in reading. *Journal of Educational Psychology, 92*, 331–341.

Hacker, D. J., & Tenent, A. (2002). Implementing reciprocal teaching in the classroom: Overcoming obstacles and making modifications. *Journal of Educational Psychology, 94*, 699–718.

Hamilton, D. T., Moore, A. L., & Pellegrino, J. W. (2001). The motivational and academic consequences of elementary mathematics environments: Do constructivist innovations and reforms make a difference? *American Educational Research Journal, 38*, 611–652.

Hickey, L. S., McCaffrey, D. F., Stecher, B. M., Klein, S. P., Robyn, A., & Bugliari, D. (2003). Studying large-scale reforms of instructional practices: An example from mathematics and science. *Educational Evaluation and Policy Analysis, 25*, 1–29.

Luke, A., Rahim, R. A., Koh, K. H., Lau, S., Ismail, M., & Hogan, D. (2005). *Innovation and enterprise in classroom practice: A discussion of enabling and disenabling pedagogical factors in P5 and S3 classrooms*. Singapore: Centre for Research in Instruction and Practice.

Ministry of Education, Singapore. (2009). *Report of the Primary Education Review and implementation committee*. Retrieved from http://planipolis.iiep.unesco.org/upload/Singapore/Singapore_SERI_2010.pdf.

Mullis, I. V. S. (2000). *TIMSS 1999 Mathematics items: Released set for eighth grade*. Boston: International Study Centre.

Newmann, F. M., et al. (1996a). *Authentic achievement—restructuring schools for intellectual quality*. San Francisco: Jossey-Bass Publishers.

Newmann, F. M., Marks, H. M., & Gamoran, A. (1996b). Authentic instruction and student performance. *American Journal of Education, 104*, 280–312.

Nie, Y., & Lau, S. (2010). Differential relations of traditional and constructivist instruction to students' cognition, motivation, and achievement. *Learning and Instruction, 20*, 411–423.

Palincsar, A. S., & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction, 2*, 117–175.

Partnership for 21st Century Skills. (2009). Curriculum and instruction: A 21st century skills implementation guide. http://p21.org/documents/p21-stateimp_curriculuminstruction.pdf.

Perkins, D. (1999). The many faces of constructivism. *Educational Leadership, 57*(3), 6–11.

Saklofske, D. H., Michayluk, J. O., & Randhawa, B. S. (1988). Teachers' efficacy and teaching behaviors. *Psychological Reports, 63*, 407–414.

Sharpe, L., & Gopinathan, S. (2002). After effectiveness: New directions in the Singapore school system? *Journal Educational Policy, 17*, 151–166.

Shuell, T. J. (1996). Teaching and learning in a classroom context. In D. C. Berliner & R. C. Calfree, (Eds.), *Handbook of educational psychology* (pp. 726–764). New York: Simon & Schuster Macmillan.
Smerdon, B. A., Burkam, D. T., & Lee, V. E. (1999). Access to constructivist and didactic teaching: Who gets it? Where is it practiced? *Teacher College Record, 101*, 5–34.
Smith, J. B., Lee, V. E., & Newmann, F. M. (2001). *Instruction and achievement in Chicago elementary schools*. Chicago, IL: Consortium on Chicago School Research.
Tan, C. (2006). Creating thinking schools through 'Knowledge and Inquiry': The curriculum challenges for Singapore. *Curriculum Journal, 17*, 89–105.
Tschannen-Moran, M., & Woolfolk Hoy, A. (2001). Teacher efficacy: Capturing an elusive construct. *Teaching and Teacher Education, 17*, 783–805.
Woolfork, A. E., & Hoy, W. K. (1990). Perspective teachers' sense of efficacy and believe about control. *Journal of Educational Psychology, 82*, 81–91.