Effect of Structure Strategy Instruction on Academic Self-efficacy

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Abstract

Consistent evidence has been shown that learners, across age and language background, could benefit from structure strategy instructions on researcher-designed and standardized reading outcomes (Hebert, Bohaty, Nelson, & Brown, 2016; Meyer & Ray, 2011); however, few studies assessed the instructional impacts on motivational outcomes such as self-efficacy, and the few that included self-efficacy outcomes did not explore how or for whom structure strategy instruction was effective (e.g., Meyer et al., 2002; Wijekumar et al., 2014). This study examined the effects of a web-based Intelligent Tutoring program for the Structure Strategy (ITSS) on fourth- and fifth-grade students' academic self-efficacy as well as whether and to what extent this effect was mediated or moderated by their reading performance. By analyzing secondary data from a large-scale cluster randomized control trial (RCT) of the ITSS, results indicate the instruction improved fifth graders' academic self-efficacy indirectly through its impact on reading performance and below-average readers gained more from the instruction.

Introduction

Text structure refers to how the idea units within a text are connected and integrated to convey meanings to readers (Meyer & Rice, 1984). Meyer (1975) identified five top-level structures of expository text: comparison, problem and solution, cause and effect, sequence and description. Using the structure strategy can help learners taxonomize expository texts, identify main ideas, construct elaborated mental representation and boost reading comprehension (Meyer & Ray, 2011). Previous studies have shown the delivery of structure strategy exerted positive impacts on reading performance as well as academic self-efficacy, but few of them addressed the how (mediation) and for whom (moderation) questions. This study intends to provide more nuanced understandings of the effects of structure strategy instruction delivered through a web-based Intelligent Tutoring program (ITSS) on academic self-efficacy with a focus on whether and to what extent this effect is mediated or moderated by reading performance.

Methods

The analysis sample for this study consisted of 131 fourth-grade and 128 fifth-grade classrooms in the Northeastern U.S. In the original RCT with pretest and posttest design, classrooms were randomly assigned to ITSS intervention or business-as-usual groups within schools by grade level. The structure strategy instruction was delivered via a web-based intelligent tutoring system (ITSS) where modeling, practice and immediate feedbacks were provided (Wijekumar et al., 2012; 2014). ITSS classrooms received the intervention for 30 to 45 minutes per week over 6 to 7 months, whereas control classrooms maintained their language art curriculum for the same instructional time. Students completed standardized reading tests and survey questions about structure strategy self-efficacy, reading self-efficacy, and learning self-efficacy before and after the intervention. The Gray Silent Reading Test (GSRT; Wiederholt & Blalock, 2000) was used to assess reading performance. The academic self-efficacy questionnaire was adapted from previous studies (Gambrell, Palmer, Codling, & Mazzoni, 1996; Sherer & Maddux, 1982) as well as created by the research group. We applied structural equation modeling to examine the mediating and moderating effects of reading performance in the relations of ITSS intervention and academic self-efficacy.

Results

Results of the mediation analysis, shown in Table 1 and Figure 1, indicated no significant direct effect of ITSS on academic self-efficacy at posttest regardless of grade. However, ITSS instruction improved fifth grader' structure strategy self-efficacy at posttest (adjusted difference = .013, $p < .05$, *ES* = .019) and reading self-efficacy at posttest (adjusted difference = .011, $p < .05$, *ES* = .021) indirectly via its effect on reading performance, controlling for gender, prior reading performance and prior self-efficacy level.

Results of the moderation analysis, shown in Table 2, indicated there was a significant interaction between ITSS intervention and prior reading performance on fifth-grade students' reading self-efficacy at posttest (*B* = -.012, *SE* = .006, $p < .05$), controlling for gender, prior reading performance and prior self-efficacy level. Specifically, students with lower prior reading skills gained more on reading self-efficacy from the instruction.

Table 1. Parameter Estimates of the Half-longitudinal Mediation Model (Grade 5)

Path	Unstandardized Estimate	Standardized Estimate	Standard Error	95% CI for Unstandardized Estimate
Direct Effect				
ITSS → GSRTPO	.398*	.120*	.154	[.096, .701]
ITSS → SSEFPO	.019	.028	.033	[-.044, .083]
ITSS → RDEFPO	.030	.058	.021	[-.010, .071]
ITSS → LNEFPO	-.001	.002	.021	[-.042, .040]
GSRTPR → SSEFPO	.033***	.148***	.005	[.024, .042]
GSRTPR → RDEFPO	.029***	.166***	.003	[.023, .034]
GSRTPR → LNEFPO	.013**	.078**	.004	[.005, .021]
Indirect Effect				
ITSS → GSRT → SSEFPO	.013*	.019*	.005	[.003, .024]
ITSS → GSRT →RDEFPO	.011*	.021*	.005	[.002, .021]
ITSS → GSRT →LNEFPO	.005+	.001+	.003	[.001, .012]

Fig 1. The Half-longitudinal Mediation Model with Unstandardized Estimates (Grade 5)

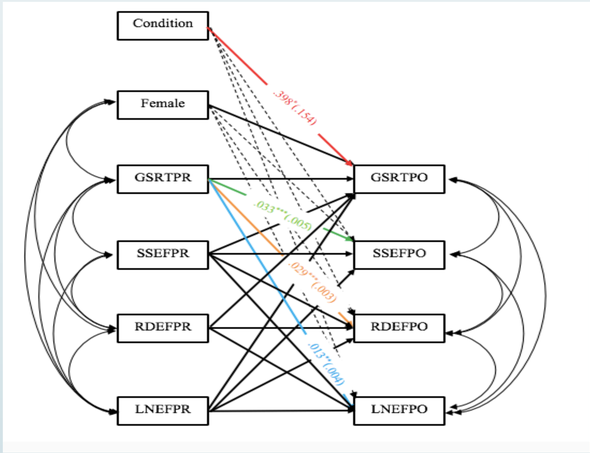

Table 2. Parameter Estimates of the Moderation Model (Grade 5)

Predictors	SSEFPO			
	B (SE)	B 95% CI	b (SE)	b 95% CI
Gender	.073** (.025)	[.024, .122]	.054** (.018)	[.018, .090]
SSEFPR	.316*** (.026)	[.266, .367]	.313*** (.025)	[.264, .362]
RDEFPR	.254*** (.042)	[.172, .336]	.192*** (.030)	[.132, .251]
LNEFPR	.090** (.030)	[.030, .149]	.068** (.029)	[.023, .113]
ITSS	.018 (.033)	[-.046, .082]	.013 (.024)	[-.034, .060]
GSRTPR	.038*** (.007)	[.025, .051]	.168*** (.029)	[.111, .225]
ITSS * GSRTPR	-.009 (.008)	[-.024, .007]	-.027 (.025)	[-.079, .024]
	RDEFPO			
	B (SE)	B 95% CI	b (SE)	b 95% CI
Gender	0.013 (.016)	[-.019, .045]	.012 (.016)	[-.019, .043]
SSEFPR	.061*** (.014)	[.033, .088]	.078*** (.018)	[.042, .114]
RDEFPR	.525*** (.028)	[.471, .579]	.515*** (.022)	[.471, .559]
LNEFPR	.071** (.022)	[.028, .113]	.070** (.022)	[.027, .113]
ITSS	.029 (.020)	[-.007, .074]	.028 (.019)	[-.010, .067]
GSRTPR	.035*** (.005)	[.026, .044]	.202*** (.029)	[.148, .257]
ITSS * GSRTPR	-.012* (.006)	[-.022, -.001]	-.048* (.024)	[-.095, -.002]
	LNEFPO			
	B (SE)	B 95% CI	b (SE)	b 95% CI
Gender	.017 (.018)	[-.018, .052]	.016 (.017)	[-.018, .051]
RDEFPR	.130*** (.032)	[.067, .193]	.131*** (.032)	[-.042, .039]
LNEFPR	.364*** (.032)	[.301, .427]	.368*** (.031)	[.067, .194]
ITSS	-.001 (.020)	[-.043, .040]	-.001 (.020)	[-.042, .039]
GSRTPR	.015** (.006)	[.004, .027]	.090*** (.034)	[.023, .158]
ITSS * GSRTPR	-.005 (.007)	[-.019, .010]	-.019 (.032)	[-.083, .044]

Note. ITSS = Intelligent Tutoring of Structure Strategy; GSRTPR = The Gray Silent Reading Test pretest; GSRTPO = The Gray Silent Reading Test posttest; SSEFPR = structure strategy self-efficacy pretest; SSEFPO = structure strategy self-efficacy posttest; RDEFPR = reading self-efficacy pretest; RDEFPO = reading self-efficacy posttest; LNEFPR = learning self-efficacy pretest; LNEFPO = learning self-efficacy posttest. $^{+}p < .1$, $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Conclusion

First, even though ITSS instruction did not impact students' academic self-efficacy directly, it may promote their perceived confidence in structure strategy use and efficacy as readers indirectly through its effect on reading performance.

Second, ITSS instruction is likely to yield more benefits on reading self-efficacy for fifth-grade under-achievers. In other words, this intervention program appears to help below-average readers to build up their confidence in fulfilling reading-related tasks. Another plausible interpretation could be the ceiling effect; that is, students performed better on reading pretest already had a high level of reading self-efficacy, which limited the growth of reading self-efficacy at posttest.

Future research should refine the self-efficacy measures and collect longitudinal data on three or more occasions to confirm the findings.