

Pragmatic AI Makes Huge Impact on Literacy

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Outline

- The technology landscape in schools
 - The promise and pitfalls
 - Our solution
 - Impact
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Technology Landscape

- A daily barrage of grand ideas
 - No theoretical or empirical evidence for 99% of solutions
 - Gimmicks and games
 - Huge investment of time and \$\$
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- Artificial Intelligence is only as intelligent at the programmer who programmed it! – Marvin Minsky (1989)
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The Evidence

- What Works Clearinghouse

<https://ies.ed.gov/ncee/wwc/study/77453> - Meets What Works Clearinghouse Standards Without Reservations and has at least one positive and statistically significant finding.

- US News and World Report:

<https://www.usnews.com/news/education-news/articles/2017-09-25/3-lessons-learned-from-education-technology-research>

“Only one piece of software that taught reading, Intelligent Tutoring for the Structure Strategy ([ITSS](#)), showed promise, suggesting that it is possible to create good educational software outside of math, but it’s a lot harder.”

More Evidence

- US Department of Education IES call <https://ies.ed.gov/director/remarks/4-15-2019.asp>:

List of Proposed Interventions for the Systematic Replication RFA

Mark Schneider, Director of IES | April 15, 2019

IES is working on next year's RFAs, which we hope to release later this spring. As you may know, we are initiating a research competition focused on the *systematic replication of interventions that IES believes have strong evidence of impact*. The purpose and general outline of that competition can be found [here](#). I want to share with you a list of the NCER- and NCSEF-funded studies that we are interested in having systematically replicated.

[Wijekumar, K. K., Meyer, B. J., & Lei, P. \(2012\). Large-scale randomized controlled trial with 4th graders using intelligent tutoring of the structure strategy to improve nonfiction reading comprehension. *Educational Technology Research and Development*, 60\(6\), 987-1013.](#)


[WWC single study review](#)

Comprehension

Directly from researcher, Kay Wijekumar

Intelligent Tutoring
for Structure
Strategy (ITSS)

Our solution

- Intelligent Tutoring System for the Text Structure Strategy (ITSS) - English reading comprehension instruction for students in grades 4 to 16
 - Strategy instruction on the web for English learners (SWELL) – Spanish supported version of ITSS
 - We-Write persuasively – a writing instructional system for grades 3 to 6
 - Massively Open Online Virtual Learning System (MOOV) – Teacher professional development system using the intelligent tutoring platform
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Elephants

Two different kinds of elephants exist today; these two types are the African elephant and the Indian elephant. These interesting creatures differ dramatically in ears, backs, and how long they live. African elephants have very large ears. Their backs arch down in the middle. African elephants live 50 to 60 years.

Indian elephants have small ears. The backs of the Indian elephants arch up in the middle. They live 70 to 80 years.

Please click on a box below, then click on the details in the passage on the left. Do not type in the boxes below. Click the 'Clear' button to clear the selected box.

	African elephant	Indian elephant
ears	<input type="text"/>	<input type="text"/>
backs	<input type="text"/>	<input type="text"/>
lifespan	<input type="text"/>	<input type="text"/>

Clear

We-Write



nmuntz1234



Tool Box



Self Statements



ITSS



Log Off

Revising Essay

jlk;

Reason & Explanation

Topic (0 / 1)

Reason (0 / 3)

Explanation (0 / 3)

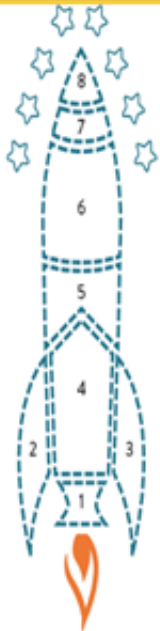
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✕ Clear All Markings

✍ Revise Essay

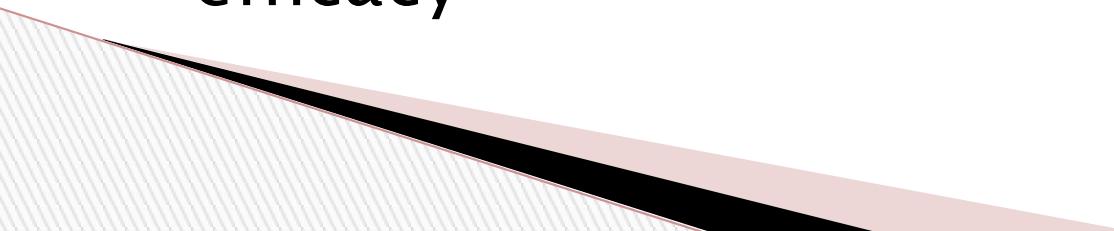
✓ Submit Essay for Review



The Design

- Cognitive models of learning process
 - Expert tutor models
 - Expert student tutees
 - Novice student tutees
 - Struggling novice tutee
 - Measures, NLP, & scoring systems
 - Student learning patterns and gaming
 - Instructional roadmap with feedback loops
 - System data mining and updating pathways
 - Documenting the learning (uptake) of profiles of learners
 - Forecasting and adapting lessons
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The Results

- 100% pass rates for grades 3, 4, and 5 struggling readers
 - 10 to 20 point improvements on State level standardized tests
 - SEED Grant – 7.5 million dollars, 3.3 million for SWELL efficacy, 3.3 million for We-Write efficacy, and 3.4 million for ITSS High poverty efficacy
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ITSS Efficacy 5th Grade Effect Sizes (Wijekumar et al., 2014)

Measures	Coefficient for ITSS (standard error) from HLM ^a	Pooled student- level standard deviation	Effect size
Gray Silent Reading Test	2.34*** (.44)	11.45	.20
Comparison text			
Signaling test	2.93*** (.39)	7.05	.42
Main idea quality	.82*** (.08)	1.54	.53
Total recall	5.57*** (1.07)	17.49	.32
Comparison competence	.64*** (.14)	2.42	.26
Problem and solution text			
Total recall	2.38*** (.64)	12.20	.20
Problem and solution competence	.37** (.12)	2.45	.15

Note. Effect size = Adjusted difference between ITSS (coded ½) and Control (coded -½) groups divided by the student-level pooled standard deviation.

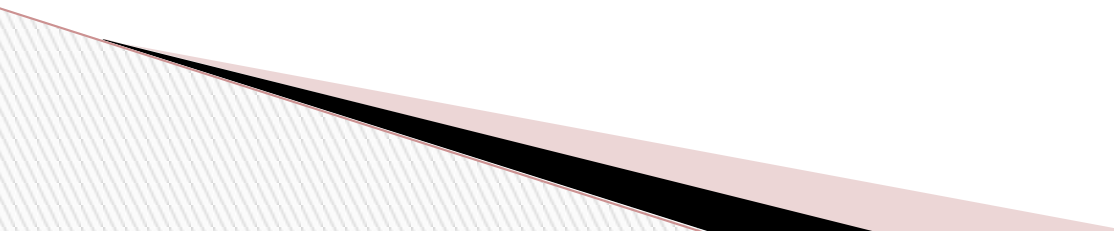
p<.01, *p<.001. Source: Wijekumar et al., 2014, p. 10.

Measures	Coefficient for ITSS (standard error) from HLM ^a	Pooled student- level pretest standard deviation	Effect size
Gray Silent Reading Test	2.12*** (0.48)	11.52	0.18
Long Comparison Text			
Top level structure	0.52*** (0.13)	1.58	0.33
# issues	0.17** (0.06)	0.54	0.31
Competence	0.31** (0.10)	1.09	0.28
Main Idea (Short text)			
Top level structure	0.72*** (0.10)	1.55	0.46
# issues	0.51*** (0.08)	0.55	0.92
Competence	0.39*** (0.06)	1.54	0.25
Problem and Solution Text			
Top level structure	0.59*** (0.15)	2.49	0.24
Competence	0.52*** (0.13)	2.05	0.25

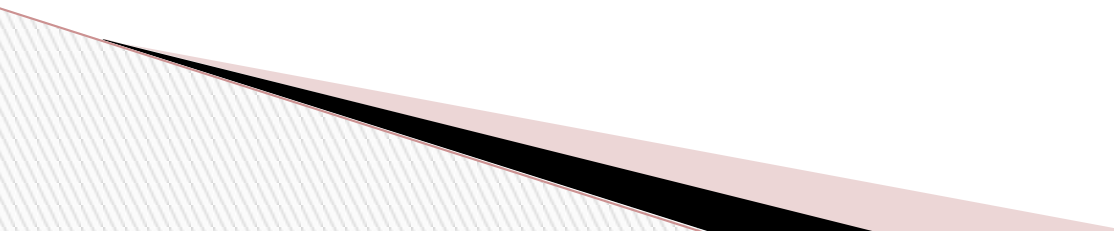
Note. Effect size = Adjusted difference between ITSS (coded ½) and Control (coded -½) groups divided by the student-level pooled standard deviation of pretest scores. ^aEstimates are extracted from model 1; df = 80.

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

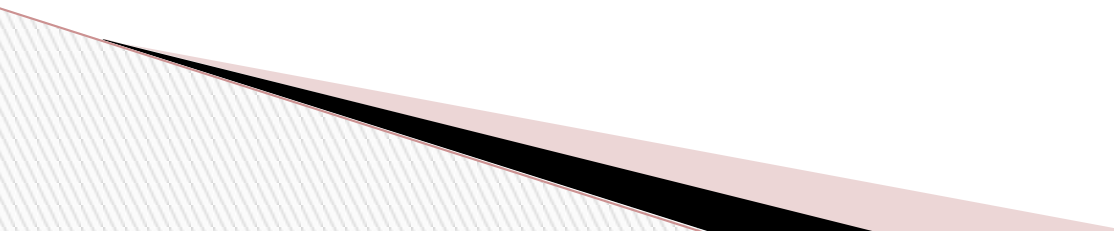
Most recent RCT

- High poverty schools
 - Spanish speaking English learners
 - 100% pass rates in special education settings
 - High success for all teachers implementing with fidelity
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Looking into the crystal ball

- Mining the interaction data
 - Refining the tools
 - Adapting to new profiles of learners
 - Teacher professional development using intelligent tutoring framework
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References

- Wijekumar, K., Meyer, B.J.F., Lei, P., Xuejun, J., Joshi, R.M. (2017, April 5). Evidence of an Intelligent Tutoring System as a Mindtool to Promote Strategic Memory of Expository Texts and Comprehension with Children in Grades 4 and 5. *Journal of Educational Computing Research*. DOI: 10.1177/0735633117696909
- Wijekumar, K., Meyer, B.J.F., Lei, P. (2012). Large-scale randomized controlled trial with 4th graders using intelligent tutoring of the structure strategy to improve nonfiction reading comprehension. *Journal of Educational Technology Research and Development*. 60, 987-1013.
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