

IMPACTS OF ONE-TO-ONE
COMPUTING IN K-12 CLASSROOMS:
A SYSTEMATIC REVIEW OF DIVERSE
EVIDENCE

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Agenda



- By way of an introduction
- About this study
- Why do this study?
- The progress to date
- Preliminary findings
- What's next?

An Introduction



- New ideas, new technologies
- Ubiquitous technology in our lives
- Ubiquitous technology in the classroom
- Where do we go from here?



1 About this study

Laptops in the classroom

1 About this study



The research question

How, to what extent, and under what circumstances does one-to-one computing in K-12 settings impact educational goals including but not limited to student achievement, student and teacher technology use, technology proficiency, and attitudes toward technology.

The research method

A systematic review of primary intervention studies and evaluation reports.

And so ...

The research question

- How it works – the theory behind the intervention.
- To what extent – the impact.
- The context – when, where, for whom does it work.



The research method

- Traditional literature review.
- Quantitative synthesis (meta-analysis).
- Qualitative synthesis (meta-synthesis, realist synthesis, etc.)

Literature Review



Synthesis of theoretical articles, opinion papers, and position papers, and other reviews* to identify main theoretical foundations for intervention (eg. Clarke 1994 – “Media will never influence learning”).

*quantitative reviews (meta-analyses) will be integrated into present meta-analysis.

Quantitative synthesis



Meta-analysis:

The synthesis of quantitative studies in order to estimate a “population effect”.

- Calculation of effect sizes.
- Aggregation of effect sizes.
- Moderator analysis.

Qualitative synthesis



Various methodologies from content analysis to meta-ethnography. Three categories:

- all studies combined to form one large data set (eg. content analysis);
- studies treated as units of analysis similar to study participants (eg. case survey or grounded theory);
- studies treated as separate data sets and themes compared across studies (eg. meta-ethnography or meta-synthesis).

Challenges



- Quantitative (loss of generalizability, data quality, inclusion criteria, sampling);
- Qualitative (methodological diversity, loss of detail, application of standards of quality);
- Practical (what methods can be used to synthesize diverse data?)

Synthesis of diverse evidence



- Quantitative – all qualitative data converted to quantitative and quantitative analysis performed;
- Qualitative – all quantitative data converted to qualitative and qualitative analysis performed;
- “Horses for courses” – research question parsed into sub-questions that are best answered by different types of data.



2 Why do this study

Evidence-based decision-making is important

Why do this study?



- The need for a reliable evidence base to inform practice.
- What's been done: Michigan Freedom to Learn - Research Summaries, Penuel (2006 and 2002), Apple Computing (2005), Andrews (2006), Maderthaner (2007), Bonifaz & Zucker (2004), and others.

Has the question been answered?



The existing reviews (and primary studies) come to the same conclusions:

- ▣ Technology works in some contexts and with some students more than others.
- ▣ One-to-one computing works best as one part of a technological integration strategy that includes specific guidelines and training in pedagogically sound uses of computers in the classroom, and a well articulated change management strategy.
- ▣ More research is needed.

Hits and Includes by Database Search

Study	Hedges' g	Standard Error (σ_g)	Variance (σ_g^2)	95 th Lower Limit	95 th Upper Limit	z value	p value	Weights (w)	Weighted g (w)(g)
121C17	0.66	0.08	0.01	0.50	0.82	8.13	0.00	153.12	100.59
17521C44	0.01	0.04	0.00	-0.07	0.09	0.20	0.84	623.28	5.10
121C64	0.21	0.13	0.02	-0.05	0.47	1.55	0.12	57.11	11.75
121C64	0.09	0.14	0.02	-0.18	0.36	0.67	0.50	53.86	4.92
15021C64	0.06	0.12	0.02	-0.18	0.30	0.49	0.62	66.63	3.97
121C77	0.06	0.05	0.00	-0.05	0.16	1.10	0.27	345.22	20.53
121C78	0.12	0.07	0.00	-0.02	0.26	1.74	0.08	196.50	24.34
12521C79	0.50	0.13	0.00	0.24	0.76	3.83	0.00	58.55	29.28
121C92	-0.26	0.08	0.00	-0.42	-0.11	-3.29	0.00	158.97	-41.47
121C147	0.93	0.19	0.00	0.55	1.31	4.83	0.00	26.97	25.11
100121C149	0.43	0.12	0.00	0.19	0.67	3.51	0.00	66.78	28.11
121C149	0.28	0.12	0.00	0.04	0.53	2.26	0.02	67.72	18.63
73121C149	0.23	0.09	0.00	0.03	0.41	2.48	0.01	115.89	26.74
121C150	0.73	0.36	0.00	0.23	1.23	2.87	0.00	15.37	11.23
121C163	-0.02	0.02	0.00	-0.06	0.02	-0.88	0.38	2142.78	-40.79
9021C167	0.35	0.01	0.00	0.32	0.38	31.02	0.00	8005.61	2775.34
121C 53	0.22	0.17	0.00	-0.10	0.5	1.3	0.18	35.55	7.96
121C 16	0.24	0.3	0.00	-0.35	0.8	0.8	0.42	10.78	2.62
25	0.2	0.0	0.0	0.23	0.2	27.2	0.00	2200	3014.52
								Q	174.63
								df	17
								p	0.00

3 Findings to date

How, to what extent, and for whom does it work?

The Study – Five big steps



- The research question
- Search and retrieval of documents
- Coding for inclusion and study features
- Data extraction
- Analysis & synthesis
 - ▣ Theoretical
 - ▣ Quantitative
 - ▣ Qualitative
 - ▣ Synthesis of syntheses

Search, selection, and retrieval



- ERIC – 4 separate searches: March 2007, January 2008, March 2008, March 2009.
- Other databases – March 2007, March 2008.
- Hand searches (internet and paper based): March 2007, March 2008, March 2009.

Search results by type of search

As of March 2009

	Hits	Includes (quant)	Includes (qual)	Hit rate (includes/hits)	%age of total hits	%age of total includes
Non-ERIC Database searches	444	18	13	7.0%	14.6%	11.0%
Eric searches	401	21	7	7.0%	13.2%	12.9%
"Hand searches"	290	124	29	52.8%	72.2%	76.1%
Totals	1135	163	49	18.7%	100.0%	100.0%

Theoretical synthesis (how it works)



- Increasing access to information;
- Providing access to a richer learning environment;
- Makes learning more situated, authentic, life-like;
- Increasing opportunities for active learning and inter-connectivity;
- Enhancing student motivation to learn;
- Increasing opportunities for feedback;
- Enhancing opportunities for collaboration.
- Catalyst for change, supporting the learning process through course design and motivation.

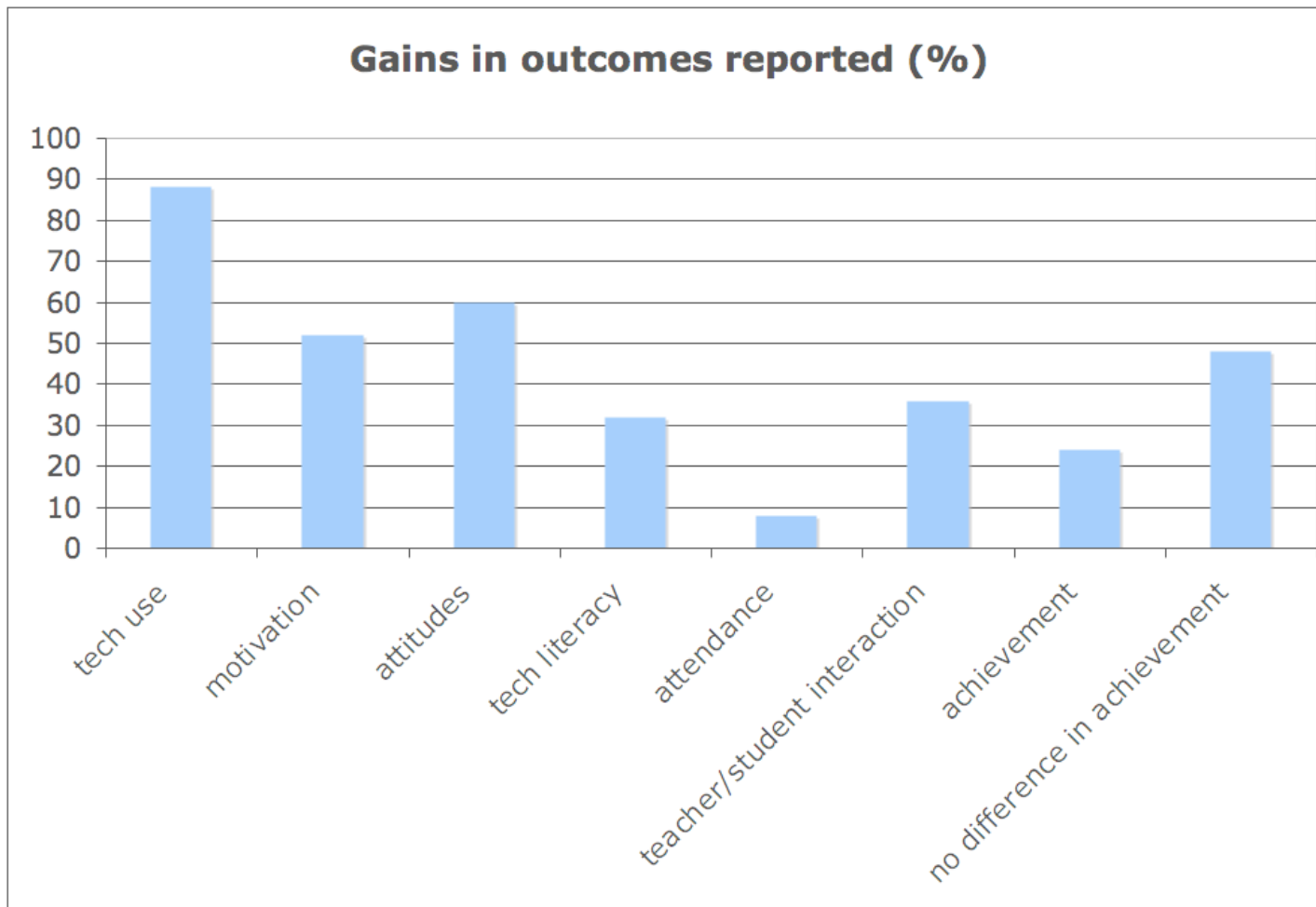
Quantitative synthesis (to what extent)



Interim analysis as of June 2008:

- 114 quantitative articles and reports of one to one evaluations
- 44 with quantitative data on achievement
- 22 with quantitative data from which effect sizes could be extracted

Quant synthesis of attitude data



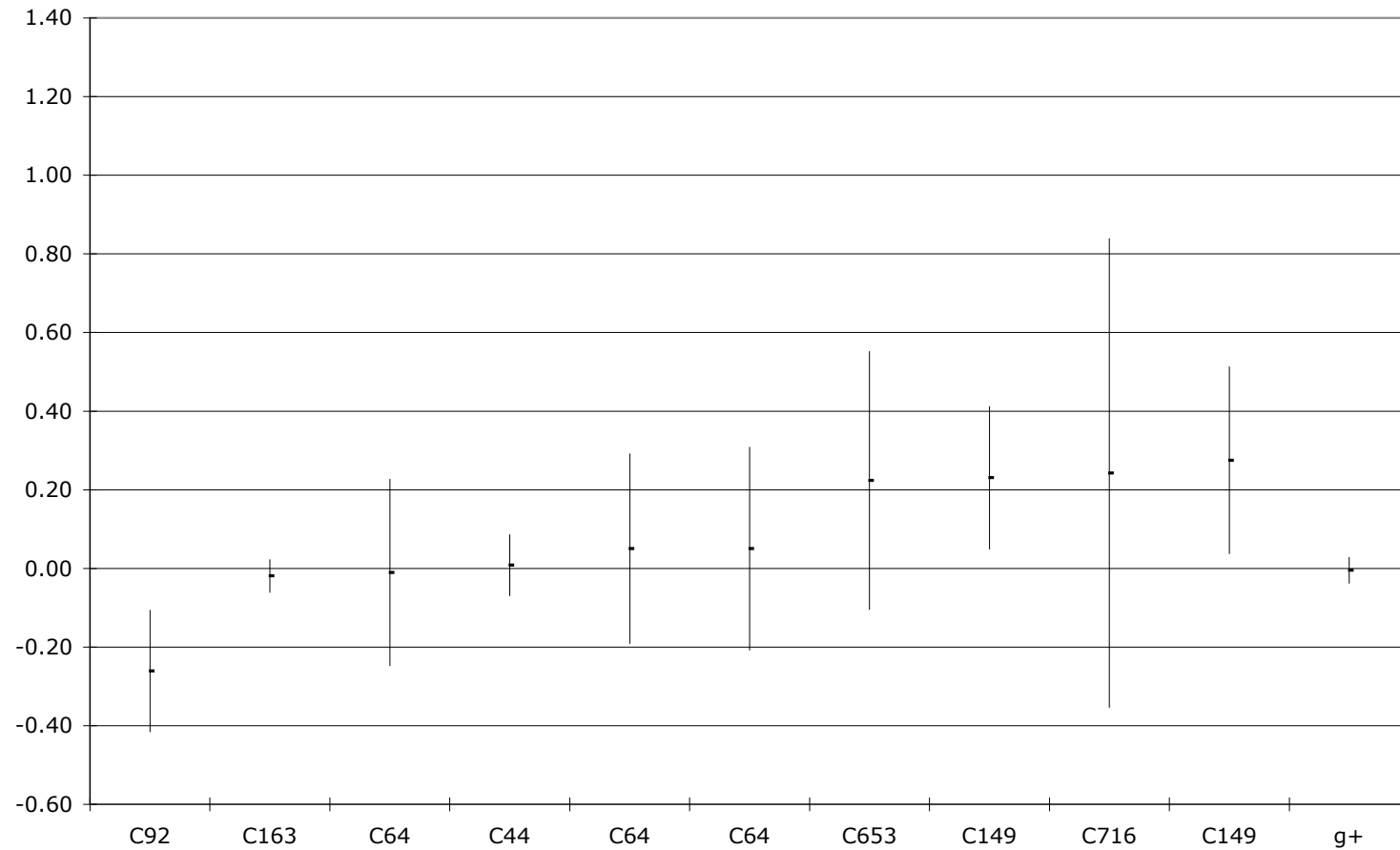
Meta-analysis of outcome data



- Overall average effect size estimate of $g^+ = 0.25$.
- Bulk of the effect due to writing interventions – these were removed and analyzed separately;
- Writing interventions avg effect size: $g^+ = 0.33$.
- Non-writing interventions avg effect size: $g^+ = 0.02$.

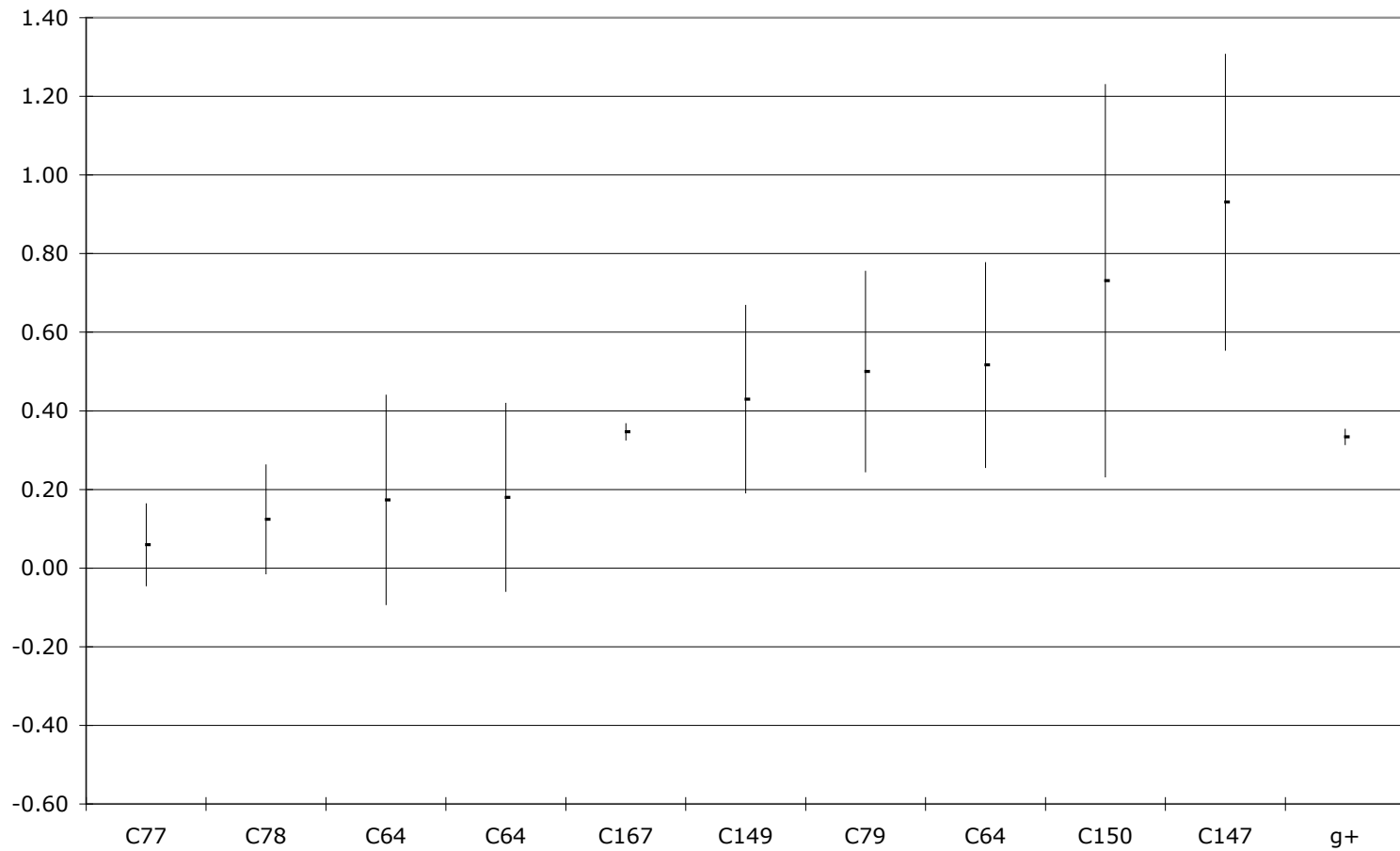
Effect sizes: non-writing studies

Effect Size and Confidence Intervals Writing Removed, 121C17 Removed



Effect sizes: writing studies

Effect Sizes and Confidence Intervals - Writing Scores



Qualitative synthesis (context)



Coming Soon!

In summary:



- Improvements in technology integration, use, and proficiency, in attitudes towards technology, and to some extent increased engagement and motivation;
- Positive impact on student writing;
- No consistent impact on general achievement measures;
- Continuing need to analyze and interpret contextual factors.



4 What's next?

Where do we go from here

What's next?



- Meta-analysis of new quantitative studies;
- Detailed analysis of successful interventions;
- Aggregation of quantitative attitude data (surveys);
- Qualitative synthesis;
- Synthesis of syntheses – what works best in what contexts;
- Dissemination of findings.

Questions

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Thank you!

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