

Multimedia Learning

Brief history of educational innovations

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Today's Aerial Geography Lesson

(NYT, 1927) (Cuban, 1986)



- Change in rigidity
- Bizarre change
- Forgotten change
- Fake?

Formal educational system does not work well

- Children are not motivated
- We teach children what they don't need
- We fragment education
- Education is passive
- Teachers are not good
- Educational is not visual / demonstrative
- ...
- **Technology will help!**

Formal educational system does not work well... for a long time

- Idas
 - Dewey, Kilpatrick (, Comenius)
 - Child-centred schools ~1920
 - „Cultivate cooperation... encourage children to think and question... teach practical skills marketable in the community...”~1970
- Evidence
 - „Passive, routine, clerical“ – school inspection, 1913
 - A 1907-11 study: question frequency of a particular teacher: 2-3/min (Cuban, p. 10)

Does it work?

(Tamim et al. 2011 Rev Edu Res)

- Technology vs. no technology
- Meta-meta-analysis
 - 25 meta-analyzes
 - 1055 primary studies
 - ~109 700 participants
- $d = 0.32$

Meta-analysis	Technology	Grade level	Subject matter
Bangert-Drowns (1993)	Word processor	All	Combination
Bayraktar (2000)	CAI	S and P	Science and health
Birk, Ouedrao, Oter, and Overmaat (2002)	CAI	E	Language
Christmann and Badgett (2000)	CAI	S	Combination
Fletcher-Flinn and Gravatt (1995)	CAI	P	Combination
Goldberg, Russell, and Cook (2003)	Word processor	E and S	Language
Hsu (2003)	CAI	P	Mathematics
Koufogiannakis and Wicker (2006)	CAI	P	Information
Kuchler (1998)	CAI	S	Mathematics
Kulik and Kulik (1991)	CBI	All	Combination
Y. C. Liao (1998)	Hypermedia	All	Combination
Y.-J. Liao and Chen (2005)	CS	E and S	Combination
Y. K. C. Liao (2007)	CAI	All	Combination
Michko (2007)	Technology	P	Engineering
Onaola (2007)	Simulations	S and P	Science and health
Pearson, Ferdig, Blomeyer, and Moran (2005)	Digital media	S	Language
Roddy, Castine, and King (1988)	CBI	All	Combination
Rosen and Salomon (2007)	Technology	E and S	Mathematics
Schenker (2007)	CAI	P	Mathematics
Sze, Keki, and Chang (2000)	CAI	E and S	Language
Timmerman and Krupke (2006)	CAI	P	Combination
Toogerson and Elbourne (2002)	ICT	E	Language
Waxman, Lin, and Michko (2003)	Technology	E and S	Combination
Yaakub (1998)	CAI	S and P	Combination
Zhao (2003)	ICT	P	Language

Note: E = elementary; S = secondary; P = postsecondary; CAI = computer-assisted instruction; CBI = computer-based instruction; ICT = information and communication technology.

Digital learning games vs. “traditional” teaching

(Wouters et al. 2013 | Edu Psy)

- Learning outcomes immediate:
 - $k = 77, N = 5547$
 - $d = 0.29$ [0.17, 0.42]
- Learning outcomes delayed:
 - $k = 16, N = 499$
 - $d = 0.36$ [0.07, 0.68]
- Motivational outcomes:
 - $k = 31, N = 2,216$
 - $d = 0.26$ [-0.03, 0.56]

- **Reasons?**

E-books (Takacs et al. 2014 Front in Psych)

- E-books with animated illustrations, background music, sounds...
- Children: pre-school, elementary (up to ~11y)
- $N = 1272$

Outcome measure	Adult support in print-like condition	Number of contrasts included	Effect size ($g+$)	Standard error	95% confidence interval	p
Overall	Yes	17	-0.02	0.10	(-0.22, 0.17)	0.81
	No	21	0.35	0.08	(0.18, 0.51)	<0.01
Story comprehension	Yes	12	-0.07	0.12	(-0.30, 0.16)	0.56
	No	18	0.40	0.09	(0.22, 0.58)	<0.01
Vocabulary	Yes	9	0.00	0.12	(-0.24, 0.24)	0.99
	No	11	0.30	0.12	(0.07, 0.53)	0.01

Innovation that does work

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Innovation that does work

Chalk

Chalk

- The same information at the same time
- Quickly change information, but keep it for a long time
- Cheap, reliable
- „Please, wait until calcium update is completed...”

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Life-cycle of a techno-innovation

1. Proponents' hype
2. Philanthropists and proponents in ministries centrally try to implement it in schools
3. Research starts
4. News report success stories (case-studies)
5. Research reviews report that studies are of low quality
6. Research reviews report that it works a bit
7. ...but there are certain technical obstacles
8. The use is marginal
9. And the teachers are to blame

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Film – proponents

- „A medium that can breathe reality into the spoken and printed world“
- Effective, interesting, emotional
- Edison:
 - „books will soon be obsolete in the schools“ (1913)
 - „...the average we get around 2 percent efficiency out of textbooks... [with film] it should be possible to obtain one hundred percent efficiency“ (1922)

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Film – the beginning

- 1910: „Catalogue of Educational Motion Pictures“, George Kleine, >1000 films
- 1910 – 20: first schools
 - used in schools directly
 - the technology expensive
- 1931: 25 US states depts. for “media education” (Cuban, p. 12)
 - e.g., loans: technologies, films

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Film – studies

- Experimental x control between-subject design
- 1934: film $\geq$ control (13th Yearbook of the National Elementary School Principals Association, ch. 10)

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Film – studies

- “Survey of teachers’ usage” not sooner than in 30-40ties

TABLE 1.1 Estimated Teacher Use of Films by Level, 1946

	Frequently	Occasionally	Never
Elementary	37.5%	32.1%	35.5%
Junior High	34.9%	24.3%	39.0%
Senior High	20.7%	29.2%	56.0%

(data from US:
National
Educational
Association)

TABLE 1.2 Estimated Teacher Use of Films by Level, 1954

	Frequently	Occasionally	Never
Elementary	42%	33%	11%
Secondary	23%	33%	19%

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Radio - beginning

- Darrow (~1930):
 - „The central and dominant aim of education by radio is to bring the world to the classroom, to make universally available the services of the finest teachers...”
- 1924 – 1925: first commercial broadcasting, 56 lessons per season, 20 min each
- 1942 survey: at least 29 edu-stations in 17 states

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Radio

TABLE 1.3 Wisconsin School of the Air Program Series, 1943–1944

	Day and Hour	Series Title	Grades
Monday	9:30 A.M.	Afield with Ranger Mac	5–8
	1:30 P.M.	Exploring the News	5–8
Tuesday	9:30 A.M.	Story Book Land	1–3
	1:30 P.M.	Let's Draw	5–8
Wednesday	9:30 A.M.	Let's Find Out	2–4
	10:45 A.M.	Young Experimenters	5–8
Thursday	9:30 A.M.	Music Enjoyment	1–4
	1:30 P.M.	Men of Freedom	5–8
Friday	9:30 A.M.	Rhythm and Games	K–3
	1:30 P.M.	Book Trails	4–6

Source: Norman Woelfel and Keith Tyler, *Radio and the School* (Yonkers-on-the-Hudson, NY: World Book Co., 1945), pp. 80–81.

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Radio – the use

- Wisconsin study of radio use (1942)
 - 3000 teachers “proponents” volunteered
 - a complete program and materials
 - teachers switched the radio on ~3 per week (30 min lessons)
- 6y study by Federal Communications Commission (1943)
 - „radio has not been accepted as a full fledged member of educational family“

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Television – beginning

- ~1960: Ford's foundation, Kennedy's administration
 - a lack of teachers in 50' and 60'
- Three models:
 - entirely by TV
 - TV as a supplement (idea: 1/3 of time)
 - TV from time to time
- Comparative studies
 - TV = teachers (Cuban, p.38)

Television – American Samoa

- 1961: 5100 students and 284 teachers
- 1966: 1/4 - 1/3 time in schools TV (80 % students), own studio, model teachers
- 1970: newspaper – success story
- 1972: survey: neither teachers nor students like this method
 - teachers want a higher level of control what to teach
- 1973: teachers can choose how much TV to use
- 1975: primary level: drop in viewership to 60% (~5 h/week); higher levels: broadcasts canceled
- 1979: only primary level, only languages and “civics”

Television – the usage

- Model schools (~1980):
 - 2 – 3 x week
 - mainly afternoons
 - 15-20 min
 - most teachers just switch the TV on (no supplementary activities): “it's time for me when I can relax a bit”
 - more primary level

Summary

- Marginal media (percentages of school time)
- Only a fraction of teachers, only from time to time, only as a supplement
- Mainly primary level
- Mainly afternoon (non-demanding) lessons

Why technology „does not work “

- Technical issues
 - user unfriendly (for teachers as well as students)
 - textbook and chalk work even in no-one use them for a year
- Doesn't fit the schedule
 - less of a problem at the primary level
- Teachers don't know how to use it
- Teachers can't control it
 - top-down implementation
- Frontal education is cost effective

Evropa 2045



- Free for schools 2008-17
- Notorious issues
 - teachers seminars, teachers work lists...
 - tailored to school curricula
- Better than a discussion ($d \sim 0.3$)
- Enjoyed more than a discussion ($d \sim 0.6$)
- Played by 5-10,000 students

Example: how to tackle technical issues



- ~16 let
- $N = 166$
- 20 min games after 45 min lesson
- Negligible differences between individual and teacher-led play

(Brom et al. 2015, Comp Hum Beh)

Acceptance at schools

(Courtois et al. 2014
Comp Hum Behav,
2014)

- Mobile Computer Supported Collaborative Learning

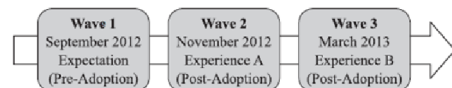
Student acceptance of tablet devices in secondary education: A three-wave longitudinal cross-lagged case study

overcoming this chasm, remains a difficult issue. Recently, debate has sparked on the potential of tablet devices as educational means (Peluso, 2012). While in public discussions proponents praise the supposed motivating character of tablet technologies, fuelled by the many easily accessible affordances they potentially offer (Alvarez, Brown, & Nussbaum, 2011; Ferrer, Belvis, & Pàmies, 2011; Henderson & Yeow, 2012), critics however frame it as a too expensive and inefficient manifestation of technological determinism, inspired by the alleged hype-factor that dominates the discourse on the issue. Such concerns not only surface in mainstream opinion

Student acceptance of tablet devices in secondary education: A three-wave longitudinal cross-lagged case study

(Courtois et al. 2014 Comp Hum Behav.)

- Belgium, 2012
- Attitude, subjective norm, perceived control, intention to use, actual usage
- The whole schools, semi-compulsory, „minimize paper usa“
- $N = 678$ (82% / 52% last wave)
- $M_{age} = 14.73$, $SD_{age} = 1.98$



Constructs

Subjective norm

(normative belief; 'completely disagree' to 'completely agree')

To what extent do you agree with the following statements?

- My teachers think the iPad is useful for school work
- My school's board of directors think the iPad is useful for school work

Attitude

(belief; 'completely disagree' to 'completely agree')

To what extent do you agree with the following statements?

- Using the iPad for school is fun
- Using the iPad for school is enjoyable
- It feels good to use the iPad for school
- It is interesting to use the iPad for school

Results

- Drop-out partly (5% variability) explained by prior attitude and subjective norm
- Perception of control doesn't influence use intention (wave 1), but it does influence actual use (wave 2)
 - i.e., what seems to be easy-to-use may not be easy-to-use after all
 - technical problems during the year
- Subjective norm mildly, but constantly, influence use intention and actual use
 - actual use in the 3rd wave influence only by subjective norm (wave 3)
- Attitude to technologies influence use intention (wave 1), but not actual use (wave 2, 3)

