Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
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GenAI: What can we learn from previous "disruptive" educational technologies?

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Professor in Computer Science
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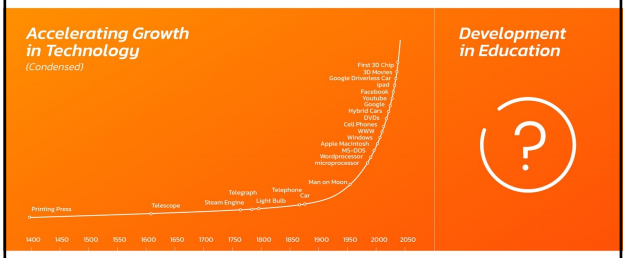
Plagiarism

Education Progress VS Tech Development



Resource: 2021,Narayanan Komerath, A Technology Countdown Approach To Historical Timelines

Michael Gillespie

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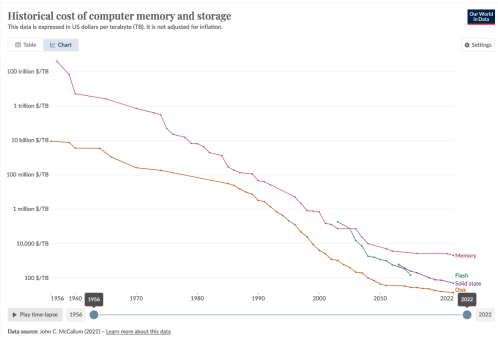
If you doubled a piece of paper 50 times how high would it be? (Assume 1mm thickness).

Moore's Law (rule of thumb)
Computing power doubles every two years

Answer:
Out beyond the asteroid belt!
0.001*(2**50)mm
= 1.14*10**10 km.

3

Cost



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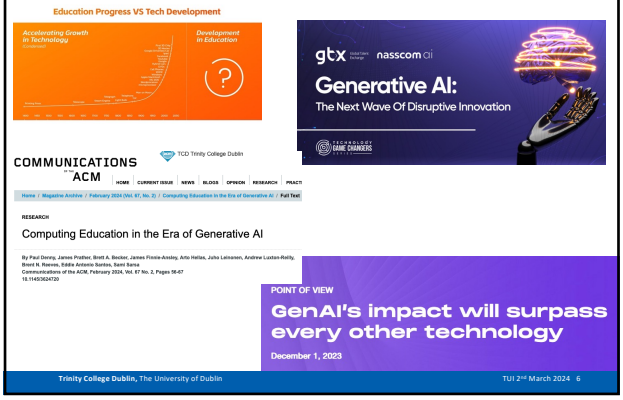
GenAI A Game Changer?



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Focus groups with TCD CS undergrads

- Vast majority of our CS student have used/are using ChatGPT for multiple reasons. JF years had already been using it in School level (so expectations are that any incoming JF will already have used ChatGPT in some way)
- Students use ChatGPT used across the entire CS curriculum but perhaps used less in different areas of CS e.g. less useful in mathematics & logic subject areas
- Some student have ChatGPT paid accounts but most usage is the free version (using GPT 3.5)
- **Many objective given by students for ChatGPT usage**
  - paraphrase / help understand content delivered in lectures/tutorial
  - supplementary explanation and expansion on learning material given in class/lectures/tutorials
  - summarise longer passages of learning content – creation of learning notes
  - rephrase/improve English for written answers
  - assistance in correcting errors in programming code
  - generation of programming code for projects/programmes

Student Opinion of usage

- More experienced student (in topic/subject) have confidence they identify any ChatGPT hallucinations/errors.
- Some (mild) concern for using ChatGPT in areas where students have no experience/prior knowledge as they may not be able to identify hallucinations/errors
- Strong desire to be able to continue to use ChatGPT for learning and assistance in developing their knowledge

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Initial Evidence of Benefit of GenAI

The present study performed a meta-analysis of 24 randomized studies. The main goal of the current study was to meta-analytically examine the effects of AI chatbots on students' learning outcomes and the moderating effects of educational levels and intervention duration.

The results indicated that AI chatbots had a large effect on students' learning outcomes.

Moreover, AI chatbots had a greater effect on students in higher education, compared to those in primary education and secondary education. In addition, short interventions were found to have a stronger effect on students' learning outcomes than long interventions.

Received: 20 January 2023 | Accepted: 17 April 2023
DOI: 10.1111/bjet.13334
REVIEW
British Journal of Educational Technology BERA

Do AI chatbots improve students learning outcomes? Evidence from a meta-analysis

Rong Wu | Zhonggen Yu

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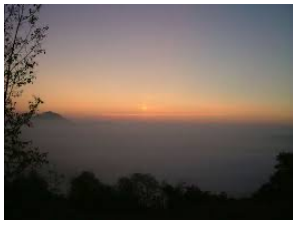
False Dawns



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Disruptive Educational Technologies

The *network* will carry education as they do music to the backwoods, isolated farms and into the mountains of Tennessee, Kentucky and West Virginia. The limitations of "the little red schoolhouse" will pass away; the country schoolteacher will be reinforced by college professors and other specialists.

New York Times 1923 on radio

While children may be bored and restless when merely listening to a speaker [on radio] without seeing him, living talent or motion pictures broadcast at a certain time to all schools in a given area will capture and hold their interest. The fascination of television for children has already been demonstrated in the homes of those now possessing television receivers in the New York area. (Sarnoff, 1941)

With the advent of interactive computer networks, education will be revolutionized. The child's imagination will finally be set free to roam the world, guided by his own interests.

And we already hear rumours of the next round: Why should students be interested in flat-screen interaction with a two-dimensional world? But with full-immersion virtual reality we can present the child with infinitely rich learning environments. He lives in the world he is learning about, and even helps to create it.

From 1997 https://www.netfuture.org/fwd/1997/1.html

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Irish Predictions

- ***The availability of new VLE systems for schools in Ireland will allow staff shortages to be offset by teachers who can get a lot more done in less time.***
  [Software for Schools website 2010]
- **http://www.software4students.ie/blog/2009/12/16/ICT_in_Schools__Continuing_The_Journey_in_Ireland]**

- ***Taking full advantage of the benefits of ICT in teaching and learning will encourage and enable all students to become self-assured and self-directed learners.***
  [www.education.ie/servlet/blobservlet/icu_smart_schools_smart_economy.pdf 2010]

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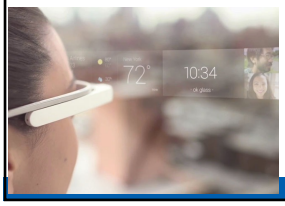
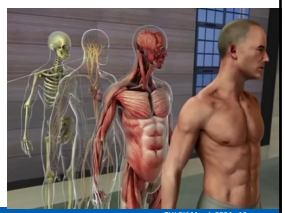
Recent Candidates

KHANACADEMY





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Result not quite as planned!

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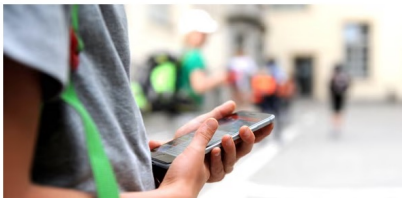
UNESCO 2023

‘Put learners first’: Unesco calls for global ban on smartphones in schools

Major UN report issues warning over excessive use, with one in four countries already banning the devices

- **Analysis: distraction and bullying are key concerns**
- **‘I would crank up the restrictions’: teachers on banning phones in school**



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And even where computers are used in the classroom, their impact on student performance is mixed at best. Students who use computers moderately at school tend to have somewhat better learning outcomes than students who use computers rarely. But students who use computers very frequently at school do a lot worse in most learning outcomes, even after accounting for social background and student demographics.

The results also show no appreciable improvements in student achievement in reading, mathematics or science in the countries that had invested heavily in ICT for education. And perhaps the most disappointing finding of the report is that technology is of little help in bridging the skills divide between advantaged and disadvantaged students.

Students, Computers and Learning
MAKING THE CONNECTION

OECD

OECD (2015), *Students, Computers and Learning: Making the Connection*, PISA, OECD Publishing. *http://dx.doi.org/10.1787/9789264239555-en*

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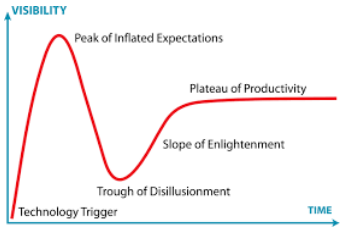
Gartner Hype Cycle



Wikipedia

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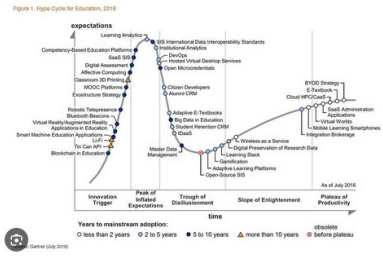
2016 Higher Education



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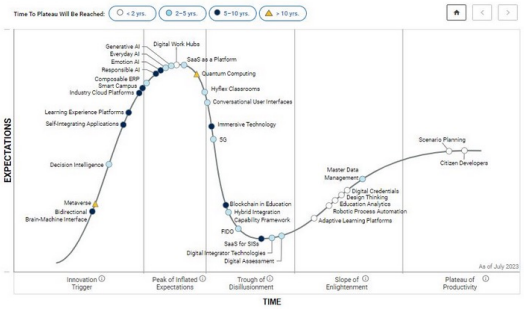
2023 Higher Education



https://www.linkedin.com/posts/gracefarrell_the-hype-cycle-for-higher-education-2023-activity-7090381657559433216-NMAs/

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Integrating Technology With Teaching & Learning

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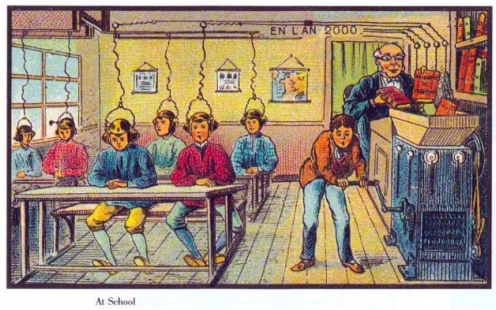
"En l'an 2000" ("In the Year 2000") from around the World's Fair in Paris1900



At School

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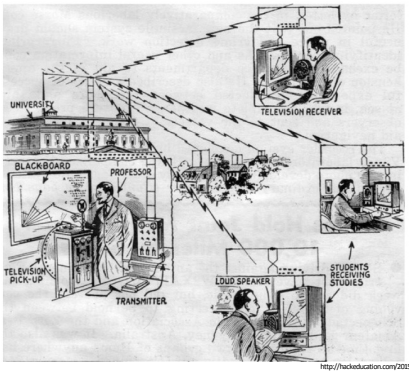
Radio. Radio Books. Lectures via television (This image is from 1935).
Professor as transmitter. Students as receivers.



http://hackeducation.com/2015/02/19/the-history-of-the-future-of-education

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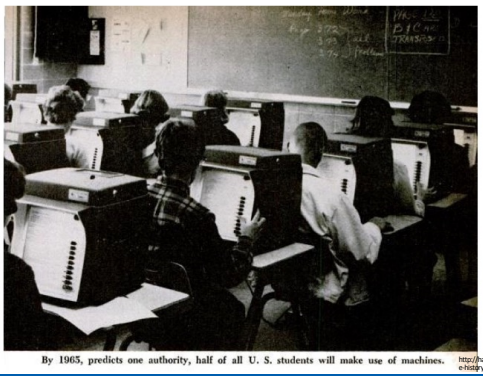
From *Popular Science* in 1961, a prediction that by 1965, half of all students will use teaching machines.



By 1965, predicts one authority, half of all U. S. students will make use of machines.

http://hackeducation.com/2015/02/19/the-history-of-the-future-of-education

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Envision New Technology Within Existing Paradigms

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Assimilate New Technologies Within Existing Paradigms

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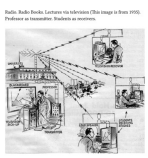
Applied to Education



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A Different Way Of Looking At Things

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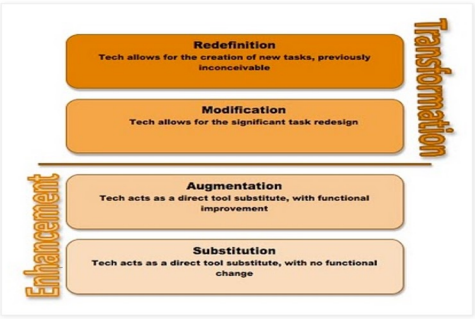
The SAMR Lens on Integrating ICT into the Classroom



Puentedura, R. (2012)

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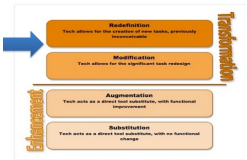
One Argument

Learning activities at the SAMR redefinition layer "*do not sit well within a conventional school system featuring didactic methods of teaching and learning, …… Instead, they are more in keeping with the widely-discussed 21C Learning approach to education*".

(Tangney B., Bray A., Oldham E., 2015)



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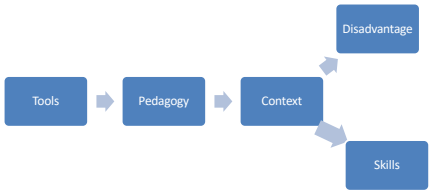
Aside – My own journey



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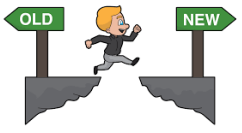
Educational Change



https://commons.wikimedia.org/wiki/File:Career_Change_Jump_Cartoon.svg

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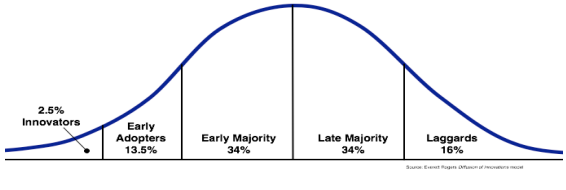
Diffusion of Innovation - Rogers



Where are you on this curve?

Rogers, E. (1962) *Diffusion of innovations*. Free Press, London, NY, USA.

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Technology Acceptance Model

- Davis's Technology Acceptance Model (TAM) highlights the importance, from a user's perspective, of the perceived **ease of use** of any new technology and its perceived **usefulness** (Davis 1985).

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Challenges With Any Classroom Change

(Zhao *et al.* 2002) **Distance** - how far removed the educational innovation is from current practice.

(Ertmer 1999) describes barriers to the adoption of technology by teachers as occurring at two levels.
1. Inadequacies in infrastructure, technical support and training in the use of technology.
2. **Teacher beliefs about the nature of teaching and learning, their role and how they interact with and assess student work.**

(Fullan 2007), to bring about any change in any educational context is ultimately a function of "**what teachers do and think**".

It may be helpful to have these concepts in mind as we grapple with GenAI.

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Concrete Example

Challenges in Implementing Transversal Competencies

Definitional	Operational	Systemic
Lack of clarity in scope of transversal competencies	Lack of assessment mechanisms	Large class size
Lack of clarity in the desired outcomes of the teaching of transversal competencies	Insufficient teach/learning materials and teacher guides	Overloaded curricula
	Lack of incentives	Pressure to achieve academic success
	Insufficient capacity of teachers	Inconsistency with high-stake exams
	Lack of budget (policy-budget inconsistency)	Lack of understanding among parents and other stakeholders
	Additional burden on teachers	Overall school/community culture

Figure 1. Challenges in implementing transversal competencies in classrooms (UNESCO 2015).

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Three Issues With GenAI

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The Calculator Analogy

summarise the concernes which were raised about the introduction of calculators in schools

Show drafts

When calculators were first introduced in schools, several concerns were raised:

Impact on basic skills: Many feared students would become overly reliant on calculators, neglecting and losing proficiency in mental math and basic arithmetic operations.

Understanding vs. execution: Critics worried students would simply "plug and chug" numbers into calculators without truly understanding underlying mathematical concepts and strategies.

Atrophy of problem-solving: Some argued that overreliance on calculators would impede the development of critical thinking and problem-solving skills, hindering their ability to approach complex mathematical issues.

Equity and accessibility: Concerns existed that access to expensive calculators could create an uneven playing field, disadvantaging students from lower-income backgrounds.

Standardized testing: The rise of calculators on standardized tests brought questions about fairness and whether they truly assessed mathematical understanding or just calculator proficiency.

These concerns sparked ongoing debates about the appropriate role of calculators in education. While arguments remain, many educators emphasize the importance of striking a balance between utilizing calculators effectively and fostering strong foundational skills and conceptual understanding.

Gemini

https://www.flickr.com/photos/psd/40890499

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What do you need to know in order to make good use of GenAI?

https://www.news.com.au/technology/motoring/on-the-road/schoolkid-drives-900k-lamborghini-aventador-with-iplates/news-story/a1673c5d3df59989a8e8560ea2b5f074

https://commons.wikimedia.org/wiki/File:Girl_on_bike_training_wheels.jpg

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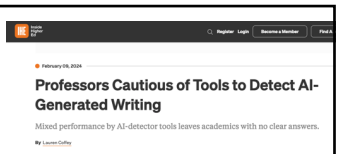
Assessment



February 09, 2024

Professors Cautious of Tools to Detect AI-Generated Writing

Mixed performance by AI-detector tools leaves academics with no clear answers.

By Lauren Coffey

What role does the lecturer/teacher need to have in assessing student work?

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What are people doing?

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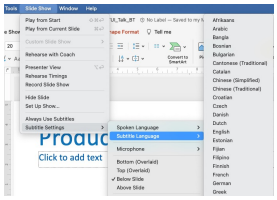
Enhancement

As a productivity tool (search engine, summarise a topic, generating quizzes, essay topics, images etc.)

Live captioning and translation.



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My Colleagues

Various CS modules. Require students to sign a declaration that GenAI was not used in the assignment.

Introduction to programming. Minimise marks for coursework.

S/W Engineering (postgrad) "The module has fully embraced the use of Generative AI tools for all stages of the process, and an additional assessment criterion has been added where students are required to assess the strengths and limitations of Generative AI tools in the development process."

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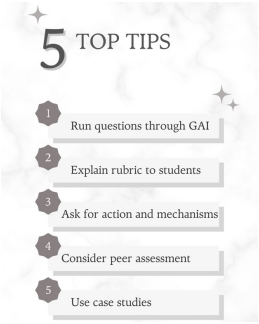
Health Sciences - Tips



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Myself

Technology & Society (1st Year CS)

Assessment is by coursework only and students are required to work in teams to prepare videos and TED-style talks on various topics. Presentations are followed by Q&A. Students were encouraged to use GenAI in any way they saw useful but were required (in the Q&A) to describe how they used it. Whole class discussions led to a collaborative exploration of where and when the use of Generative AI was helpful and/or appropriate. **Greater emphasis was placed on the Q&A aspect, so students realised they had to be able to defend the ideas they presented.**

Students reported using ChatGPT for initially researching a topic and proof-reading text they produced for talks and video narrations**. Most interestingly one group reported how they feed the text for their talk into GPT and prompted it to suggested questions which might crop up in a Q&A.** Other teams then adopted this practice.

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Punchline

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Punchline

1. The history of technology and learning is littered with false dawns.
2. The jury is out on how significant Gen AI will be, as we all try to figure out how to utilise it.
3. Educators' beliefs about teaching & learning will shape their views on Gen AI and how it is to be utilised.
4. SAMR provides a lens to help frame approaches to ICT integration.
5. The issues around integrating ICT in teaching & learning, and the supports needed to achieve it (if that is the goal) are well understood, if not practiced.
6. Both educators and students need support on how to make best use (or not) of GenAI.
7. The role of the educator in assessment – emphasis on Q&A

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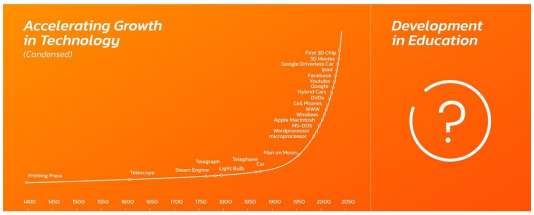
Even if GenAI is not THE game changer is it reasonable to expect education not to be radically effected by technology in the next 10-20 years?

Education Progress VS Tech Development



Resource: 2021,Narayanan Komerath, A Technology Countdown Approach To Historical Timelines

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Two Questions for All of Us

1. Are the skills and knowledge assessed by the Leaving Cert (established) the best ones to be focusing on going forward?

2. In light of Q1, is the backwash effect of the CAO admission process, on senior cycle teaching and learning and helping prepare students for further education, a price worth paying for the transparency of the system?

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Bibliography

Care, E., H. Kim, K. Anderson and E. Gustafsson-Wright (2017). "Skills for a Changing World: National Perspectives and the Global Movement." Center for Universal Education at The Brookings Institution.

Davis, F. D. (1985). A technology acceptance model for empirically testing new end-user information systems: Theory and results, Massachusetts Institute of Technology.

Ertmer P. (1999). "Addressing first and second order barriers to change: Strategies for technology implementation." Educational Technology Research and Development **47**(4): 47-61.

Evans C. (1980). The Mighty Micro, Coronet Books.

Fullan, M. (2007). The new meaning of educational change, Routledge.

Hamilton, E. R., J. M. Rosenberg and M. Akcaoglu (2016). "The Substitution Augmentation Modification Redefinition (SAMR) Model: a Critical Review and Suggestions for its Use." TechTrends **60**(5): 433-441.

Rogers, E. M. (2010). Diffusion of innovations, Simon and Schuster.
Puentedura, R. (2012). "The SAMR model: Background and exemplars." Retrieved March 2016, from http://hippasus.com/rpweblog/.

Zhao, Y., K. Pugh, S. Sheldon and J. Byers (2002). "Conditions for classroom technology innovations." The Teachers College Record **104**(3): 482-515.

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