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# Integration of Technology Enabled Education in Learning:

## a comparative study of the influence of learning standards in the U.S., Japan, Singapore, and Finland

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# Press release announcement (New!)

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Fujitsu Laboratories of America, Inc.
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## Fujitsu and MIT Announce Breakthrough Platform Technology for Improving Effectiveness of Online Learning

***Navigation and simulation technology for massive online learning systems***

**Sunnyvale, CA and Cambridge, MA, June 17, 2013** — Fujitsu Laboratorie
Technology (MIT) today announced the joint development of a personalized le
learning.

In recent years, a wide range of learning materials has become available onlir
sufficiently utilized learning environments that fully leverage the advantages of
learning materials for users from among an infinite amount of disparate conte
learning materials and learning pathways based on users' level of understandi

Using navigation technology that can organize a massive volume of online lea
it possible to navigate 100,000s of learning materials, which has been a chall
behaviour simulation technology based on an advanced probabilistic learner n
simulations without having to rely on actual students, a major problem faced

Fujitsu Laboratories of America and MIT will move forward on deploying the n
online learning systems used by colleges and enterprises.

Details of the new technology will be introduced at the Sixth Conference of M
be held from June 17-19, 2013 in Massachusetts.

### Background

The trend toward online learning has grown recently due to the prevalence of
quality educational content is available free of charge. Additional growth is du
Courses (MOOCs)(2), primarily at universities in the US, in which courses of
style of learning, which takes advantage of the Internet to offer education rega

### Newly Developed Technology

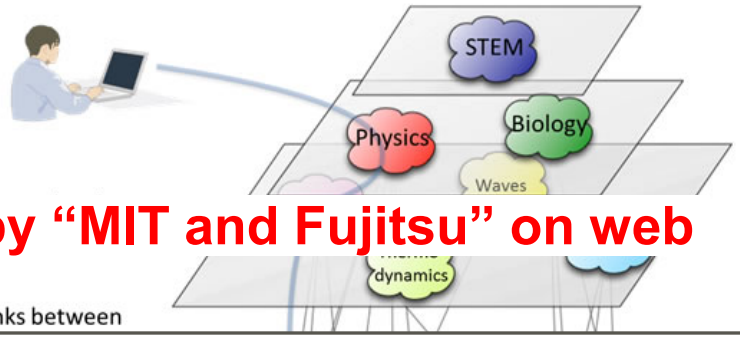
The new platform takes the same personalization features currently found in search engines and e-commerce sites and leverages them in the field of education. The technology is designed as a learning platform that can provide optimal learning materials and pathways based on the learner's level of understanding and interests. Using navigation technology that can organize massive volumes of online learning materials into multi-layer topics, the new platform makes it possible to navigate 100,000s of learning materials, which has been a challenge for students. In addition, by developing learning behaviour simulation technology based on an advanced probabilistic learner model, it is possible to predict learning outcomes through simulations without having to rely on actual students, a major problem faced by learning system providers. The features of the newly developed technology are as follows:

**1) Navigation of massive volumes of learning materials organized into multi-layer topics**

The technology extracts a list of conceptual topics corresponding to the categories found in the learning materials. The topics are then automatically organized by size into multiple layers. Learning materials for each topic are linked to topics, and a single learning material can be linked to multiple topics. For instance, if a calculus student wishes to deepen his or her understanding about derivatives, the technology will recommend materials to the student including differential calculus lecture notes and physics videos covering mechanics. In the example shown in Figure 1, the student can access actual video materials via topics related to physics and mechanics.

**2) Technology for simulating learner behaviour in massive online systems**

By creating a probabilistic model of a learner's knowledge and the percentage of answers solved correctly, and by performing first-ever simulations with algorithms that replicate complex learner behaviour, Fujitsu Laboratories of America and MIT successfully simulated a realistic representation of student learning processes in large-scale online courses.




Links between

- **Please search by "MIT and Fujitsu" on web**

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# Outline of the Presentation

- Overview of the Study
- Methods
- Cases from the Four Countries
- Conclusions

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# Overall Goals of this Study

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- Examine how Technology Enabled Education (TEE) can be successfully integrated into the classroom.
  - What potential TEE has for cost reduction or the adoption of new pedagogical techniques.
  - Question whether national learning standards incentivize or deter TEE adoption.
  - Investigate the impact of national learning standards on the adoption of TEE in Finland, Japan, Singapore and the United States.

- A holistic examination of the 1) development and implementation of learning standards and 2) responses to these standards in
  - Curriculum
  - Teaching
  - Assessment
  - Professional Development
  - TEE

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# Methods

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- Literature review of primary sources and secondary analysis of development and implementation processes in each country
- Interviews with American teachers, principals, state administrators and other educators
- Ethnographic study of Japanese elementary school

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# Cases from the Four Countries

- United States
- Japan
- Singapore
- Finland

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# Standards in the United States

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- First national, but not federal, standards being adopted now (Common Core State Standards and Next Generation Science Standards) to combat the traditional “mile wide and inch deep” curriculum.
- Lack in progress towards teachers improving instructional methods.
- No Child Left Behind act of 2003 institutionalized large-scale standardized testing in all K-12 schools. “Deeper” assessment techniques are being developed, but behind schedule.
- Teacher training and professional development vary widely from state to state and district to district, is seen by many as ineffective.

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# TEE in the United States

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- 1.5 million students were using online or blended learning instruction in 2010, but the use of technology varies across the country due to the lack of unified national curriculum.
- Opportunities for TEE providers to create resource for standards-aligned materials.
- With the federal government's investment in providing broadband internet connections to schools, TEE can harness the current technology infrastructure.

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# Standards in Japan

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- National curriculum standards. Introduced "integrated studies" as a course in the early 2000s and cut down the content by 30%
- No major change in pedagogical methods. Due to the entrance exam system and expectations from parents/students, teachers feel pressure to "teach to the tests" and often focus lessons on rote memorization.
- Standardized tests are required for entering secondary and post-secondary schools from age 15 (or earlier). Assessment system needs certain modification to reflect the learning results.
- A multi-dimensional, continuous, and systematic training program for teachers due to the practice of Lesson Study.

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# TEE in Japan

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- Japanese government's commitment to equip one device per student at school by 2020.
- i-Japan strategy in 2009 for training teachers in using ICT for classroom instructions by 2015.
  - Only 62% had the ability to use digital media for teaching in 2011.
- Widespread practice of Lesson Study would make the TEE adoption effective.
  - Existing lessons are transferrable, could be shared with other teachers nationwide.

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# TEE in Japan: “Future School” Project

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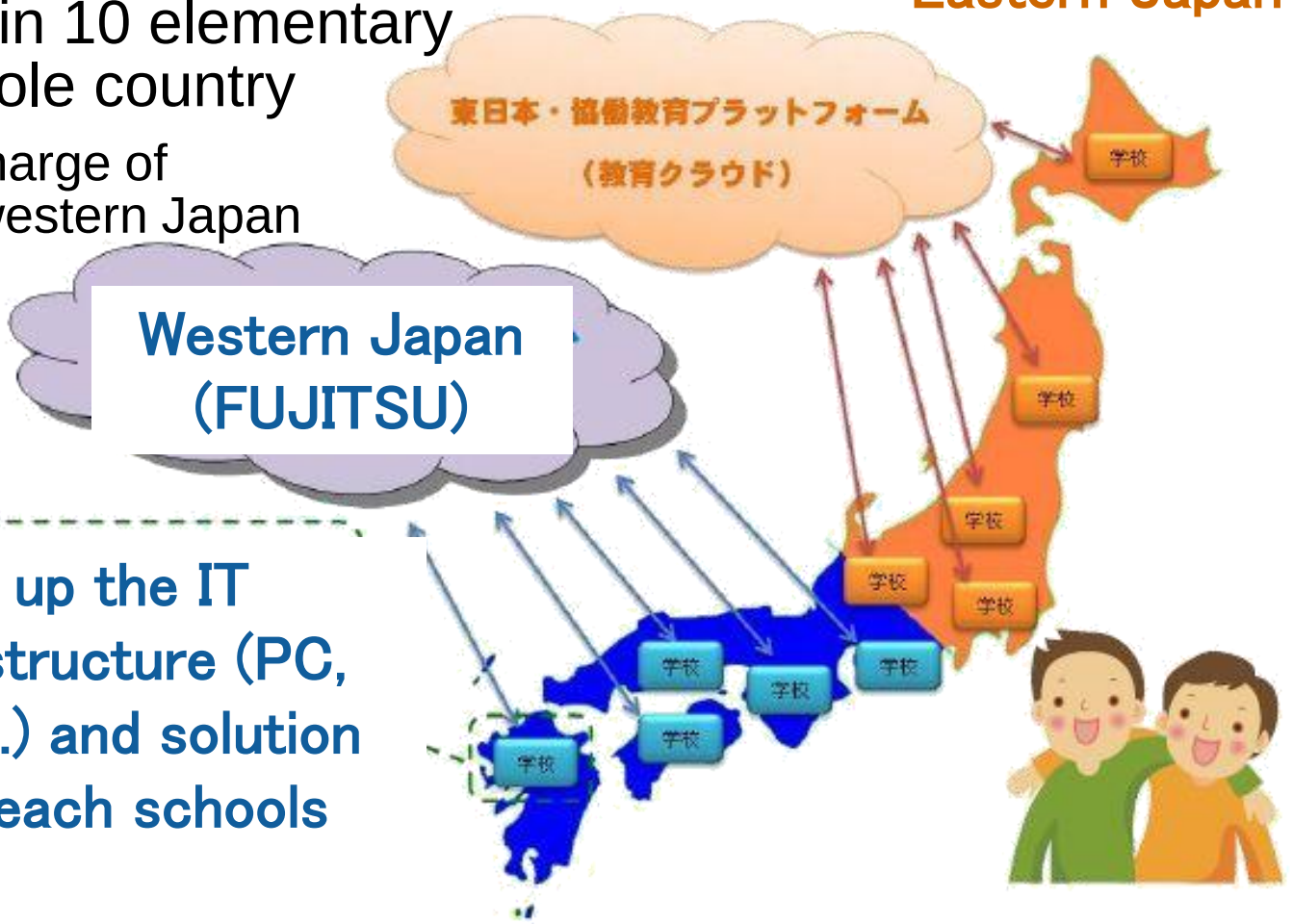
- Experimental study to promote “cooperative education” with ICT
  - 3 year national project funded by MIC (Ministry of Internal Affairs and Communications) (FY2010-2012)
- Implemented in 10 elementary schools in whole country
  - Fujitsu is in charge of 5 schools in western Japan




FUJITSU set up the IT system infrastructure (PC, network , etc.) and solution software for each schools

# TEE in Japan 1 (Tablet PC client)

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- Every student has their own PC on their desktop
- Collaborative learning with tablet PC

# TEE in Japan 2 (Interactive White Board)

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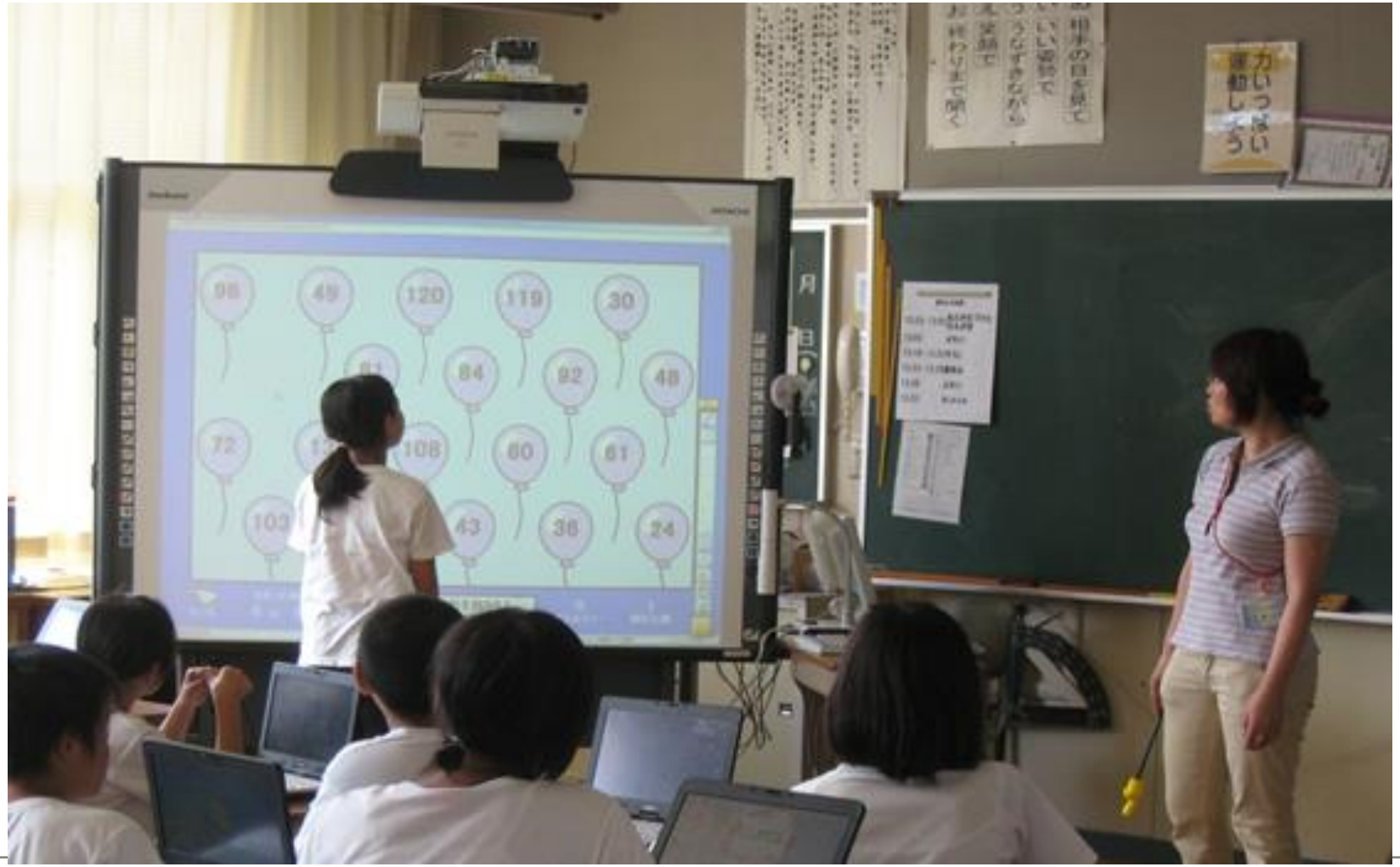
- Math class with Interactive White Board(IWB)
- Playing math game(finding multiple number balloon) in front of other students→ ICT interactive Gamification in Class



# TEE in Japan 3 (Power supply management)

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- Special equipment for managing ICT class (other then network infrastructure)
- Pc- power charge cabinet for whole day use

# TEE in Japan 4 (Interactive ICT support)

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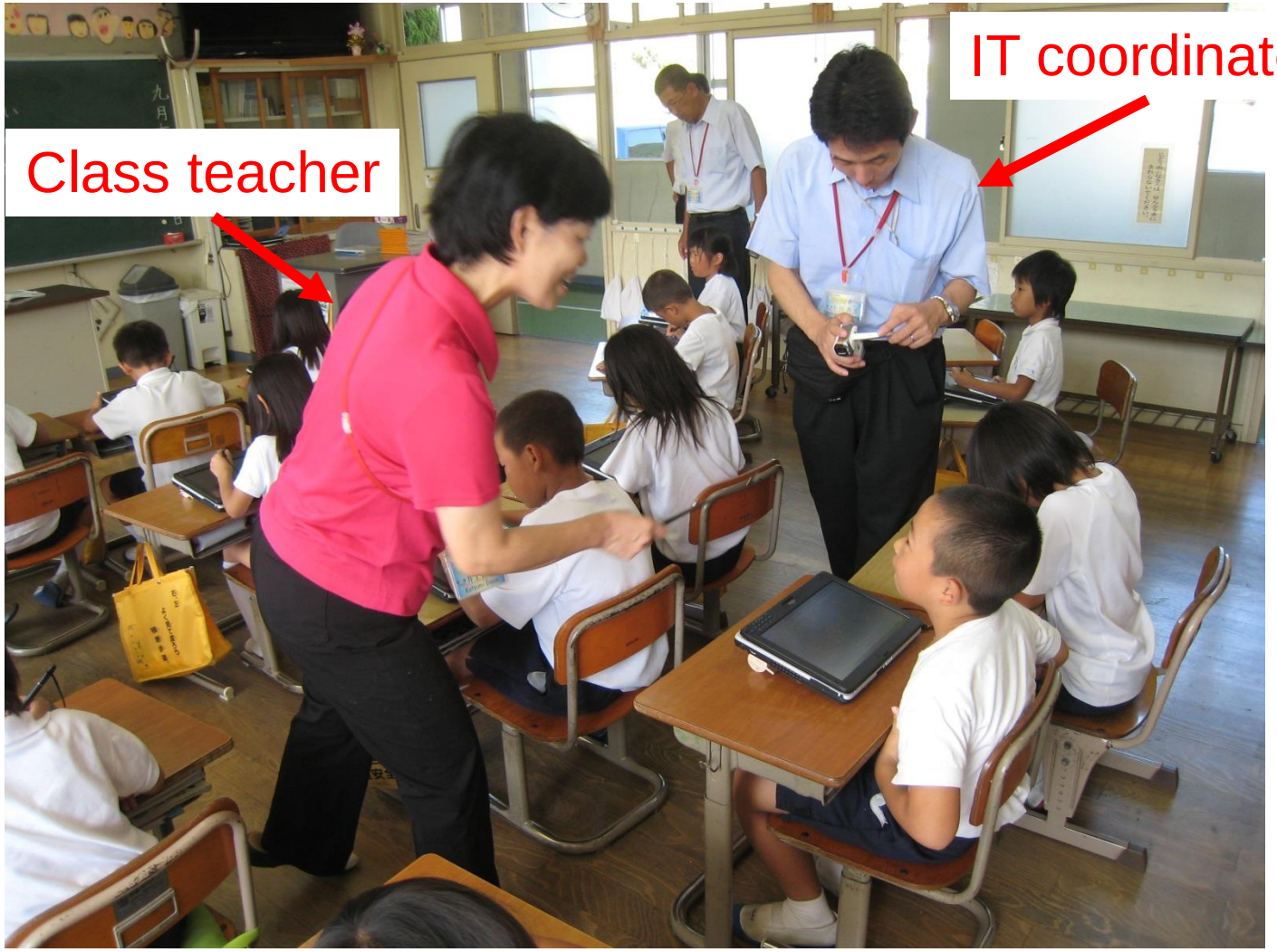
- IT coordinator support the IT issue during the class, so teacher can concentrate students reaction



# Standards in Singapore

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- Teach Less, Learn More (TLLM) policy in 2004 cut down the national curriculum by 10-20%, shifting a focus from teaching facts to engaged student learning.
- Hyper-competitive examination system put pressure on teachers to focus lessons strictly on rote memorization of exam topics.
  - Ministry of Education (MOE) evaluate schools every two years. Due to this system, more increased level of professionalism among teachers.
- Standardized tests begins at the age 11 as a part of tracking into 4 streams.
- Collaboration between MOE and the National Institute of Education to build a strong teaching force through a detailed planning, aggressive teacher recruitment, comprehensive training and effective teacher retention.

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# TEE in Singapore

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- Student to computer ration was 6.5/student in primary school, 4/student in secondary schools and junior colleges in 2007.
- Teachers are equipped with a notebook computer.
- ICT integrated about 30% of the curriculum time.
- MOE's professional development focused on TEE.
  - Goal to place about 4 ICT mentors in each school

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# Standards in Finland

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- National framework curriculum in 1994 introduced more local autonomy (loose framework with a focus on experiences and learning, enabling and supporting schools to design curricula, more flexibility of choice)
- No standardized tests until the age of 16. Students are assessed by teachers during the school years.
  - High school completion rate of 93%.
- Lessons based on students' input, not centered on any rote learning. More focus on "learning to learning" (Sahlberg 2010)
- Strong pre-service professional development and very selective admission to teaching programs. Teachers are trained as researchers.
  - Teachers are top 10% of the graduates.
  - Master's degree is required for all teachers.

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# TEE in Finland

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- National Plan for Educational Use of Information and Communications Technology in 2010.
  - ICTs at School's Everyday Life project included in the Finnish government platform for 2007-2011 and National Information Society Policy for 2007-2011.
  - Finland is at around the European average and the last of the Nordic countries in terms of ICT use in education (National Plan … 2010: 16).
- Relatively low technology use in classroom.
- Teachers tend to use technology to support the same pedagogical styles without adopting new pedagogies for TEE.
  - Vague national guidelines regarding the use of TEE in schools (Thayer 2012)
  - Lack of teachers' pedagogical vision to integrate ICT effectively within teaching (Kaisto 2007)

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# 4 countries comparison at a glance

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| | Learning Standard | TEE adaption | Overall |
|---|---|---|---|
| US  | Common Core Standard<br>Teacher training ineffective | Web based<br>Moocs<br>Open Education | Big challenge for diverse nation by web tech |
| Japan  | Integrated Study<br>Teach to the tests<br>Lesson Study | Device based<br>Teachers ICT skill development problem | Required ICT software training for teacher |
| Singapore  | Teach less learn more<br>Pressure on Teachers | Teachers are well equipped ICT<br>Gov focused on ICT | Well balanced and successful strategy so far |
| Finland  | Learning to learning<br>Master degree requires all teachers | Low technology use in class<br>Old pedagogy to adapt | New TEE pedagogy adapting will be the key |

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# Conclusions: TEE integration in learning and national learning standards

- Coordination
- Teacher Buy-in
- Contextual Factors
- Professional Development

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# Conclusions: Coordination

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- **Need a coordinated approach to new standards across the entire system, more so for TEE.**
  - **Assessment must be** compatible with new standards, in these cases be **based on students' demonstration of skills** rather than memorized facts. Assessment with otherwise act as a forcing function towards rote teaching and learning.
  - **Teachers must be prepared to teach in new methods, in particular for TEE,** by professional development, both pre-service and in-service, or they will not be able to achieve the desired outcomes.
    (Successful in Singapore; unsuccessful in Japan and Finland; a huge looming problem in USA).

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# Conclusions: Teacher Buy-in

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- **Need to empower & incentivize teachers to receive their buy-in for changes, including TEE.**
  - Moving from a centralized system to **decentralized system** (Finland) allows for effective dissemination of practices and information early in the implementation.
  - **Autonomy** given to schools and teachers encourages more teacher buy-in to these changes (Singapore), but a barrier for the implementation of TEE (Finland).
  - **Explicit encouragement or regulation for TEE.** Otherwise teachers end up using technologies to support old pedagogies (Finland).

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# Conclusions: Contextual Factors

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- **Need to consider how social structures and contextual factors drive change within the education system**
  - Integration of TEE into the classroom should be **included in national standards**, with clear guidelines for the use of TEE in schools (Finland).
  - **Educational reform has to be part of all social reforms** to create a sense of equity and sharing in society (Finland).
    - Otherwise competition remains among students and parents and performance on testing is the largest incentive in education (Singapore, Japan).
  - **Small** (Finland and Singapore) and **homogenous** (Finland and Japan) countries can more easily adapt to local problems in implementation.

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# Conclusions: Professional Development

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- **Need a robust professional development system for the integration of TEE in learning**
  - Effective utilization of TEE because of the **support to teachers** (Singapore).
  - **Teachers form informal bonds** with other teachers, usually locally through their schools or over the Internet, which are hard to break into.
  - More **pre- and in-service training regarding the use of TEE** in the classroom. Only little formal pre-service training for the use of TEE in the classroom in most countries surveyed.

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# Thank you for your time!

Questions?

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