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A Comparative Study of STEM Educators' Views of Technology: A Case of Canada, China and Korea

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Department of Curriculum and Pedagogy

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a place of mind | THE UNIVERSITY OF BRITISH COLUMBIA | TEACHING AND LEARNING ENHANCEMENT FUND

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The Teaching and Learning Enhancement Fund: supporting and encouraging innovation in teaching and the learning environment

$210,000

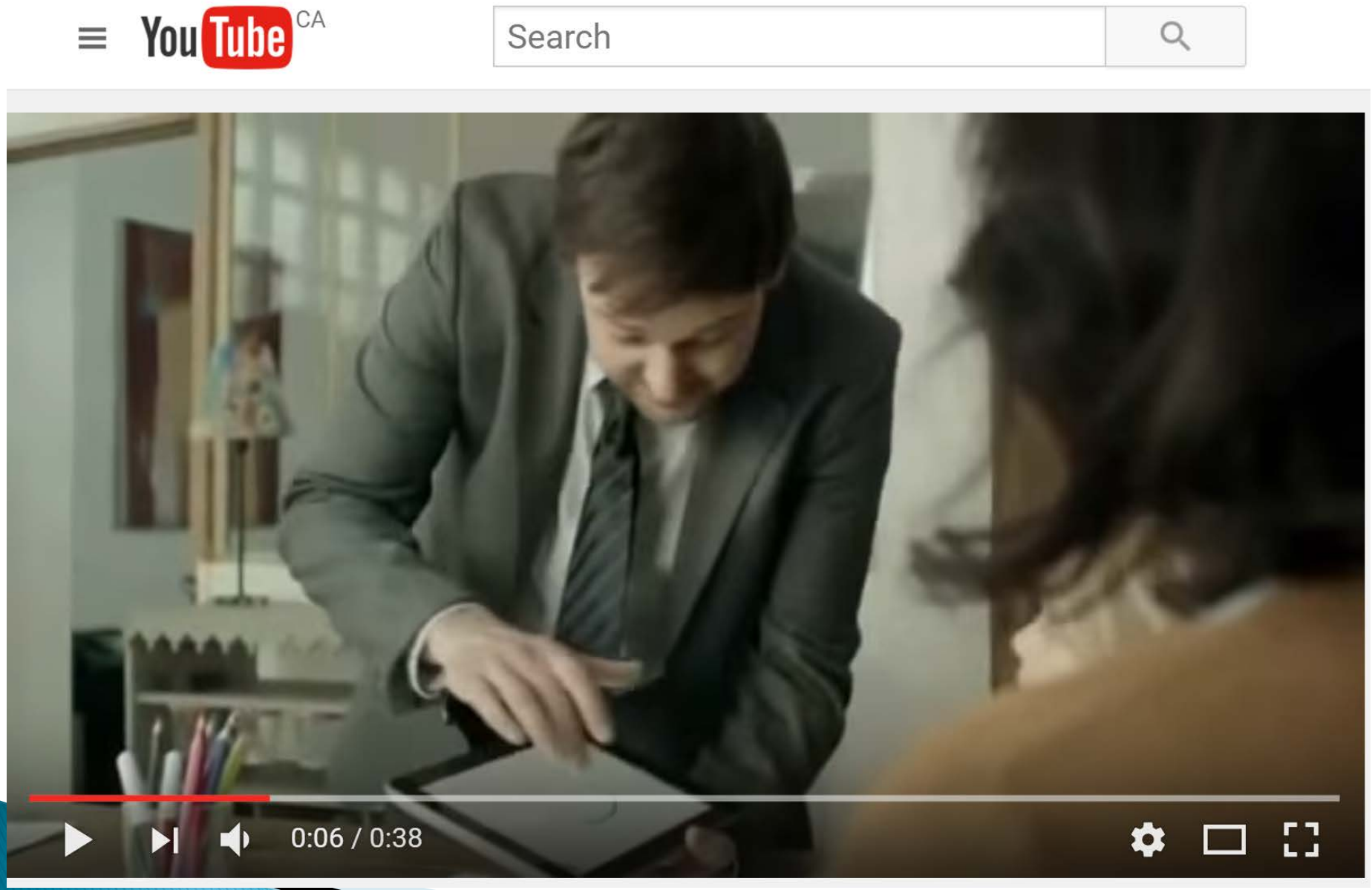
2011-2017

In Collaboration with
Prof. Jungsook Oh, Daegu University

Seminar Structure

- Part 1: The Big Picture
- Part 2: Research study
- Part 3: Future directions

- QUESTIONS ARE WELCOME AT ANY TIME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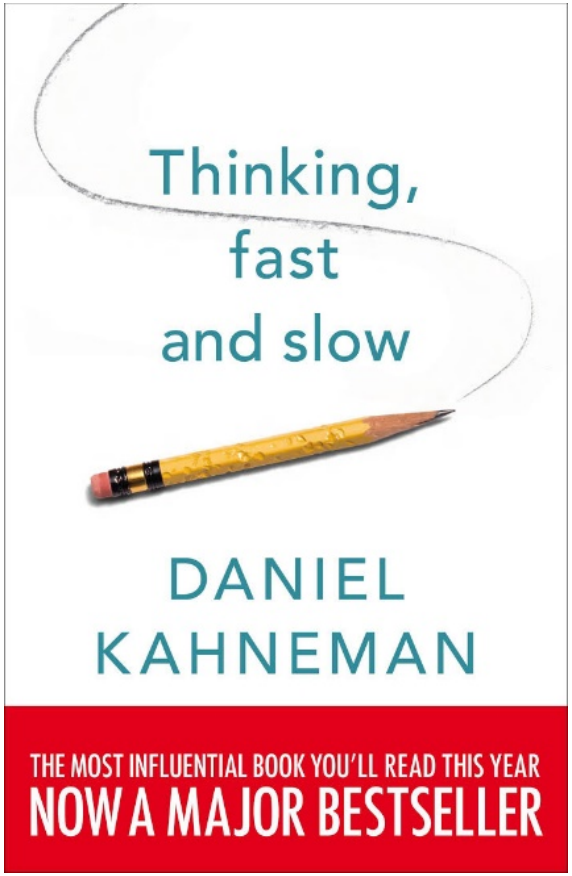
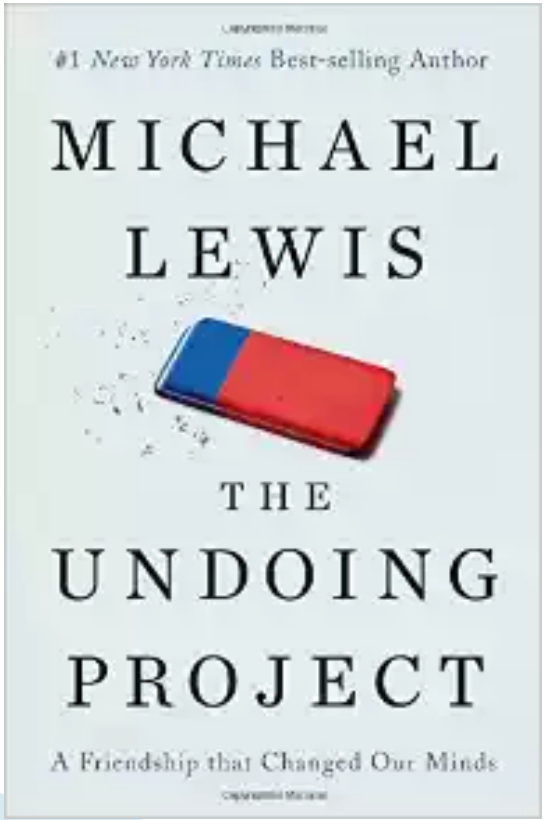
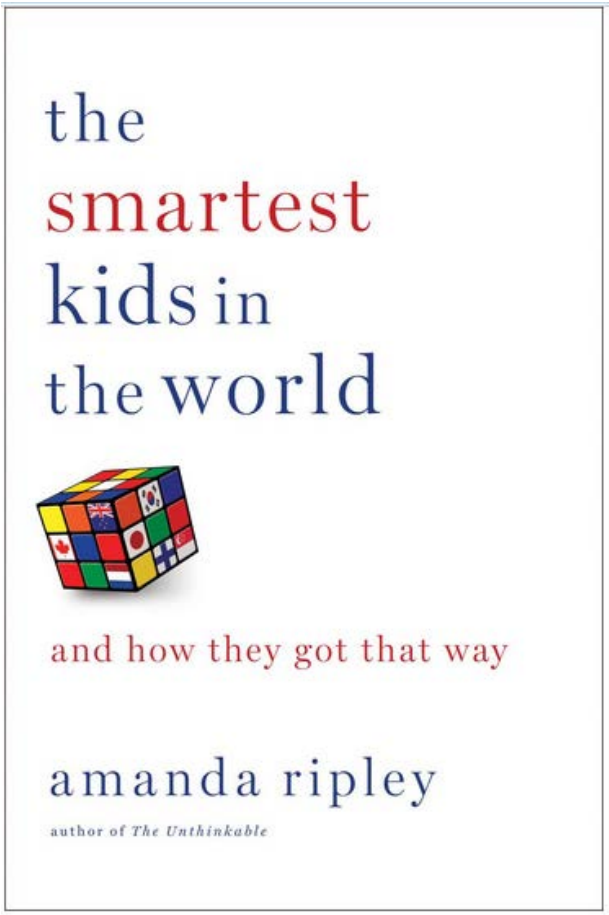
Research Inspiration



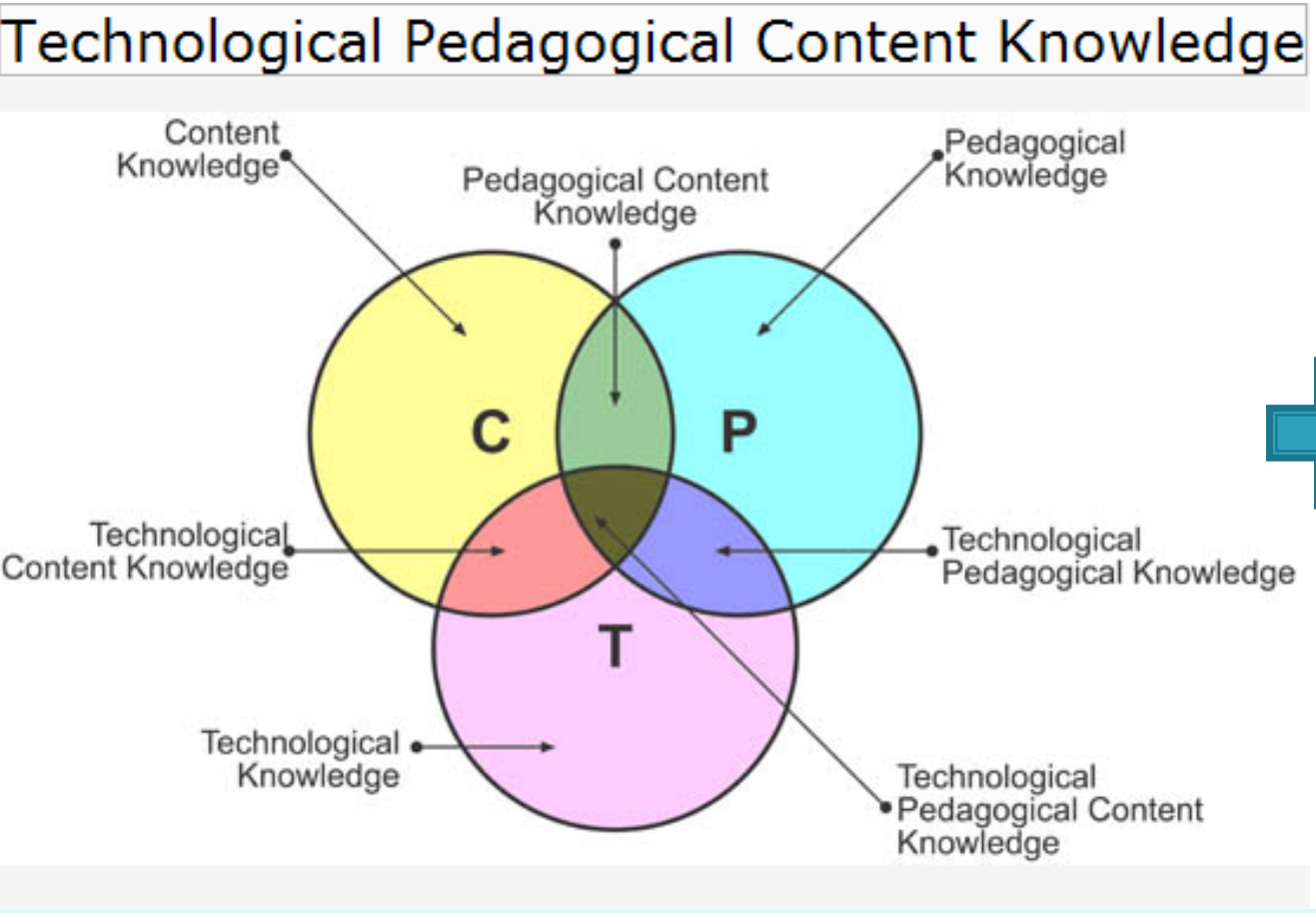




Big Picture: Research Goals

Figuring out how Technology can help us promote TCs' capacity & positive attitudes for Deliberate Pedagogical Thinking that Promotes Student Learning

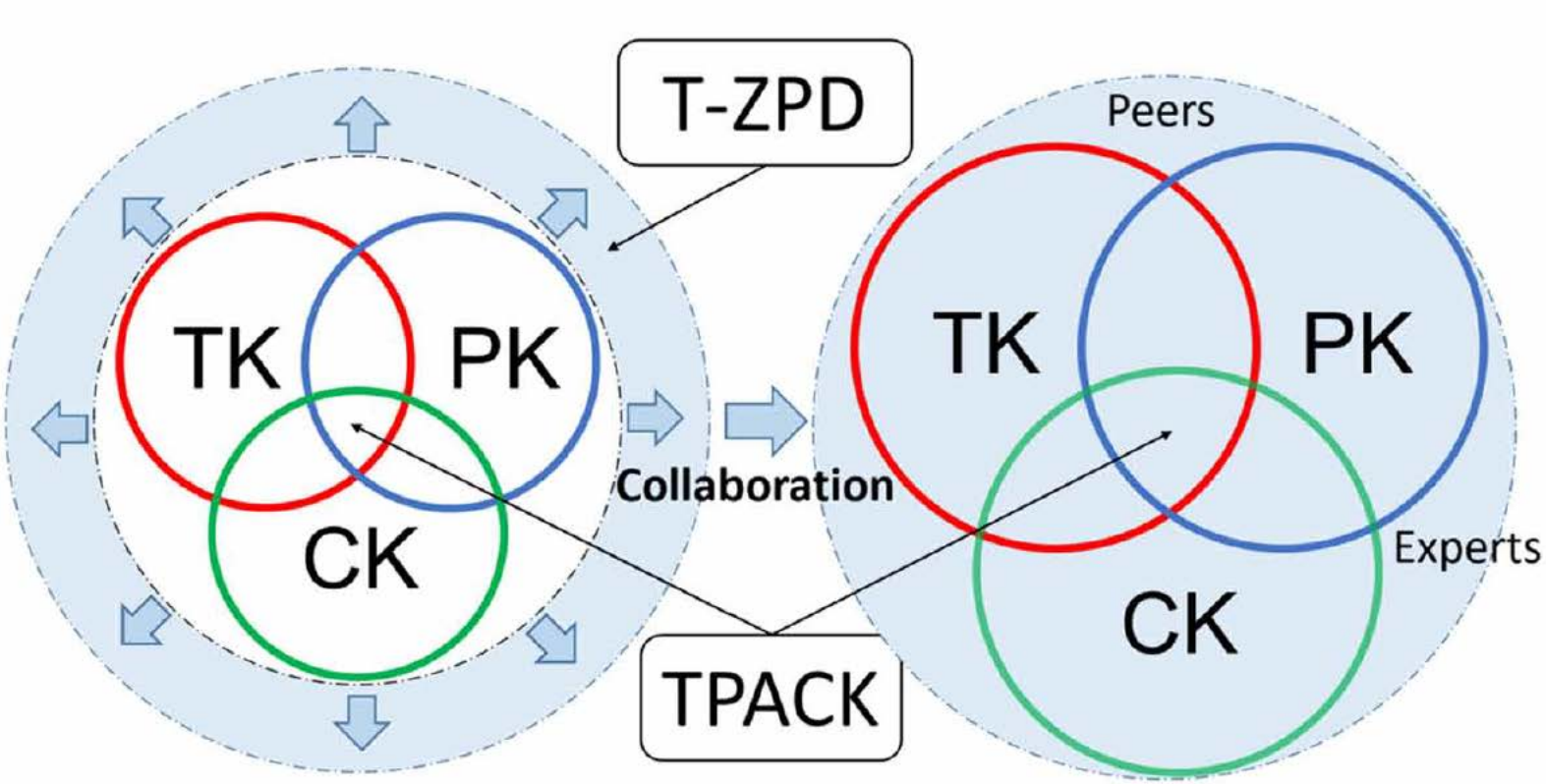
Original Theoretical Framework



Teachers' positive attitudes about educational technologies

M. J. Koehler and P. Mishra, "What is technological pedagogical content kn owledge?", *Contemporary Issues in Technology and Teacher Education*, **9**, 60 -70 (2009).

Our Theoretical Framework



Milner-Bolotin, M. (2017). Technology-supported inquiry in STEM teacher education: Collaboration, challenges and possibilities. In I. Levin & D. Tsybulsky (Eds.), *Digital Tools and Solutions for Inquiry-Based STEM Learning* (Vol. 1, pp. 252-281). Hershey, PA: IGI Global.

Chapter 10

Technology-Supported Inquiry in STEM Teacher Education: From Old Challenges to New Possibilities

Marina Milner-Bolotin
University of British Columbia, Canada

ABSTRACT

The chapter describes the implementation of collaborative educational technologies in STEM teacher education to support teacher-candidates in acquiring inquiry-based teaching skills and positive attitudes about inquiry learning. The focus is on five different collaborative technology-enhanced pedagogies: (1) Peer I... collaborative design of conceptual questions with Peer... inquiry via using live data collection and anal... ... and (5) collaborative re...

Milner-Bolotin, M. (2017). Technology-supported inquiry in STEM teacher education: Collaboration, challenges and possibilities. In I. Levin & D. Tsybulsky (Eds.), *Digital Tools and Solutions for Inquiry-Based STEM Learning* (Vol. 1, pp. 252-281). Hershey, PA: IGI Global.

Growth of Teacher Knowledge

- How do we teach (STEM and in general)?
- Who decides to go into teaching?
- How do we educate teachers?
- How do teachers use technology?
- How do teachers collaborate?
- How do teachers engage in Pro-D?
- What is considered “good teaching”?…

THE ANSWERS DEPEND ON THE CULTURE

Context: UBC, BNU, Daegu U

(a) (b) (c)

Research Questions

1. What are educators' perceptions of their own Technological Pedagogical Content Knowledge?
2. How do educators view the goals of technology use in their teaching?
3. How do educators perceive the limitations of technology use in their teaching?

Methodology: Participants

	Canada	China	Korea
In-service	81	51	185
Teacher ed.	9	0	10
Elementary	9	11	0
Secondary	81	40	195
Total (336)	**90**	**51**	**195**

(a)

(b)

(c)

Methodology: Study Instruments

Question focus	Question Format	# of Q's
Demographics, teaching info	Multiple choice	9
Self-reported TPCK competency	5-point Likert scale	6
Purpose of technology use	5-point Likert scale	10
Limitation of technology use	5-point Likert scale	7
Descriptive info. technology use	8-point Likert scale	9
Goals of technology use	Choose all	9
Import./Confid. in technology use	5-point Likert scale	18
Teaching philosophy	5-point Likert scale	20
Total number of questions		88

Methodology: Data Analysis

To test our hypotheses we used:

- T-tests
- One-way ANOVA

- SPSS was used as a statistical package

Research Question 1: Part 1

What are educators' perceptions of their own Technological Pedagogical Content Knowledge?

 (a)  (b)  (c)

	Knowledge	F	Scheffe
Importance	Content	3.708*	b>a,c
	Pedagogical	10.147*	a,b>c
	Technological	10.651**	a,b>c
Confidence	Content	4.534**	a>b,c
	Pedagogical	5.908**	a>b,c
	Technological	7.843**	a>b,c

Research Question 1: Part 2

What are educators' perceptions of their own Technological Pedagogical Content Knowledge?

Knowledge	Importance – Confidence	T-test
Content	0.164	3.406**
Pedagogical	0.262	5.032**
Technological	0.268	5.172**

Research Question 2: Part 1

How do educators view technology use goals?

 Canada	 China	 Korea
Improve: 1. Independent stud. learning 2. Communication between teachers, students & parents 3. Student content knowledge	Improve: 1. Documentation of student learning 2. Communication between teachers, students & parents 3. Independent stud. learning 4. Student content knowledge 5. Student social interactions	Improve: 1. Student content knowledge 2. Independent student learning 3. Student social Interactions

Research Question 2: Part 2

How do educators view technology use goals?


(a)


(b)


(c)

Knowledge	F	Scheffe
Develop critical thinking	3.779*	
Improve individualized learning	11.064**	a,b>c
Improve student social interactions	21.245**	b>c>a
Develop student content knowledge	1.862	
Improve documentation of learning	14.268**	a,b>c
Improve communications (T, St, Par.)	24.076**	a,b>c

Research Question 3: Part 1

How do educators perceive limitations of technology use?

	Canada	China	Korea
1	Inadequate technical support	Inadequate technical support	Inadequate technical support
2	Inadequate access to computers	Lack of comfort with technology	Inadequate software
3	Inadequate software	Inadequate software	Inadequate access to computers

Research Question 3: Part 2

How do educators perceive the limitations of technology use?

 (a)  (b)  (c)	F	Scheffe
Limited internet access	19.463**	a<b,c
Limited computer access	7.166**	b<c
Limited access to a computer projector	28.254**	a<b,c
Limited software availability	18.240**	a,b<c
Lack of technical support	3.144**	a<c
Lack of comfort with technology	66,195**	a<b,c
Lack of comfort with STEM technology	54.507**	a<b,c

Overview of Results

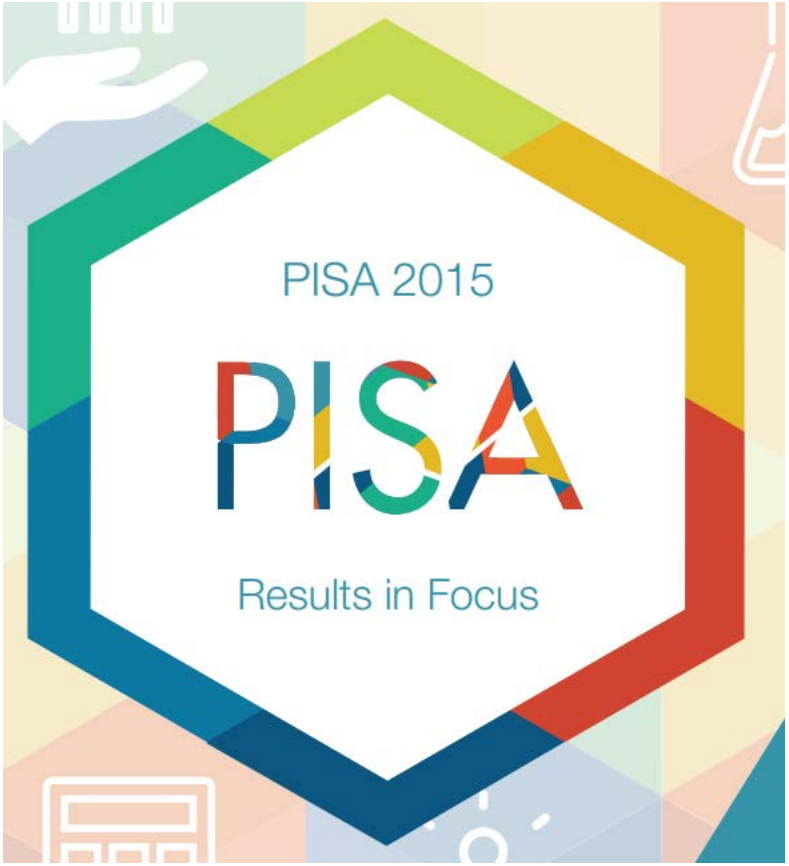
1. Educational goals, available support and TPACK confidence affect how teachers use technology
2. Teachers in developed countries indicate the lack of technical support in technology use in their schools
3. TPACK professional development is universally limited
4. Teacher-educators need more TPACK support

Implications for Practice

OECD
BETTER POLICIES FOR BETTER LIVES

Programme for International Student Assessment (PISA)

s Key findings Contacts



http://www.oecd.org/

Implications for Practice

Snapshot of performance in science, reading and mathematics

Countries/economies with a mean performance/share of top performers **above** the OECD average Countries/economies with a share of low achievers **below** the OECD average
Countries/economies with a mean performance/share of top performers/share of low achievers not significantly different from the OECD average
Countries/economies with a mean performance/share of top performers **below** the OECD average Countries/economies with a share of low achievers **above** the OECD average

	Science		Reading		Mathematics		Science, reading and mathematics	
	Mean score in PISA 2015	Average three-year trend	Mean score in PISA 2015	Average three-year trend	Mean score in PISA 2015	Average three-year trend	Share of top performers in at least one subject (Level 5 or 6)	Share of low achievers in all three subjects (below Level 2)
	Mean	Score dif.	Mean	Score dif.	Mean	Score dif.	%	%
OECD average	493	-1	493	-1	490	-1	15.3	13.0
Singapore	556	**7**	535	**5**	564	1	39.1	4.8
Japan	538	3	516	-2	532	1	25.8	5.6
Estonia	534	2	519	**9**	520	2	20.4	4.7
Chinese Taipei	532	0	497	1	542	0	29.9	8.3
Finland	531	**-11**	526	**-5**	511	**-10**	21.4	6.3
Macao (China)	529	**6**	509	**11**	544	**5**	23.9	3.5
Canada	528	-2	527	1	516	**-4**	22.7	5.9
Viet Nam	525	-4	487	**-21**	495	**-17**	12.0	4.5
Hong Kong (China)	523	**-5**	527	-3	548	1	29.3	4.5
B-S-J-G (China)	518	m	494	m	531	m	27.7	10.9
Korea	516	-2	517	**-11**	524	-3	25.6	7.7

Annual educational expenditures per student secondary per capita

$9543
18% of GDP

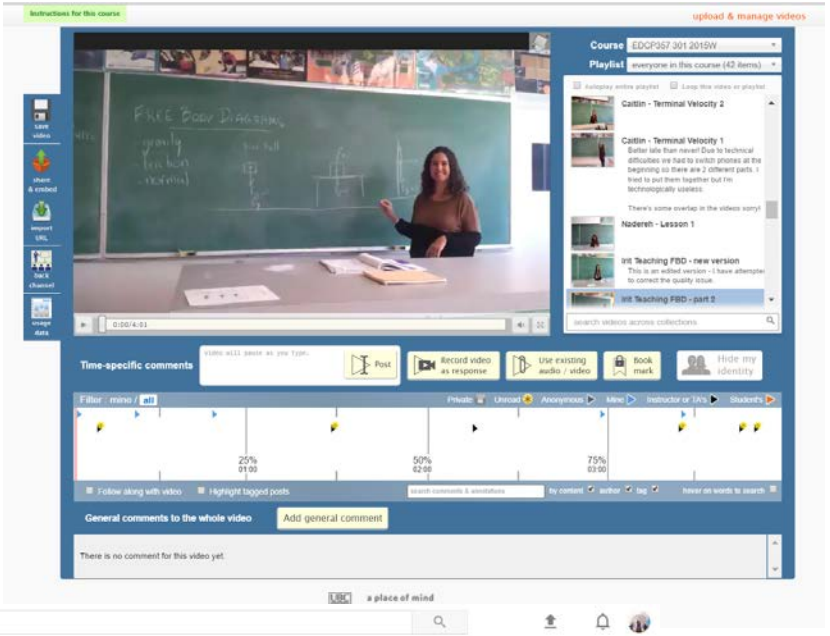
$100
12% of GDP

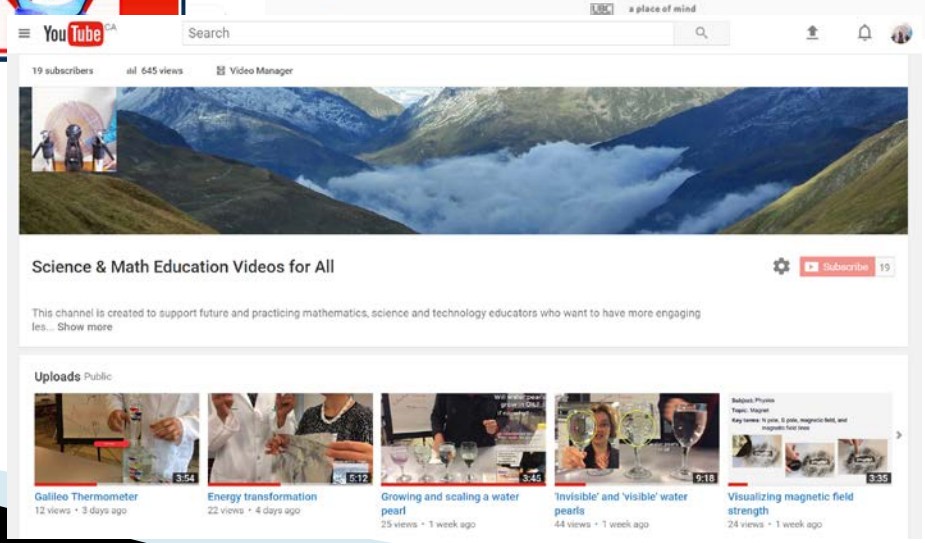
$6177
24% of GDP

Study Limitations

- We used a convenience sample in China, as we had access to a special group of teachers
- We had an unequal number of respondents from different countries
- Our overall number of respondents is relatively small

Future Directions





Part 3

To be continued: Big questions

1. HOW DO **WE LEARN** WITH TECHNOLOGY?
2. HOW DO WE **EMPOWER TEACHERS TO LEARN** WITH TECHNOLOGY?
3. HOW DO WE **UNCOVER OPPORTUNITIES** WITH TECHNOLOGIES INSTEAD OF DOING THE SAME OLD THING WITH NEW TOOLS?

Research Team Members

- Gerald Tembrevilla (Grad. Doctoral student)
- Solmaz Khodaeifaal (Grad. M.Ed. Student)
- Carlos Marotto (Grad M.Ed. Student)
- Davor Egersdorfer (graduated M.Ed., 2016)
- Murugan Vinayagam (graduated M.Ed. 2015)
- Alexandra MacDonald (graduated, MA, 2014)
- Heather Fisher (graduated, MA, 2014)