

CONFERENCE THE CHALLENGES OF MATHEMATICS EDUCATION IN THE DIGITAL AGE

CAJA CANTABRIA FOUNDATION, SANTANDER, FEBRUARY 27, 2020

Emerging technologies and Pedagogies in Mathematics Education

Dr Theodosia Prodromou

PhD, MSc, MA, BSc (Hons), DipTeach, DipArt, GCTE

University of New England, Australia

theodosia.prodromou@une.edu.au, theodosia.prodromou@gmail.com

EMERGING TECHNOLOGIES LEAD TO EMERGING PEDAGOGIES

- Potential changes in curriculum
- How learners and teachers interact with each other for a specific of time.

THE USE OF DIGITAL TECHNOLOGIES IN MATHEMATICS EDUCATION

- 1) dream-oriented research
- 2) adoption oriented research
- 3) humanity-oriented research
- (Chan et al., 2018)

I) DREAM-ORIENTED RESEARCH

- Simulate a virtual learning companion that could 'learn' together with the human learner under the supervision of a virtual teacher

2) ADOPTION ORIENTED RESEARCH

- spreading it out in the real world and searching for best practices:
- networked learning system that :a) enable students to interact in real time to support collaborative learning and competitive learning games.

2) ADOPTION ORIENTED RESEARCH (CONTINUED)

- network learning research, large network learning community.
- School-For-All.
- an online course
- MOOCs

2) ADOPTION ORIENTED RESEARCH (CONTINUED)

- Possibly taking hold of the global classroom, the impact of MOOCs is huge, driving the change of education at all age levels.
- there are still many rooms for improvement in order to search for the best practice and advance forward.
- collect large learner data, MOOCs will try to support adaptive learning through learning analytics.
- strategies developed in flipped classroom, small-scale online learning, and blended learning are in line with adoption-oriented research, a rich research area in the forthcoming years

2) ADOPTION ORIENTED RESEARCH (CONTINUED)

- Another avenue of adoption-oriented research is to rethink the architecture of how to design and develop curriculum by adopting emerging technologies.
- Neural network, visualization tools, semantic knowledge graph, cognitive map, as well as technologies for news generation, image generation, and video generation will provide enormous potentials.

HUMANITY-ORIENTED RESEARCH

- intends to develop learners' interest in learning
- maximize every learner's capacity
- and cultivate wellbeing of the globe as learners' value
- Difference between interest-driven approach and the school (examination-driven) approach.
- work with a group of researchers for a while to develop the interest-driven creator theory (Chan et al., 2018)

INTEREST-DRIVEN CREATOR THEORY (CHAN ET AL. 2018)

- hypothesizes that, with the support of technology, learning activities can be designed as interest-driven creation processes of ideas or artifacts
- Forming habits by repeating these processes as daily routines, learners will excel in learning performance, develop twenty-first-century skills, and enjoy their learning.

DEVELOPMENT OF TWENTY-FIRST-CENTURY SKILLS,

- communication,
- collaboration,
- critical thinking,
- creativity,
- and so forth.

-
- Today, learning should go beyond knowledge acquisition, and learners need to develop twenty-first-century skills while acquiring knowledge, or vice versa.
 - new pedagogies, with the support of technology, are needed.

QUESTIONS

- we used to be concerned about **what learners learn**, we now are also concerned **how they learn** and **why they learn**;
- we used to ask **do they learn**, we now also ask **can they learn** and **will they learn**.
- However, for me, the first concern is why they learn, and the first question to ask is **will they learn?**

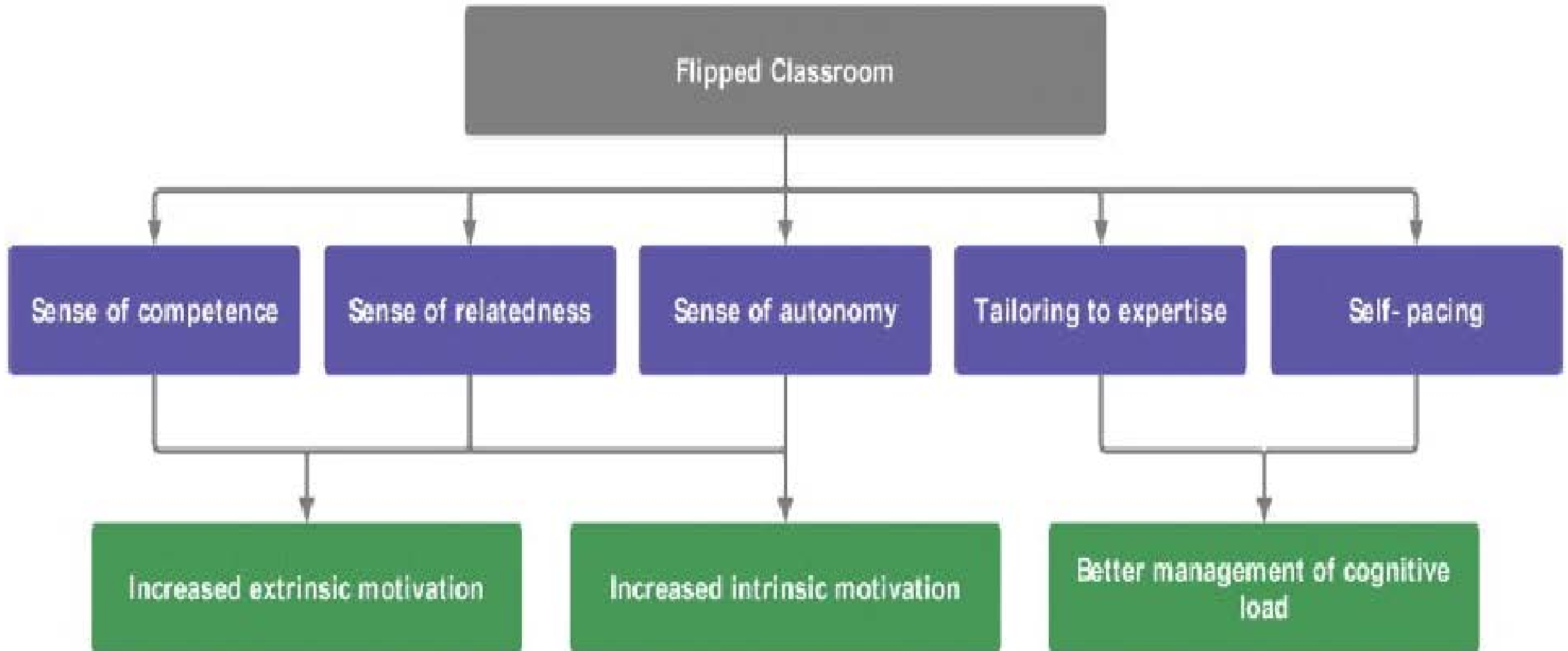
NEW EMERGING TYPES OF TECHNOLOGIES AND PEDAGOGIES

- **Heutagogy**, a form of self-determined learning. Instead of doing what teachers assign, learners are encouraged to explore areas of their interest and choose what they want to study or find their own problems to solve. Teachers' job is to provide a safe and supportive environment for their exploration and create opportunities for them.

FLIPPED CLASSROOMS

- Flipped classrooms integrate digital technologies allowing the teacher to implement the restructuring and re-organisation of teaching materials in both synchronous and asynchronous modes.
- The facilities of the classroom approach can be accessible from anywhere, in both real time or otherwise.
- How to best take advantage of digital technologies implemented in flipped classrooms is a challenge while attending at the same time to the dynamics of a flipped classroom and what is entailed in flipped learning

THEORETICAL MODEL FOR THE FLIPPED CLASSROOM



THE THEORETICAL MODEL FOR THE FLIPPED CLASSROOM IS:

- appropriate for gaining a better understanding of how the flipped classroom approach is implemented in practice.
- appropriate when analysing data about the teacher's role in organising the teaching materials in the flipped classroom. (Prodromou, 2016)

FLIPPED LEARNING

- increased interaction and personalized contact time amongst students and teachers;
- students take responsibility for their own learning;
- the role of the teacher is not the ‘sage on the stage’, but the ‘guide on the side’;
- a blending of direct instruction with constructivist learning;
- students who are not able to attend the class due to illness or extra-curricular activities such as athletics or fieldtrips, don’t get left behind;
- content is permanently achieved for review or remediation;
- all students are engaged in their learning;
- all students can receive a personalised education. (Bergmann, Overmyer and Wilie, 2013)

AUGMENTED REALITY

- Augmented reality (AR) is the technology that overlays virtual objects (augmented components) into the real world.
- These virtual objects then appear to coexist in the same space as objects in the real world. Augmented reality has the potential to transform how we interact with almost every industry today, and it will be equally transformative both from a consumer and an enterprise perspective. It's already transforming sectors like real estate, healthcare and education. AR is used nowadays with different learners (e.g., K-12 students, higher education students, and adult).

IMPLICATIONS-MERGING LEARNING

- When AR technology is used in educational settings, it:
 - 1) helps students to engage in authentic explorations in the real world
 - 2) facilitates the observation of events that cannot easily be observed with the naked eye by displaying virtual elements alongside real objects.
 - 3) increases students' motivation and helps them to acquire better investigation skills.
 - 4) creates immersive hybrid learning environments that combine digital and physical objects, thereby facilitating the development of processing skills (e.g., critical thinking, problem solving, and communicating through interdependent collaborative exercises.)

SUMMARY

- In the mid-eighties, we used dream-oriented research. We used a special computer for developing artificial intelligence programs. Now, almost every learner has one or more computing devices. In the nineties, we witnessed the emergence of adoption-oriented research, which is now flourishing. Currently, humanity-oriented research is still in its infancy. Bringing the potential of enormous impact to human future life and bearing the name of an emerging technology, artificial intelligence is coming back strongly to our territory of research. In future, we shall see how the three orientations of research co-evolve and change education, rapidly and effectively.

REFERENCES

- Abeysekera, I., & Dawson, P. (2015). Motivation and cognitive load in the flipped classroom: definition, rationale and a call for research. *Higher Education Research & Development*, 34 (1), 1-14.
- Bergman, J., & Sams, A. (2012). *Flip your classroom: Reach every student in every class everyday*. Washigton, DC: International Society for technology in Education.
- Chan, T.W., Looi, C. K., Chen, W., Wong, L. H., Chang, B., Liao, C. C.Y., et al. (2018). Interest-driven creator theory: towards a theory of learning design for Asia in the twenty-first century. *Journal of Computers in Education*, 5(4), 435–461.
- Prodromou, T. (2020). *Augmented reality in educational settings*. Leiden, (The Netherlands): Brill - Sense.

Thank you

- theodosia.prodromou@une.edu.au
- theodosia.prodromou@gmail.com