Café-débat "Sciences & Société" n° 6

Experiencing the digital in education

- Introduction:

Mathematical competences are currently the most sought-after skills on the labor market around the globe. Studies have proven that they are particularly important amongst the newly graduated in gaining access to their first employment. It suggests that strong mathematical competences increases the chances of employment across all economic sectors and even in jobs that do not require such competences (Durrani & Tariq, 2012). Other studies have found that poor mathematical competences are associated with lower earnings, savings and overall financial literacy as well as poorer health, lower levels of individual well-being and quality of life (Da Costa et al., 2014).

Educational systems have translated these trends in various ways, in some cases by increasing the number of hours of STEM subjects being taught: sciences, technology, engineering and mathematics. Another recent approach for tackling such trends has been the integration of ICT in teaching and learning. One OECD report highlights the rapid increase in the number of computers, tablets and Internet being used in classrooms in many countries (OECD, 2016). Learning with digital technologies offers many benefits, for example; materials can be adjusted to suit the needs of each individual as well as those of smaller groups; lessons become portable and accessible from various devices; and students, parents and teachers can approach learning in a more interactive way.

- National strategy – "Digital Lëtzebuerg":

Luxembourg is a country characterized by an exceptionally high immigration rate (46% of the national population has a foreign origin (STATEC, (2016)), a lifestyle, an economy and an academic environment characterized by multilingualism.

Following the trends presented, Luxembourg launched in 2014 the national strategy "Digital Lëtzebuerg". Its purpose is to assert the new direction of Luxembourg towards a modern nation, which is open, highly connected and ready to embrace a digital society. At the same time, acknowledging the potential of this digital strategy to support pedagogical innovation, in May 2015, the Ministry of Education, Childhood and Youth (MENJE) launched its strategy "Digital (4) Education" (MENJE, 2015). This educational direction has a dual role. First, it aims at preparing young people to live and work in the 21st century, a world now ruled by a

multitude of new technologies. Second, it aims at exploring ways of incorporating digital technologies as an integral component of classroom activities and learning, by offering students and teachers access to a wider range of diverse learning resources. This is expected to bridge the digital gap and enable the diversification of teaching and learning strategies to meet the various learning needs of the students.

- MathemaTIC, a project within the strategy "Digital (4) Education":

"MathemaTIC" (www.mathematic.lu), one of the projects launched by MENJE within the "Digital (4) Education" strategy, is being developed to meet the demands of the digital dimension: "Digital learner". The project gathered both national and international partners, such as the National Ministry of Education in France and the Luxembourg Institute of Socio-Economic Research (LISER). Our institute has been part of the team since the very beginning, with the task of supporting and monitoring the implementation, and evaluating its different outcomes at different points in time.

Mathematics was chosen based on national and international research findings, showing that from primary education onwards, students lack mathematical competences (EPSTAN, 2011-2013), especially arithmetical competences, which rely considerably on language. The digital learning environment "MathemaTIC" aims to facilitate the learning of mathematics by offering students all the learning materials (audio and written) in four different languages (German, French, Portuguese, and English), changeable at any moment while working in MathemaTIC.

MathemaTIC has several strong points. It bridges traditional paper-based learning and assessment with newer digital approaches. It uses innovative technology-enhanced items, a multi-adaptive process and real-time feedback to facilitate engaged and independent learning. The important language asset also facilitates autonomous student learning. More specifically, it is a national curriculum-based learning environment, which is adaptive and can be connected to the Internet through all devices, allowing students to work with MathemaTIC at any time anywhere, both at school and at home. It offers a student interface, with different exercises (items) and tools, and a teacher interface, in which teachers can follow the progress of their students as well as individualize and guide their learning.

On the student interface, each curriculum-based module in MathemaTIC is composed of items, which grows in difficulty and complexity. The simpler learning items are in the form of animated tutorials, which help students to acquire knowledge independently or to review acquired knowledge. The more difficult and complex items are of an applied and problem-solving nature, enabling students to deepen their knowledge and apply this in other

generalized or abstract situations. As the student works through each item, different forms of real-time feedback and adapted guidance is provided to the learners, with the aim of promoting independent learning and increasing their motivation. The students can also use a variety of special (digital) tools that help them solve problems. These tools are adapted to the age of the learners and developed based on principles of mathematics' didactics. At the end of a task, the student earns between one and three stars, which acts as an indicator of individual performance. By using this environment, children are expected to not only improve in mathematics, but also to increase their knowledge and understanding of other digital skills, such as logging in and out of programs, working with tutorials and working with specific digital tools (e.g., 3D geometrical representations, zooming, drawing, etc.).

The teacher can also use MathemaTIC through the teacher interface, thus providing a concrete space and content to identify specific learning difficulties and to offer differentiated support to each student based on their specific needs. As MathemaTIC allows students to choose their learning content and to progress in their own rhythm, there is a need for teachers to gradually adapt and integrate this new way of learning into their teaching practices, if embraced.

Parents can observe and work with their children on MathemaTIC at home and in one of the four languages that best suits them. Moreover, they can discover the explanatory tutorials and items (exercises, applications or problem-solving) with their children, thereby helping and supporting their learning process with MathemaTIC.

Finally, one example of research findings concerning a similar digital formative assessment tool « Snappet » in the Netherlands, evaluated the role of the platform in learning, in relation with feedback and monitoring (Faber, Luyten, & Visscher, 2017). « Snappet » allowed students to receive immediate feedback as well as an overview of their individual progress, which was also the case for the teachers. The findings of this research indicate that students using « Snappet » had higher scores in math tests and increased their motivation of learning mathematics. The general positive effects concerning their practice was stronger for students than for teachers.

- <u>Possible questions for debate:</u>

The debate will aim to question the actual opportunities that digital learning tools have to offer, as well as their real potential for equity and adaptability of learning. It is important to engage parents, students and teachers as well as to discuss the opportunities and challenges that digital technologies generate for our society, but also for schools and families.

Questions proposed for the debate:

- How the new digital technologies (e.g. digital devices, digital learning tools or platforms, and others) could be used to better approach the student diversity in the educational system?
- What are parents' view concerning the utility and role of digital learning tools and programs? How are digital devices and digital learning programs used at home?
- What are teachers' and students' opinions concerning the utility and role of digital learning tools and programs for learning? How are digital devices and digital learning programs used at school?
- Could the digital technology and tools help tackle the language background diversity in school? What is the degree of utility of the digital approach, according to you?

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