Trends in Higher Education and Innovative Pedagogical Practices

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Abstract: *This article presents three types of contemporary trends in higher education depending on their temporal significance based on NMC Horizon Report: fast, mid-range and long-range trends. It is made a comparative analysis of three year of researches and is presented an elements of the Creative Classroom Research Model for the needs of the Report to determine them. In the fast trend case is discussed growing ubiquity of social media and integration of online, hybrid, and collaborative learning. Rise of data-driven learning and shift from students as consumers to creators is reviewed in the mid-range trend. Long-range trends are including agile approaches of change and evolution of online learning. Lastly is made an analysis how MALog project corresponds to these contemporary trends.*

Keywords: *trends, education, developing, learning, online, hybrid, collaborative, social media, data-driven learning, student, creator, high education, university, innovative technology, MALog, project*

INTRODUCTION

The NMC Horizon Report: 2014 Higher Education Edition, examines emerging technologies for their potential impact on and use in teaching, learning, and creative inquiry within the environment of higher education. Over the decade of the NMC Horizon Project research, more than 850 internationally recognized practitioners and experts had participated in the creation of every annual report. The discussions of trends and technologies which present the adoption of technology in higher education are organized into three categories due to the temporal significance [1]:

- fast trend - driving changes in higher education over the next one to two years;
- mid-range trend - driving changes in higher education within three to five years;
- long-range trend - driving changes in higher education in five or more years.

Creative Classroom Research Model is a directive for each of the six trends examined bellow. At last is made a comparative analysis of the project MALog versus current trends.

1. Elements of the Creative Classroom Research Model

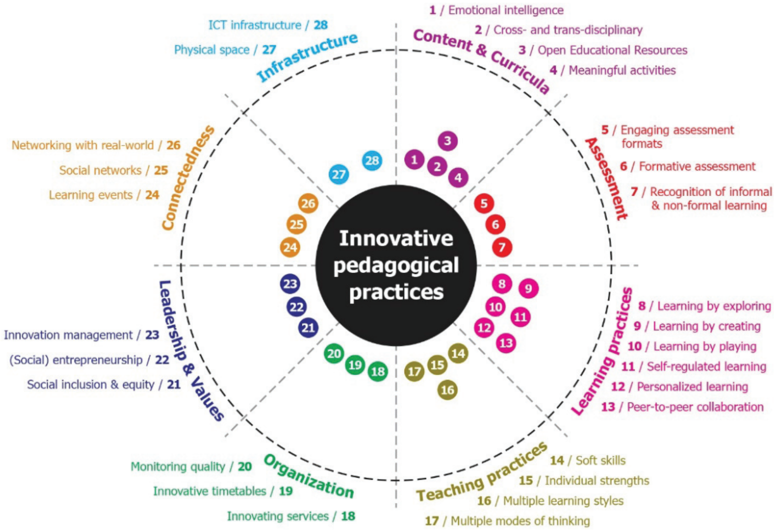

Figure 1. Elements of Creative Classroom Research Model

Up-Scaling Creative Classrooms (CCR) project, developed by the European Commission Institute for Prospective Technological Studies (IPTS) and pictured in the chart on figure 1, is used to identify implications for policy, leadership, and practice [2] that are related to the trends. The CCR multi-dimensional concept (8 key dimensions and 28 reference parameters) intends to capture the essential elements of Creative Classrooms which can be seen as 'live ecosystems' that constantly evolve over the time, mainly depending on the context and the culture to which they pertain. Focus is on the innovative pedagogical practices and on the systemic approach that is needed for the sustainable implementation and progressively scaling up of ICT-enabled innovative learning environments.

2. Fast trend

2. 1. Growing ubiquity of social media

"The top 25 social media platforms worldwide share 6.3 billion accounts among them," the Horizon report says. "Educators, students, alumni, and the general public routinely use social media to share news about scientific and other developments. The impact of these changes in scholarly communication and on the credibility of information remains to be seen, but it is clear that social media has found significant traction in almost every education sector" [1, p. 7].

For educational institutions, social media enable "two way dialogues between students, prospective students, educators, and the institution that are less formal than with other media", it continues, adding that educators are using them "as professional communities of practice, as learning communities, and as a platform to share interesting stories about topics students are studying in class" [1, p. 7].

2. 2. Integration of online, hybrid, and collaborative learning

According to Horizon Report: 2014 Higher Education Edition, "education paradigms are shifting to include more online learning, blended and hybrid learning, and collaborative models" [1, p. 10]. The introduction of more online learning platforms through courses make dynamic, flexible and accessible content. "To encourage collaboration and reinforce real world skills, universities are experimenting with policies that allow for more freedom in interactions between students when working on projects and assessments" [1, p. 10].

3. Mid-range trend

3. 1. Rise of data-driven learning and assessment

"There is a growing interest in using new sources of data for personalizing the learning experience and for performance measurement," the Horizon report says. "As learners participate in online activities, they leave an increasingly clear trail of analytics data that can be mined for insights" [1, p. 12]. Using platforms generate more information, which leads to the creation of models for training type library content and algorithms for fast data transfer.

3. 2. Shift from students as consumers to students as creators

Students rather than consumers of knowledge become creative thinkers by taking control of the development of research and analysis of research by including more practical experience. "University departments in areas that have not traditionally had lab or hands-on components are shifting to incorporate hands-on learning experiences as an integral part of the curriculum. Courses and degree plans across all disciplines at institutions are in the process of changing to reflect the importance of media creation, design, and entrepreneurship" [1, p. 14].

4. Long-range trend

4. 1. Agile approaches to change

According to the Horizon report, there is “a growing consensus among many higher education thought leaders” that institutional leadership and curricula could benefit from “agile startup models”. Such models “use technology as a catalyst for promoting a culture of innovation in a more widespread, cost-effective manner” [1, p. 16]. Involving employers in the planning process of learning, searching for “real world experience”, is structuring learning activities in the way that educators are able to experiment with new technologies and approaches before implementing them in courses and they have the opportunity to evaluate them and make improvements to teaching models.

4. 2. Evolution of online learning

Integration of some forms of face-to-face learning in the process of education is becoming a part of the perception of online learning. According to the 56-strong panel of experts that were consulted for the report, the advent of voice and video tools is increasing the number of interactive activities between online instructors and students and improving their quality.

5. Comparative analysis of researches done by NMC Horizon Report for 2012, 2013 and 2014

Table 1. Trends and Challenges in Education selected by years (2012 - 2014)

	Fast trend	**Mid-range trend**	**Long-range trend**
2012	Mobile Apps; Tablet Computing	Game-based learning; Learning Analytics; Integration of Online, Hybrid and Collaborative Learning; Role of the educator	Gesture-Based Computing; Internet of Things
2013	Tablet Computing; Massively Open Online Courses	Game-based learning; Learning Analytics; Integration of Online, Hybrid and Collaborative Learning; Shift from Students as Consumers to Students as Creators; Agile Approaches to Change; Role of the educator	3D Printing; Rise of Data-Driven Learning and Assessment
2014	Learning Analytics; Growing Ubiquity of Social Media; Integration of Online, Hybrid and Collaborative Learning; Flipped Classroom	Game-based learning; 3D Printing; Rise of Data-Driven Learning and Assessment; Shift from Students as Consumers to Students as Creators	Wearable Technology; Quantified self; Virtual Assistant; Agile Approaches to Change; Evolution of Online Learning

Above are presented trends and challenges in higher education of three NMC Horizon Reports divided by years. The results of the comparative analysis of [1], [3] and [4] show that the temporal significance of the trends is changing from long-range to short range period which proves what was predicted 2012 is completed by 2014.

6. MALog project

"Mathematical logic develops the kind of thinking that is needed by the future planners of technical devices in order to have end-user friendly, logical technical applications. This creates an urgent need for workers with mathematical logic skills in European enterprises" [5]. MALog project is created to "engaged with business enterprises who perceived a mathematical logic "skills shortage" within their organization" was said in the site of the project and it is discovered how this "skill shortage manifests itself in the workplace". To deal with this problem have been designed and deployed high-quality educational materials in a variety of mathematical logic and applied logic topics that best address these issues.

First specific goal of the project was to perform a needs analysis of schools, universities and business. At the beginning of the project the needs analysis survey was been conducted in high-schools to establish what mathematical logic learning material might be required. The data gathered from schools was used to lay the foundation for material planning and production.

The university partners Tampere University of Applied Sciences (TAMK) - Tampere, Finland [6], University of Warwick – Coventry [7], UK and Technical University of Civil Engineering Bucharest - Bucharest, Romania [8] had been responsible for the planning, development and evaluation of learning materials.

Representatives from companies had been interviewed to ascertain their particular training requirements which helped to collect relevant example problems from the real-life which is the second goal of the project.

The results of needs analysis helped the project to decide what kind of materials should be produced and how this material should be delivered. By giving a questionnaire to a target group of students, which were in the age bracket of 15-40 years with a mean of 20.6 years, the results had indicated a large percentage of students had spent little or no time studying the topic. In the course of the research the respondents answered "that the easiest ways of learning were "Exercise/problem classes", "Lectures/Classroom teaching" and "Working with the computer" , as the less time was spent on "Working with computer" (table 2) [9, p. 12]. This had indicated the students "would like to learn mathematical logic with the help of a computer, but at the moment the teaching does not offer such an opportunity" [9, p. 12]. The project is offering the solution to this problem and is coming to meet the needs of students.

Table 2. Environment –
from highest time spent to lowest time spent

Rank	Environment
1	Lectures/classroom teaching
2	Exercise/problem classes
3	Preparing for a test/exam
4	Individual study with learning materials
5	Individual study with example problems
6	Working with the computers

According to table 3 it was calculated that students identified example questions/answers and interactive demonstrations as particularly helpful with 34% and 20% respectively saying "very helpful". Combining the totals for very helpful and helpful together, these percentages rose to 79% and 63% [9, p. 13]. That leaded to another MALog project goal which was developing a list of suitable mathematical logic topics in the form of an ontology, prerequisites and different scenarios. At this point, at least sixty units of learning materials were produced as theoretical and practical tutorial material in mathematical logic, including practice assignments, visualizations and simulations using an innovative learning model by making an individual learning path available to each learner. This means each learner is able to meet his own individual learning requirements and goals.

Table 3. Helpfulness of the learning material format

Helpfulness (%)			
Learning material format	Helpful	average	unhelpful
Course book/textbook	54	34	12
Lecture slides	52	34	14
Example questions and answers	79	18	3
Exam questions	55	34	11
Interactive demonstration	63	27	10
Summaries of material	50	38	12

Learning materials are available in a variety of formats including PDF, Microsoft Word and Microsoft PowerPoint. Video files are provided in Ogg Theora Video format. Because the last goal of the project was to test and evaluate delivery of learning materials they are available in English, Finnish, Romanian, French and German and licensed under a Creative Commons license, which made them free to use to all interested European educational institutions and enterprises.

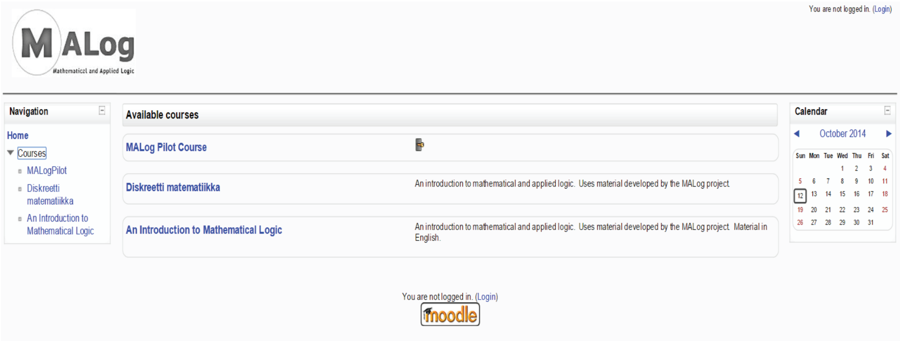

Figure 2. MALog on Moodle platform

On the other hand on-line delivery of materials is also possible through a learning environment (fig. 2) where the materials are integrated into other learning activities such as on-line quizzes.

CONCLUSION

Comparing the MALog project, which is created in 2012, with the comparative analysis of Table 1 it can be considered that corresponds to innovation pedagogical practices which refer to period 2012 – 2014. Therefore, a project that conformed to latest development of the trends is beneficial to education.

Mathematical logic is easily identified as an important topic of mathematics. It plays an important role in the field of engineering. The skills developed are important for creative and innovative problem solving, and help create a skilled future work force for a competitive and economically expanding Europe. The most important to handle logical and engineering tasks is to think logically. Links between the learning materials will further enhance their quality and usefulness.

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