SOCIAL CREATIVITY IN THE DESIGN OF DIGITAL RESOURCES TO AFFORD CREATIVE MATHEMATICAL THINKING

Chronis Kynigos¹, Maria Daskolia¹, Ioannis Papadopoulos²

Educational Technology lab, University of Athens and CTI & Press ‘Diophantus’¹
Dept of Primary Education, Aristotelian University of Thessaloniki²

The M C Squared European FP7 project was about supporting social creativity in the design of resources ambitioning a new genre of mediation in mathematics education. The resources were e-books meshing narrative with dynamic and constructionist digital artefacts. The project generated four socio-technical environments, each involving a Community of Interest producing 64 very diverse c-books. Embedding mathematics in narratives with a constructionist interactive element is considered as an activity re-addressing teacher, learner and material identity in a context of critique of mathematics education paradigms tightly associated with conformity, accountability, austerity and revelatory approaches.

RATIONALE, OBJECTIVE AND METHOD

In Mathematics Education there is a growing appreciation for the need of a paradigm shift in institutionalized approaches from a ‘guide to the knowledge monument’ to a ‘meaning-making’ and ‘creativity’ approach (Chevallard, 2012). Restrictions to meaning making and creativity mostly stem from the priorities of a pre-digital industrial age and are greatly enhanced by a culture of austerity, conformity, accountability and standardization in testing in our age of crisis.

The Mathematical Creativity Squared (MC2)¹ project was funded to build technologies, methods and communities supporting social creativity in designing resources ambitioning a new genre of mediating mathematical ideas and processes in education and enhancing teacher, learner and material identities (Chronaki, 2016). We called the resources in question ‘c-books’. C-books allow for the unrestricted meshing of narrative and dynamic -constructionist digital artifacts coming from any authoring tool (Kynigos, 2015). Our question was; How can we imagine (in the sense of

¹. The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement nº 610467 - project “M C Squared”, http://mc2-project.eu. The c-book technology is based on the widely used Freudenthal Institute’s DME portal and is being developed by a consortium of nine partner organisations, led by CTI&Press ‘Diophantus’. 

Skovsmose, 2015) a resource addressing a reader who can use it to also tinker, construct and explore with? Is there a way to facilitate the emergence of such designs? In the MC2 project we looked at the case of c-books affording creativity in mathematical thinking. As pedagogists, we asked the question: how can we foster creativity in the design and writing of c-books aiming to engage ‘readers’ in creative Constructionist activity for mathematical thinking? We perceived of the design process as collaborative in order to boost the flow and generation of new ideas. We saw pedagogical imagination as connected to the enhancement of teacher identity. We engaged a creative group of designers with diverse expertise –and coming from different communities of practice- to think outside-the-box about what a Constructionist book may look like. The project focused on the question of how we can study the design process and assess its potential for generating a new kind of mediation such as the c-book. The means to achieve this were based on the generation of Communities of Interest (Col) (Fischer, 2011). To help design the c-book and its associated data-analytics tools as well as enhance our understanding of social creativity in pedagogical design, the project generated and support four such Col who operated as a socio-technical environment, a living entity where the roles of “designer” and “consumer” are blurred and intermixed involving everyone (including learners) in the co-design of dynamic re-useable and re-constructible, educational materials for CMT.

In order to study the process of collaborative design and the meanings and identity interactions generated by the Col members two constructs were employed in conjunction to make sense of such cultures for professional design, the ‘documentational approach’ (Gueudet & Trouche, 2012) and the ‘boundary crossing with digital media as boundary objects’ approach (Akkerman & Bakker, 2011; Kynigos & Kalogeria, 2011).

RESULTS AND PRODUCTIONS

The project’s operational definition of creativity in CMT when addressing the affordances of a c-book was based on (Liljedahl & Sriraman, 2006) involving: fluency, flexibility, novelty/originality and elaboration. The integration of the ‘problem-solving and- posing’ view with the four cognitive components of math creativity was a key element in operationalising the definition in the context of the project. The project’s operational definition of Social Creativity in collaborative c-book design was defined in the MC Squared project as a complex phenomenon taking place in a particular context, a socio-technical environment where diversity within its social component becomes generator of creative processes and productions, while also novelty appropriateness and usability are core features of a creative idea or product.

The project developed a five-level method to evaluate social creativity
in collaborative design based on the unit of a creative idea and the illumination (level 5) versus measurability (level 1) dimension. Theory networking within the context of this project yielded some interesting aspects of the process of forging connections between theories, which were rather implicit in previous networking ventures.

The nested structure which we adopted to think of diverse frames, implied that there was a core research challenge which in our case was to illuminate social creativity by developing a more explicit language to understand its manifestations in the project’s specific socio-technical environment. What permeated the M C Squared work was the dynamics of the forged connections between theories which emerged in a functional way to facilitate the project’s objective to elucidate the core challenge. The two connectivity dynamics identified in the M C Squared project, ‘directionality’ and ‘complementarity’, yield two different kinds of connections. The former, directionality, places existing frameworks in a structured, hierarchical system, where any decision is taken with regards to the order of importance or closeness of frameworks to the research problem at hand. The latter, complementarity, places two frameworks at an equal distance. The important thing here is however that each of the two frameworks is used to explain a different aspect of an overarching parent frame.

The project’s productions were:

- technologies: a c-book author, data analytics module and a tool to support social creativity in collaborative design (called ‘ColCode’).
- resources: 64 c-books stemming from primary to tertiary, from
algebra to spatial geometry, from story driven to task driven.

- four CoI engaged in an impressive productivity and a rich meshing of expertise and viewpoints
- a contribution to the definition, the evaluation method, the theoretical underpinnings regarding social creativity in this context
- the quest for integrating approaches to theory.

CONCLUSIONS

The project set out to empower mathematics teachers in education by means of engaging CoI to ambition the generation of a new kind of mediation in mathematics education. This was considered a challenge both in relation to inherent resisting paradigms in mathematics education and in relation to an era of societal crisis focusing on conformity, accountability and austerity. The project's initiating of a search for new identities for teachers as collaborating designers of potentially new genres of resources, learners and materials can be seen as culturally responsive in the sense of Greer (2010). The aim for critical, imaginative, contextualized meaning making in situations where mathematics is a socially mediated tool, process and object in itself may help to generate sustainable identities in the context of societal crisis.

REFERENCES


