

DESIRING / RESISTING IDENTITY CHANGE POLITICS: MATHEMATICS, TECHNOLOGY AND TEACHER NARRATIVES

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This paper discusses how secondary mathematics teachers invest in discourses of 'change' as part of their professional development trajectories. The paper is based on an ethnographic study and focuses on a small group of mathematics teachers who are trained to become teacher trainers for technology mediated mathematics. Based on an analysis of 'teacher narratives' through interviewing and extensive participant observation, we claim that their professional development paths envelope both desiring and resisting identity change. The micro-physics of the everyday life in their school simultaneously requires appropriation and resistance of computer-based regulatory discourses about 'change' that in turn leads to unending, fluid and fractured identity formulations.

Teacher A: You shouldn't ask me, because you see me. At least myself, I was at a different phase at the beginning and I have now developed. I understood what you wanted, then I questioned it, then I was convinced and I, now, hold on to what I personally want from what you wanted.

MATHS TEACHERS AND TECHNOLOGY: INTENSITY FOR CHANGE

During the last day of a three month long training course for technology-based mathematics teaching and learning, a small team of mathematics teacher trainees and their tutors (the authors of this paper) discuss – as a way of collective reflection - the significance of the particular course for themselves as professionals. The focus soon shifted to the kind of 'changes' they had experienced in this particular training course. 'Change' -the desired outcome of the course- was almost felt as a pressure inscribed at different levels. At one level, the training course documentation itself – following dominant mathematics curricula reform recommendations (e.g. NCTM, 2000; Hershkowitz, et al., 2002; Mariotti, 2002; Kaput, 1992) - emphasizes 'change' in the sense of mathematics teachers developing certain 'new' skills, competences and attitudes through the use of appropriate software tools. On another level, mathematics teachers themselves anticipate, by means of participating in this training course, that learning about technology in mathematics would immediately result in significant 'changes', not only in ways they use and appreciate technology for mathematics teaching and learning, but also in ways they practice and value mathematics education in a broader sense.

Teacher A, as seen above, during that group discussion, argues that he has indeed experienced through the course a kind of 'change' – a change that has transformed him personally. In a surprising tone he says: '*You shouldn't ask me, because you see me*' - meaning that the aforementioned changes are obvious through behavioral changes. His experience of change is described as a turbulent cycle where he moves

from trying to interpret what the tutors demand (via the documentation and the practices that are modeling in the course) towards problematising those demands and choosing what he appreciates as useful for his teaching. Teacher A seems to appropriate the underlying discourse of 'change' through computer-based mathematics as he narrates an almost smooth developing path that highlights an identity transformation towards a 'new' mathematics teacher identity. But, is it really so? And is it so for any teacher?

A few weeks after the training course was completed, and as teachers go back to their daily school duties and routines, the discussion continues at a personal level of interviewing. The issue of 'change' comes up again. The teachers now talk about 'change' as a more complex experience that cannot be detected at a behavioural level and they talk about 'change' as something that cannot be really achieved. Humour helps them to cope with the uncertainty of having to deal with this utopian experience of 'change':

Teacher B: When Axxx (a tutor) was asking during the last day of the course how 'technology' has changed us, he (Teacher A) said: '*Why do you ask? Don't you see me?*' We now have used this as our slogan. When we talk with other colleagues, we ask '*How do you see me? Have I changed?*' (laughter)

Contrary to initial views (see what teacher A says above), teacher B resists the discourse of a smooth 'change' simply by means of technology-use. Along with colleagues teacher B jokes about the possibility of any noticeable 'change'. Humour is a significant characteristic of cultural communities (even animal communities) and jokes, in particular, constitute powerful metaphoric forms of communication. Currently, anthropological studies draw attention to biosocial and evolutionary aspects of humour as intrinsic aspects of social life and relations (Apte, 1985). Handelman and Kapferer (1972) argue that a 'joking license' must be allocated for jokes to be communicated amongst friends and companions. This 'license' constructs a context in which participants are issued the freedom – within boundaries - to insult or abuse one another without damaging the relationship between the parties. Hence, events of humour can even be approached as important conceptual and methodological tools because they provide insights into behavioural and cultural patterns of societal relations and support to express, to describe and to evaluate taken for granted institutional symbols, relations and values.

In our case, teacher B and his colleagues seem to have this 'joking license' to talk about 'change' and laugh about the incomplete process of changing towards a 'new' mathematics teacher identity. The significance of this humorous event points out a shared concern amongst teachers that aims to disturb the stereotypical image of computer as a 'mythical' and 'heroic' mediator for enhancing change in mathematical school life and culture. It further indicates their experience of 'identity change' as a complex and slippery process with ups and downs, risks and ambivalences - a process that envelops strain, fear, and uncertainty. Their humour, thus, highlights the 'gap' between the actual and designated phases of their becoming as computer-maths

teacher trainers and as such indicates also the reinforcement of a specific desire. Brown and McNamara (2005) resort on Lacan who suggests that '[...] *the distance between life and its supposed symbolisation must not be obliterated. This very gap creates the desire and shapes life itself*' (p. 35).

COMPUTER-BASED MATHEMATICS AS A 'CHANGE' MACHINE

The rapid pace of technological change, characterising the end of the twentieth century and the beginning of the twenty-first, leads to the rise of what Lister et al (2003) call 'upgrade' culture. Computer related hardware and software products become parts of continuous 'upgrading practices' and, as such, the notions of 'computer' or 'media' become reconstructed as technologies in flux. In this way the computer, along with varied forms of digital media, are easily seen as non-fixed, non-achieved or non-stable pieces of technology. Instead, the very notion of 'computer' and 'technology' pinpoints to continuous cycles of innovation and renewing.

Simulation technologies developed within computer science in the 1960's have challenged traditional visual culture through new visual media and imaging technologies (e.g. virtual reality and digital cinema). Central issues for theories of photography, film and cinema have been their realism and the nature of visual representation. Such deeply embedded traditions in Western visual representation forms become now reconsidered in the light of practices such as virtual reality simulation, computer-generated animation, modelling applications etc. New visual media create new visual cultures and pave the path for new social-semiotic cultures. They enable possible re-readings of cultural relations and promote varied representations and imaginations of both historical and future worlds. The late 1980's brought significant technological changes in the educational and popular culture(s) terrain with 'tools' that emphasize, amongst others, computer-mediated communication, new ways of distributing and consuming media texts characterised by interactivity and hypertext forms, virtual reality - from simulated environments to fully immersive representational spaces, and a whole range of transformations and dislocations of established media such as photography, film and television.

In mathematics education, the emphasis on 'new media' choice continues to be placed on specific software environments that support the learning of particular mathematical content. As such, digital tools for dynamic geometry, computer algebra, data handling, statistics, programming and modelling aim to encourage the development of specific mathematical skills and competences within the boundaries of certain curriculum areas (see Hershkowitz et al., 2002; Ruthven et al., 2009). However, we recently witness an expansion towards web-based communicative contexts such as *TeleCabri* - the web version of Cabri-geometer - that represents real time teaching at a distance (Balacheff & Kaput, 1996). In addition, numerous websites are now designed and maintained aiming to enhance instruction, to provide tutoring, to serve as resources to teachers and learners, and to become the platform

for developing projects and collaborative activities between schools and classrooms cross-nationally (Chronaki, 2000).

At the very least, we face on the one hand, a rapidly changing set of technological experiments and, on the other hand, a complex set of interactions between new technological possibilities and established media forms. New mathematics education technologies constitute social institutions of mathematics education practices that are simultaneously independent and inseparable from established commercial and educational cultures on which they draw to advance and support their agendas for design and implementation frameworks. These 'new' media become disseminated, received and consumed by and through their various audiences (teachers, pupils, parents, the state, the market). The politics of the hidden curriculum (via subject content and assessment procedures) acting as 'ideological state apparatus' (see Althusser, 1971) guide and control the shaping and distribution of 'new' technology products for mathematics teaching and learning. One of the teachers, as part of her observations of teachers' authoring activities for 'new' technologies in mathematics teaching, observes how teachers become trained to appropriate certain discourses about software use:

Teacher V: [...] Reading the work of last semester (teacher) trainees referred to Fxxxxxx software I get the impression that these people, without being aware of it, worked for a serious advertisement for this particular software. It is as if they were paid to advertise it.

Teachers, at large, experience the imperative for change being mediated by the 'newness' offered by computer hardware and software. The sense of the 'new' becomes a reference to the most glamorous and recent, and this in turn carries the ideological sense that new equals better. The 'new' signifies 'the cutting edge', the avant-garde, the place for forward-thinking people to be as designers, producers and practitioners. Discourses of 'change' as connotations of the 'new' are related with the long-lasting modernist belief in social progress and development as smoothly delivered by technology. Most of the teachers, unlike teacher V above, appropriate varied discourses of professional 'change' towards the 'new' with romantic enthusiasm.

Investment in discourses related to the revolutionary impact of technology (and new media) assumes that there are profound transformations of everyday life that are taking place in terms of both structural organisations and evolving relationships amongst humans and computers. The transformative nature of 'new' media is expected to influence identity sense, habits of consumption and communication, politics of gender and age, as well as local/global geopolitics.

The transformative impact of 'new' media in mathematics education has been mainly discussed in terms of teachers' epistemological, pedagogic and didactic potential for change through a number of experimental case studies that exemplify beneficial potentials. But, technology integration in mathematical classrooms remains a

challenge for most maths teachers (see Ruthven, Hennessy, & Brindley, 2004). Moreover, teachers, as also our study reports, rarely narrate experiences of any transformative learning as far as their professional practices are discussed. However, they engage with discourses of ‘change’ as they talk about the potential uses of technology in mathematics education. Change embodiment can be incorporated into an understanding of teacher-self as part of broader ‘identity change’ politics. Our intention in this paper is to explore how teachers use notions of ‘change’ discursively when they talk about technology-mediated mathematics. Our interest in this paper is the political dimension of how desired and/or resisted ‘change’ constitutes identities and how these identities are assigned to maths teachers through discourses, narratives and performances.

THE STUDY: CONTEXT, SUBJECTS AND METHODOLOGY

The present study is part of a larger ethnography (in-progress) concerning how a small group of 11 teachers (7 maths teachers and 4 language teachers) narrate their professional ‘development’ as they learn to become teacher trainers for computer-based mathematics. The research study took place in the context of implementing a specific teacher training course for technology in mathematics education (see PAKE, 2007). Because the Greek Ministry of Education had directed the nationwide initiative of training teachers to be ICT trainers, the training course had rather a centralised character. Specifically, there were central ‘national’ guidelines to be followed by the university departments that undertook the course implementation, including common tools to be used, and common methods of implementation and assessment. As a result creative initiatives were prevented from growing and emerging. Within this context, we aimed to capture how teachers appropriate and resist certain discourses of ‘identity change’ in terms of disciplinary cultures, curricula and possibilities for technology use. A preliminary analysis suggests that discourses of ‘change’ embrace talking about experiences with technology as ‘fluid shifts’ from established disciplinary norms towards ‘new’ routines, rituals and politics of representing, communicating and producing mathematical knowledge. Discourses of identity change politics as ‘content-aesthetic’, ‘power relations’ and ‘cultural/discursive’ shifts are discussed in the section below.

CHANGE AS CONTENT-AESTHETICS SHIFT

Amongst the most commonly used arguments concerning the valuing of ‘new’ technologies in mathematics teaching is that specific software and tasks enable an aesthetic change of mathematical content representation on the computer screen and enhances human-computer interaction. Teachers contrast the imagined enhanced aesthetics (e.g. via exemplary cases) with a harsh reality of an established mathematics culture. Talking about their experiences of current mathematics education localities (i.e. emphasis on content, paper-pencil and teacher-chalk, national exams for university entry, private tutorials etc.) teachers claimed that the system serves to place emphasis on training students to solve difficult (but not

necessarily challenging) mathematical problems and on making them competitive problem solvers. Teachers seem to agree that the situation is almost tragic and claim that ‘something must be done’, or ‘we cannot continue like this’.

At the very beginning of the course, teachers were asked to write down a few verbs that exemplify what children do in a mathematics classroom. Jokingly, they referred to verbs such as ‘sleeping’, ‘moaning’, ‘doing exercises’, ‘waiting for time to pass by’, ‘sitting still’, ‘solving problems’, ‘sketching figures’. Verbs referring to ‘having fun’, imagining, being creative, sharing ideas or experimenting were completely absent from their list. Thus, given the above context, technology – as also other innovative initiatives (see Thale’s friends: a popular community for mathematical literature reading in Greece) - becomes a savior or an easy solution to a long-term problem. When mathematics teachers were asked how technology might support their teaching, they referred to learners being enthused, attracted, motivated and engaged participants.

Teacher C: Children become enthused. To start with, they become enthused due to the fact that this change [from paper-pencil to computer use] takes place. And the children ...absorb what you say to them.

Teacher A: This medium is more attractive, for sure. It [means the computer] will place the learner ...It will make him ...in simple words... not bored from the endless bla, bla...even from the dialogue [means talk] during the lesson. It is different. It is more attractive. It will support pupils’ engagement..

Teacher P: [...] In this technology lesson. You must see them [implies the pupils]... all of them. Focused. Ah, do you believe it?! This thing happened! This thing happened in a vocational school.

Enhancing the variety and appeal of classroom activity was amongst the emerging themes identified by Ruthven et al. (2004) in a study concerning teacher representations of successful use of computer-based tools and resources. Teachers, as in our study, referred to activities involving technology as ‘something different’, ‘making a change’, ‘a change from the routine of the classroom’. We can add, based on our data, that the ‘novelty’ and ‘appeal’ associated with technology-use is coupled with mathematics being approached as a commodity - a commodity that needs immediate change. This change, in the teachers’ words, will need to take pupils from inertia to activity, from boredom to creativity and from a disciplined reading of mathematical content to free expression. They indicate that the ‘new’ screen aesthetics (e.g. multiple representations, the dynamic image, simulations, modeling of real life situations etc.) happen as part of human-computer interactions and can capture pupils’ attention and imagination. These ‘new’ content-aesthetics are inextricably linked to teachers’ and pupils’ increased awareness of a mathematics culture that has ceased to motivate and inspire teachers and pupils alike. This rise in consciousness is supported by increased tensions with a post-industrial information

age shift (see Castells, 1996) that stresses a shift in employment, skill and production of material goods in which new media seem to epitomize.

CHANGE AS POWER RELATIONS SHIFT

Teachers have come to see the implication of their ‘new’ role as users of computer-based mathematics as having to change from being a transmitter of knowledge to a facilitator of knowledge construction (Chronaki, 2000). In the computer-mediated classroom, the teacher as a transmitter of information and controller of knowledge is becoming redundant and is being replaced by a co-worker, co-learner, facilitator or supporter to pupils’ learning (Schofield, 1995). Teachers in this study seem to embrace this discourse with some anticipation:

Teacher A: [...] for pupils, if we can create this move for pupils. To talk. To try and try. To explain why we did such and such. They will feel it as theirs..[...] the knowledge that will come later on. They will feel it belongs to them. In other words, it [mathematical knowledge] does not come from the teacher. Or, if you like, it has been validated by the machine (means the software). I think, in this way, we win the students. We win them...

Reading through the above extract we realize, at first, a disappointment of an established culture of human interactions amongst teacher-pupils with unequal power dynamics. Teacher A relies on the computer as a ‘power mediator’ that might disrupt established power dynamics. Power is thus becoming distributed more evenly amongst pupils, teachers and computer. The teacher, thus, does not need to directly control their teaching activity because the ‘control’ is regulated via the machine. The computer-in-use, acts as another type of bureaucracy (as a panopticon machine or a technology of power) disciplines and contributes to a process of disindividualisation – a tendency to think that power resides in the machine itself rather on those who use and operate the machine (see Foucault, 1977). This form of ‘disindividualised power’ rests on the view that power resides in the machine itself. The computer becomes, for teacher A, a hidden mediator of teacher and curriculum power over the process of constructing knowledge. This discourse, in some way, entices learners making them believe that teachers are not controlling their activity and that they are free to choose their learning path.

CHANGE AS CULTURAL/DISCURSIVE SHIFT

As mathematics teachers experience the move towards becoming computer-based teacher trainers the intensity for change relates to their intention to enrol within both a ‘youth’ and a ‘scientific’ community. Through the training course, they are required not only to learn using specific ‘new’ media, but also to read academic papers that justify theoretically and empirically the choice of specific software and to provide examples of design and evaluation of computer-based mathematical activity. Involvement with technology was seen by some mathematics teachers as a way to connect with pupils and bridge an age generated cultural gap:

Teacher V: [...] If we are disconnected from pupils [...] they wouldn't be interested at all for all we try to pass on [...]. We will cease be convincing. We will belong to the Paleolithic age.

Whilst, new media enable them to bridge the generation gap between themselves and pupils, becoming trainers stresses the need to develop a theoretical language that supports a move to becoming 'scientific'. Laughter helps them again to cope with the complexities of this becoming process.

Teacher P: [...] I do not know what these theories talk about [...]. For activities-scenario description I saw pages and pages [...]. And I said, I am not going to read and learn all these. I quitted. And instead, I turned to read Einstein's theory (laughter)....//

(later on)

Tutor: (refers to the notion of 'didactic outcome' and explains it)

Teacher P: I do not understand such scientific jargon [...]. Ok?! I am asking now my colleagues. To see who has realized the meaning of this term...

(later on)

Tutor: [...] please, have a look now what I can do with this tool (refers to a specific software). It is a simple thing.

Teacher P: (using irony). Ok. It is possible. It has positive effects of learning ... according to Vygotsky. (laughter from all)

BY WAY OF CONCLUSION

This study aimed to identify how mathematics teachers who experience the complexity of becoming technology-use trainers invest in discourses of 'change' as part of a complex identity-work process. Teachers experience the intensity of 'change' and 'identity change' as they are introduced to course material (theoretical resources and practical classroom activity design) and to the demands of technology integration in mathematics classrooms. It became obvious through our study that teachers' investment in discourses of 'change' is not an individual issue. Instead, they resort collectively and politically on past experiences and future aspirations about mathematics curriculum reforms taking into account the constraints and demands of their everyday realities in school classrooms and communities. They discuss 'change' as 'fluid shifts' to something 'new' referring to content-aesthetic, power relations and cultural/discursive developments. 'Change' refers to contextual issues and 'identity change' is inscribed as a continuous move amongst possible acts and potential imageries about how these acts could adopt or resist 'change' in a material sense (i.e. content representation/simulation on screen, communicative rituals, routines and politics).

Whereas a modernist approach to understanding social life would view the individual as an agent having an authentic core of essential identity and being responsible for

social transformation, the present study comes closer to a post-structural conception of the self as involved in a continuous production of identity in historical, discursive and material contexts. Imagined discursive practices of ‘change’ as they are related to technology-use by mathematics teacher-trainers operate towards identity-politics that stress individuals binding to certain subject positions that involve the development of ‘new’ teacher/learner roles by means of using ‘new’ media.

Stressing the transformative role of ‘new’ media is an old concern that reflects broader socio-economic politics (see Castells, 1996). As far as ‘new’ media are concerned with mathematics education their transformative role, while a main concern amongst many stakeholders, is not widely experienced by teachers in the everyday experiences at school. Even the teachers in our study who obtain an intrinsic motivation for technology integration and a desire for change, experience ‘change’ not only as a complex and turbulent process but also as unachievable. Through humour they disrupt predominant notions of a smooth ‘identity change’ by means of ‘new’ technology use. At the same time, they invest in discourses of ‘change’ such as content-aesthetic, power relations and cultural/discursive shifts. Mathematics educators seem to adopt collectively those claims hoping that broader ‘changes’ in mathematics education can be materialised. Technology-based mathematics education becomes a heavy political arena that serves to regulate teachers, learners and curriculum designers toward a particular collective identity change in the name of the ‘new’ mathematics teacher.

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