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Dualism in an Attempt at Pedagogical Change

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Abstract: Successful pedagogical change is notoriously difficult. We attempted to a pedagogical change in one Israeli elementary school, leading teachers to implement a project-based learning model. Our study used rich data sources and an ethnographic approach to understand schooling before, during and after the intervention. We observed a pattern of "dualism", in which contradicting elements co-exist side-by-side. Our findings highlight the need to acknowledge the competing forces operating in a system while adopting a change.

Key words: barriers of change, dualism, ICT, innovative pedagogy, 21st century schooling

1. Introduction

It is widely agreed that life in the 21st century involves new challenges and requires the development of different skills than life in previous centuries. The rapid proliferation of information and communication technology (ICT) and social media, and their increasing role in everyday life, present school systems with the need to prepare students for life in a changed world. Many states are attempting to change their schools and adapt them to the 21st century, in particular to bring about learner-centered, technology-embedded pedagogical approaches.

The design and implementation of such reforms is often fraught with problems and traditional methods of schooling remain prevalent (Law, Pelgrum, & Plomp, 2008; OECD, 2015). The public and academic discourse on educational change often takes an approach that attributes the gap between de-jure and de-facto change to educators' deficiencies (e.g., lack of or flawed knowledge, unsuitable dispositions, etc.).

In this study we took an ethnographic approach to observe and investigate the behavior, communication patterns, workflows and tasks of the relevant actors — teachers, school management and the municipality education administration and the Ministry of Education — in their authentic environment during an attempt at pedagogical change. Specifically, we designed and implemented a learner-centered, technology-embedded pedagogical program. We traced the school through a full school year, studying its everyday interactions. Analyzing the individual case, we sought to shed light on education change processes.

We document the school's struggles to adopt a learner-centered pedagogy, in contrast to the technology itself which was readily integrated. With respect to changes in pedagogy, we introduce the notion of dualism, the coexistence of contradicting values and worldviews, or metaphorically, "double-voicedness". One voice expresses the new vision, a future we want to pursue, while co-existing alongside a second voice, which reflects the existing regime. We examine how these contradicting forces can be seen in various school levels and players. We argue that

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this dualism within the school system critically impacts the system's readiness to adopt innovation.

2. Literature Review

2.1 Traditional vs. 21st Century Schooling

"Traditional" schooling is characterized by information-focused agenda and teacher-centered practices. School in industrial society had prepared students for life by equipping them with a certain body of information, deemed important and canonic. Teacher-centered practices were efficient in traditional schooling's information-focused agenda. A common example of teacher-centered practices that aligns with the information-centered agenda is the IRE pattern for classroom discussions (Lemke, 1990): Teacher initiates a question, student responds, and teacher evaluates.

Many scholars contend that traditional schooling agenda and practices, still predominant in schools all over the world, are unsuitable for current times (e.g., Kozma, 2003; Mioduser, Nachmias, & Forkosh-Baruch, 2008; Voogt, 2010; OECD, 2015). Bereiter (2002) claims that the dominant metaphor of the mind, is that of a container. This metaphor is handy for talking about the acquisition of knowledge. It is less useful for talking about what the knowledge is good for once it is in the container, for example, how pieces should be organized to support the learners' ability to apply that knowledge creatively in new situations and contexts, deemed important for life in the 21st century.

It is suggested that schooling should move beyond information to dynamic epistemology (Scardamalia & Bereiter, 2006) and put the emphasis on new literacies and dispositions and new forms of expertise, often collectively referred to as 21st century learning or life-long learning competencies (Bereiter, 2002; Scardamalia & Bereiter, 2006; Hargreaves, 2003; Law, Pelgrum, & Plomp, 2008; Papert, 1993, 1996; Voogt, 2010).

For this new form of learning to occur, the teacher and the student need to leave behind their traditional roles and create a "third space", in which they can form a new kind of dialogue (Gutierrez, Larsson & Rymes, 1995). In this dialogue, the teacher does not merely transfer information, but rather, what counts as "knowledge" is negotiable between teacher and student. To reach the "third space", the teacher needs to give a voice to the student and allow her to add and contribute from her own world to the course of the lesson.

In order to nurture these skills and competencies, learner-centered practices should become more prevalent (Law, Pelgrum, & Plomp, 2008; Voogt, 2010). We refer to pedagogies aimed at nurturing these skills as innovative pedagogies.

2.2 Teachers' New Role and Knowledge

To identify the knowledge teachers need to teach effectively with technology, Koehler and Mishra (2009) suggest the framework of Technological Pedagogical Content Knowledge (TPACK). The model identifies three primary forms of knowledge: Content Knowledge (CK), Pedagogical Knowledge (PK), and Technology Knowledge (TK) and suggests conceptualizing teacher knowledge as to how to teach effectively with technology as located in the intersection of all three forms of knowledge, thereby emphasizing that using technology is not merely a technical matter. To use it in ways that will create new learning and benefit students and teachers, call upon teachers to function more as *instructional designers* than direction-followers, more as "chef" than "cook" (Harris, 1997): A teacher who acts like a "chef" would not accept a top-down curriculum but would explore it, change it, adapt it and rewrite it.

2.3 The Reforms

Given the above, it is no surprise that many states have invested efforts in ICT and pedagogy reforms (see the review by Melamed & Salant, 2011; OECD, 2015). In the past decade, many states have increased their investment in ICT, which have been increasingly available in schools (see, for example, the surveys by the Organization for Economic Co-operation [OECD], 2004, 2006, 2015; and the report by Law, Pilgrum, & Plomp, 2008). Moreover, many Western countries have provided training to their teachers in student-centered pedagogies that nurture 21st century skills utilizing ICT (e.g., Ertmer, 2005; Kozma, 2003; Law, Pelgrum, & Plomp, 2008, and the review by Melamed & Salant (2011)).

Israel, where this study was conducted, has a centralized education system, and its Ministry of Education (MoE) is responsible for developing curricula for all schools. Like many other Western countries, Israel has gone through many policy reforms. In 2011, the MoE launched the "National Program for Adapting School to the 21st Century", also known as the national ICT program (NICTP). Its purpose was to introduce an innovative pedagogy into Israeli schools, designed to assimilate ICT and help students develop skills relevant for optimal functioning in the 21st century. To this end, the MoE equipped schools with technology, developed pedagogical-digital content and tools, and asked teachers to take relevant professional development (PD) courses (Rimon, 2012).

In 2013, the year this research began, another national reform was launched, "Meaningful Learning". This reform promoted student-centered pedagogies, intending that each student would raise questions, find information resources, process it and create new knowledge, relevant to his world and to the digital era (Avidar, Ram, & Barkat, 2015). As part of the MoE's efforts to enhance pedagogical change, PD for teachers was mandatory in every school in Israel.

2.4 The Current Situation

Despite international reform efforts, it seems that when using technology in the classrooms, it usually does not serve as a means for student-centered practices (inquiry, collaboration, and so forth). Rather, for the most part, the use of ICT aligns with traditional schooling, employing activities such as internet search for information, online drills, and word processing (Ertmer, 2010; Project Tomorrow, 2009; Fraillon et al., 2014; OECD, 2015).

Israel is no exception. Teachers taking part in the NICTP reported that they increased their use of ICT in the classroom and used it more often than reported in other schools. However, for the most part, their reported ICT use appears to focus on traditionally important goals and practices (e.g., better imparting knowledge such as physics concepts via animated GIFs; Author, 2013; Magen Nagar et al., 2014).

2.5 The Importance of Studying the School Culture

Adapting schools to the 21st century requires the teachers not only to change their practices but also their vision and values (Ertmer, 1999), i.e., it requires a second-order change. The vast work on teachers' adoption of innovative pedagogy and integration of ICT often refers to "change barriers". Barriers are defined as the internal and external factors that influence the extent to which teachers implement a sought change (Ertmer, 1999, 2005). First order barriers include external factors such as lack of time, resources, or training. These barriers can be relatively easy to measure and overcome. In fact, according to the OECD (2015) report mentioned, these barriers have been addressed by those countries investigated.

Second order barriers are related to the teacher's beliefs and values regarding teaching and learning practices. These barriers are often hidden, even to the teachers themselves, and can be a greater obstacle for change than first order barriers (Ertmer et al., 2010; Magzan, 2012).

However, as Somekh (2008) puts it, teachers are not "free agents". Teachers' teaching practices and values

largely depend on the interlocking cultural, social, and organizational contexts in which they live and work. Learning processes are necessarily co-constructed and implemented with students, faculties, and local communities, and constrained or enabled by the regulatory frameworks and policies of national education systems and cultures (Darling-Hammond et al., 2017). To exacerbate the problem, teachers also face often contradictory and competing demands from the legislators, administrators, parents, and students, as well as lack of clarity as to what they need to do in practice (Luft & Hewson, 2014).

2.6 Understanding Organization Culture

This is not to say that teachers' beliefs and attitudes, their competencies, and confidence are not important, on the contrary (Ertmer, 2005; Tondeur et al., 2017). Rather, we claim that it is also important to study the context within they act. Many changes in the educational system fail due to an attempt to change teachers' behavior and practices without considering the organizational structures and routines which shape these behavior and practices (Sarason, 1993). To create sustainable and successful educational reforms, a shared vision should be created among all stakeholders (e.g., board members, parents, teachers, administration; Tondeur et al., 2017). Hence, a change intervention should take into consideration the organization's three levels of culture (Schein, 1993): *artifacts* — visible organizational structures and process; *espoused beliefs and values* — strategies, goals, philosophies; and *underlying assumptions* — unconscious, taken-for-granted beliefs, perceptions, thoughts, and feelings.

The organization's culture is the context in which its members operate. McDermott (1993) sees the context as an essential element in the events, much more central than just a background. The context is part of the text and the two elements mutually influence one another. Hence, we examine the context in which teachers operate, as a factor that guides outcomes.

2.7 Conceptual Frameworks to Articulate Teacher Change

Dualism. A prominent theme in our work is the co-existence of contradicting values and worldviews. Inspired by the work of Barab, Kakinster & Sheckler (2003), we use the concept of system dualism as a lens through which we examine our findings. "Dualities", "double voice", or "system tensions", all refer to overlapping yet conflicting activities and needs within the system (Engeström, 1999). Engeström (2001) viewed tensions as not only characterizing system activity but also as driving system innovation. From this viewpoint, overcoming contradictions is a key to changing a system. Hence, contradictions should not be conceptualized as everyday solvable problems, in the commonsense understanding of the word. Rather, contradictions in Engeström's sense are long-term and systemic formations that occur within collective systems (Engeström, 2008). When introducing a new element to the system, for example a new pedagogy, the new element might clash with an existing element, for example teaching practices, which in turn may lead to a systemic contradiction.

Mental models. Mental models are conceptual frameworks consisting of generalizations and assumptions from which we understand the world and act in it (Magzan, 2012). These deeply held internal images of how the world works are developed over time through processes of socialization, including education, experience and interaction with others. Once created, mental models become fixed and reinforced in the mind, and hence are difficult to change. Often, we are not aware of our mental models and their effect on our behavior. However, while people do not always behave congruently with what they say (espoused theories), they behave congruently with their mental models (Argyris, 1993).

There is a certain similarity between mental models and second order barriers. Mental models can be an obstacle for organizational change, if the change being attempted conflicts with the mental models of the organization's members. Similarly, second order barriers are often related to teachers' beliefs regarding teaching

and learning processes. However, whereas the term "barriers" portrays a dichotomist situation, emphasizing the factors preventing change and seeking to explain why a change did *not* occur, mental models can explain the duality within the process: the different, sometimes contradictory voices (worldviews, epistemologies, beliefs) that co-exist at times of change — the voice of the new vision alongside that of the existing regime.

2.8 The Proposed Change

Our intervention was designed to enable and facilitate teachers to practice the following elements in 21st century teaching: collaboration, learner-centeredness and "chef-ness" (manifested in creating new knowledge and accountability), and the role of technology to support the pedagogy. To this end, we introduced teachers to project-based learning (PBL) and computer-supportive collaborative learning (CSCL) elements.

Collaboration. Teachers practiced collaboration throughout the entire intervention. The intervention process began by creating teams of teachers by grade level. Each team designed and applied a PBL unit with elements of CSCL. Biweekly meetings were held to learn the PBL model, as well as to address teamwork related topics. Learning was structured to follow a multi-discipline model, and hence teachers were interdependent on each other.

Learner-centeredness and "chef"-ness. The design and implementation of PBL units created an opportunity for teaches to practice (pedagogical) learner-centeredness and knowledge creation skills. The work on the PBL unit required them to act like "chefs": they had to creatively synthesize pedagogical knowledge, such as knowledge of the PBL model (to be acquired) with relevant knowledge on contents and curriculum, assessment, collaboration methods, their students, technology and so forth. We hoped that the work on the units with their peers would boost teachers' accountability, their sense of ownership and empowerment.

We were aware that our intervention was a top-down intervention as it was initiated by the principal as an attempt to follow the national educational plan of "meaningful learning". Yet, since the intervention process aimed to foster teachers as "chefs" who would have a sense of ownership and empowerment, we sought to create a combined top-down and bottom-up process. Hence, alongside the top-down initiative, teachers made essential independent, bottom-up decisions, such as the project's outline, the content of the lessons, and the assessment (as presented in Table 1).

The role of technology. Technology had three main roles in the intervention process, all of them emphasizing that technology should be in the service of learner-centered pedagogy. Therefore, as they planned the units, teachers were asked how technology could help students during the learning process. Google Drive was chosen by the teachers as a mean to increase students' accountability, participation and mutual learning as well as to enable the teachers to monitor the process without dominating it.

3. Methodology

3.1 Research Method

Our study was an "instrumental case study" (Stake, 1995), was we aimed at gaining an understanding beyond the particular case, analyzing the individual case to better understand education change processes at large. We based our inquiry in a qualitative-ethnographic position. The research was therefore conducted in its natural environment, with the intention of developing a contextualized understanding of the events (Lincoln & Guba, 1985).

Table 1 Teachers' Work Structure

The intervention's outline	• PBL model • Multidisciplinary learning structure • Team work • In-service teacher's training	Top-down framework, designed by the school's management
Leading topic	• Environment	
Deadline	• End of March	
Documentation	• Participating in a movie, documenting the process	
The project's outline	• The driving question • Number of students in each group • The nature of the game	Bottom-up decisions, made by the teachers
Assessment	• Deciding between formative and summative assessment • Deciding between teacher and peer evaluation • What are the criteria for assessment?	
Expected product	• What is the expected product? • How would it be presented? • Would it be shared with the school's community?	
Team work	• Who is in charge of the project? • What is the role of each teacher in the project?	

3.2 Research Setting and Population

Our research was conducted during the entire 2013-2014 school year, in a new elementary school in the center of Israel, located in a growing middle to upper-middle class neighborhood with 452 students.

PD for teachers is mandatory in every school in Israel. Contents and structure are determined by the school. During the research year, the mandatory PD at the school had two main components. A 90-minute weekly in-service was dedicated to technology and was led by the vice principal. Another 150 minutes of weekly pedagogical counseling was dedicated to promoting "innovative best practices", which we were asked to run.

All the teachers were involved in the intervention process, but the school management chose the fifth grade teachers to be the focus of a "technology pilot" (name used by the school). These teachers were expected to get familiar with and include elements of CSCL in their teaching. Therefore, our study focused on the fifth grade team, which included two homeroom teachers, an English and computer teacher (who was also the vice principal), a math teacher, art teacher and PE teacher. Together with the school's management and the municipality's management — the mayor, the pedagogical supervisor and the superintendent — these were the key players in the intervention process.

Most fifth-grade teachers joined the school in its first year. Their teaching experience varied from 14 to 6 years of teaching. They had some experience in using computers in the classroom, mostly as low-level users (Ertmer, 2010).

3.3 Course of the Study

Since we identified the need for a methodical model with a clear design and steps for implementation, we offered the school the model of project-based learning (PBL). When we met with the teachers, we asked them to select an overarching theme for the PBL projects. Using the school's designation as an "environment friendly" school, they chose to incorporate environmental themes into all projects.

We presented the planning process to the staff. Teachers would be divided into teams by the grade level they taught. Whole staff workshops would be conducted by us, introducing the PBL model and scaffolding its different planning stages, with the aim to provide teachers with meaningful PD, enabling them to apply the new learning immediately in their classrooms (Cooper & Boyd, 1998; Ertmer, 2010). The process took place from October to

April, according to these stages: (a) in October and November the teachers were introduced to PBL, and defined a "driving question" to lead their projects; (b) December was devoted to mapping the project, i.e., identifying the necessary skills and knowledge; (c) in February, the teachers developed alternative assessments; (d) in March teachers implemented the project in the classrooms; and finally (e) April was devoted to evaluation.

3.4 Data Sources and Collection

We collected rich data to broaden the perspective and the range of interpretation (Mariano, 2001). Our data included: (a) Lesson observations. Fourteen lessons of all fifth-grade teachers were observed. These were routine lessons that preceded the intervention process. The two homeroom teachers, who taught most of the lessons, were observed 3 times each, for 50 minutes. Lessons were recorded, with some recordings transcribed and some summarized. (b) Meetings with teachers. Seventeen meetings were conducted with the fifth-grade teachers, individually, in pairs, and as a team. Meeting duration was 1–2 hours. All were recorded. (c) Meetings with school management. Eight meetings were conducted with the principal and the vice principal, lasting 60–120 minutes each, focused on planning the teachers' training. These meeting were not recorded per their request, but with their agreement were summarized. (d) Whole staff workshops. Six PBL workshops were conducted, 120 minutes each, focused on hands-on planning and applying the model. A summary of the events was written after each workshop. (e) Teachers' and students' plans. All project plans made by the teachers and all product plans made by the students were collected. (f) E-mail correspondences. All e-mail correspondence between us and the teachers, the principal and the vice principal were collected. (g) Questionnaire. Fifth-grade teachers answered a questionnaire during the month of October, regarding their teaching and learning viewpoints and practices as well as their stance about integrating technology in the process. Some questions were open-ended, and some were multiple choice. (h) A daily summary. At the end of each day that we visited the school, a summary of the main events was recorded.

3.5 Data Analysis

After collection, the data was laid out chronologically, event after event as one narrative. A first reading of the narrative was made to uncover repeated occurrences (Fielding, 1993). Events were then given a tag such as teachers' responses, principal's behavior, technology use, dialogue in the classroom, and relationships. The tags were organized into categories. Then, a second reading was made to identify repeated themes and patterns across categories (Fielding, 1993). For example, the tension between tradition versus innovation appeared both in the relationship between the school management and the teachers, the relationship between teachers and students, and in the role teachers gave technology in the learning process. The tension between "chefs" versus "cooks" appeared both in teaching practices and the relationship between the school management and the teachers. After identifying the common themes, an additional reading was made to reveal more observable facts according to these themes. If the purpose of the first reading was to identify themes in the light of the data, the second reading aimed to identify data in light of these themes, to create a process for making generalizations, and to use generalizations to establish theories (Glaser, 1978, 1992).

3.6 Participant Observation

The way we perceive our role in the field we study impacts greatly the research we conduct (Elliott, 1988; Peshkin, 1982). Hence, a special notice should be given to our role as researchers who facilitate the change process we are investigating. Although traditional ethnographic methodology emphasizes the researcher's role as a mere observer (Delgado-Gaitan, 1993), our position in this research better fits the definition of *participant observer*,

whereby the researcher interacts with people in everyday life while collecting information (Jorgensen, 1989). This position recognizes the researcher as an active participant who acts as a facilitator in the community's change process (Delgado-Gaitan, 1993).

We entered the school per the management's request, to conduct a pedagogical change intervention. Our interest was to research the process of adopting such a change. This created a unique position in which we collected data that we were part of its formation. Even more so, we used our identity of facilitators as a tool for participating in the community that we studied, and the interaction between the researcher and the researched as part of the story (Delgado-Gaitan, 1993).

We view our position as *moderate participatory* as we did not blend completely into the community we research and did not "act as the locals" to become "one of them" (DeWait, DeWait & Wayland, 1998). Instead, we wore two hats in the school, the hat of outside academic researchers and the hat of the inside facilitators of a change process. As we were aware of our dual role, we tried to maintain a balance between "insider" and "outsider" roles as they dictated different objectives. As facilitators, our goal was to have the teachers undergo a meaningful process which would reshape their core beliefs about teaching and learning. We wanted them to implement the PBL model successfully and we aimed to change the learning experience for their students. As researchers, our goal was to collect rich data, analyze it and arrive at deep conceptualization. The fact that the latter can be achieved whether the pedagogical change process is successful or not, was confusing at times. It made us confront our dual role and ask questions such as how intrusive our intervention should be, how far we should push our agenda and how much we adapt it to the school's pace and needs.

The participants (teachers and management) were also aware of our dual role as "insider" and "outsider". The good rapport we built with the teachers allowed them to trust us and follow our lead. Even though the management and the teachers knew that we were conducting research the research was not present in our everyday interaction with them. For them, we were academic experts who came to help them achieving their new pedagogical goals. As such, they saw us as an outside supportive element. At times of distress when implementing the pedagogical model was difficult for them, they even saw us as a foreign element, detached from their challenges and responsible for adding the extra workload they faced.

There are limitations to participant observation, for example the question of objectivity and the fact that it is the researcher's interests and commitments that shape which events he or she considers are important and relevant to the research inquiry (Emerson, Fretz & Shaw, 2001). At the same time, the dual role of insider\outsider gave us access to comprehensive data that otherwise would have been hard to obtain, while keeping a bird-eye point of view of the events, and a distant-enough position to analyze them.

4. Finding

The situation in the school prior to the intervention process revealed a deep gap between the perceptions of the main players regarding teaching and learning and the new vision the intervention sought to promote. This gap is most relevant in understanding the dynamics which took place during the intervention process since it defines the scope of the change the system and all its players had to undergo. Hence, we first describe the situation prior to the intervention process. Next, we describe the occurrences during the intervention. We focus on dualisms, the contradicting voices within which teachers operated, and how it affected teachers' attitudes towards the new pedagogy.

4.1 The School Prior to the Intervention Process: New Technology Sustaining Old Pedagogy

Prior to the intervention, we found no evidence of discussion oriented at pedagogical-technological knowledge (PTK), let alone challenging existing teaching practices, values and beliefs to move forward to more innovative pedagogy. Moreover, we found hierarchical structures and information-centered agenda and practices. For example, in teachers' questionnaires in the beginning of the year, teachers were asked about the skills and knowledge they need to implement CSCL. All except one pointed toward technical knowledge of how to operate software or devices and asked no pedagogical questions, e.g., the ways technology can increase or change students' learning. Teachers' responses revealed traditional information-centered and teacher-centered perceptions, while the computer was perceived as assisting them in carrying out those core beliefs and practices (e.g., getting students' attention, forcing students to focus and better presenting information). A similar attitude was found in the in-service technology PD led by the vice principal. It focused on introducing digital tools such as google docs, calendar, presentations and digital books, and less on the pedagogical new opportunities these tools may offer.

In all 14 fifth-grade lessons we observed before the intervention, practices were in line with teachers' perceptions of the role of the computer in the classroom as a tool to support traditional schooling. The use of technology in the classroom included PowerPoint presentation (used by the teachers), digital textbooks and short clips or movies. During all lessons observed, the pedagogical dialogue followed the IRE pattern (Lemke, 1990): teacher asks information questions, students respond in short, teacher evaluates. Students also had to fill in information-focused worksheets online individually and send to the teacher to review and evaluate.

Here we describe in detail one Geography lesson to demonstrate how the old regime of traditional schooling was enacted and how the technology was adopted to preserve it. As in all lessons we observed, students sit in rows in front of the smartboard. Most of them have a laptop on their desks. The teacher's laptop projects onto the smartboard. Students are asked to follow and mimic it on their computers, and "if you don't have a computer, open your [hardcopy] books", says the teacher and applies the computer is something which is "nice to have" but not a must.

The teacher assigned one student to navigate through the digital textbook on her projected computer. It is a technical assignment, which required sitting by the teacher's computer and follow her directions. Yet, students desired the position even though they had the exact same computer on their own desks, with the exact same content. The dynamic restores traditional classroom hierarchy where the teacher's position is still first in order.

The digital textbook was presented on the big screen, showing pictures and maps. The teacher used the technological aids to support her frontal, information-centered teaching practices by visualizing the concepts she introduces while asking information-centered questions such as "what do we see on the map" and "what happens when there is a flow". To these questions she receives short answers, usually one-word answers, evaluate it ("very good", "nice") and moves on to the next question.

When using the technology to screen movies about the subject matter, the information-centered agenda is well preserved and the students' role to be passive learners who retain information does not change either. The only difference is that this time it is the movie providing the information instead of the teacher. During the movie, the teacher also keeps her traditional role by standing on the side, watching over the classroom. She does not sit with the students to watch the movie and take a new role of fellow learner in a learning community, for instance. At some point, the teacher repeats the movie narrator: "Did you hear that, the plates are moving all the time very slowly." In the last sentence, it seems as if the teacher unified roles with the technology: Both are here to transfer information.

At the end of the lesson, while students are packing to leave, the teacher reminds them about the upcoming test: "Study for the test, that's the most important thing." This statement reflects the teacher's viewpoint, and the viewpoint of the system in which she operates: The purpose of school is tests and achievements, which aligns with traditional schooling.

Moreover, prior to the intervention the school seemed to be satisfied and even proud of the vast use of technology in the classroom and of the upcoming PD on how to operate the technology. The absence of a profound pedagogical discussion was prominent, a discourse which the intervention brought into the system. This gap created clashes between innovative pedagogy represented by the intervention and the perception of innovation as underlying the teaching and PD observed.

4.2 The School During Intervention Process: "Real" Teaching vs. New Learning

Throughout the school year, the teachers successfully designed and applied an innovative pedagogical model in which students were empowered to plan, research, ask and create, while participating in a collaborative learning design process themselves. Elements of the "third space", the space in which learning occurs (Gutierrez et al., 1995), were evident along with the development of 21st century skills, in contrast to the pre-intervention lessons, as described in Table 2.

Table 2 A comparison Between Routine Lessons And Intervention Process

Criteria	Routine Lesson	Intervention Process
Collaboration	Students work alone	Students work in teams, teams share with entire class.
Accountability	Traditional hierarchy in which the teacher dictates the course of the lesson.	Teacher gives the framework of the project, and students are responsible of the process.
Creating new knowledge	Memorization of existing knowledge.	Accruing knowledge to create something new.
Question asking	Closed-ended questions, asked by the teacher.	Closed and open-ended questions asked by the teachers and the students.
Learning structure	By content area. Each subject is taught without connection to other subjects.	Multidisciplinary. Content areas are being taught in relation to the same topic.
Technology as a support System	Visually supports traditional teaching methods.	1. Supports PBL model. 2. Supports cooperative learning. 3. Visual representation of learning processes.

Yet, the teachers did not view these "third space" elements as promoting learning, but rather as foreign elements, which got in the way of teaching: "We have so much to do, and if I'm only doing the project, I'm not teaching", as one teacher told us. Apparently, PBL was not considered "real" teaching. Teachers expressed dissatisfaction, complained about the extra workload, and admitted that if they had the choice, they would not have participated in the intervention process. They pointed out that they are still required to show high achievement on test results and felt that the attempt to implement an innovative pedagogy is an isolated project, disconnected from their everyday assignments. The teachers expressed frustration with the duality they experienced: On the one hand, the system presents a new vision ("Meaningful Learning" and NICTP), leads innovative pedagogy initiation and invests resources (academic advisor; new technology), and on the other hand, the system imposes traditional relationships (top-down dynamic) and assessment (standardized testing), which are translated by the teachers into traditional ways of teaching. The phenomenon they described, of a change attempt intertwining with preserving the old regime, was observed throughout the intervention process, as we now turn to demonstrate.

4.3 "Chefs" vs. "Cooks"

As described in the proposed change section, one of the intervention purposes was to develop a sense of "chefness" among the teachers, as one of the 21st century skills. In the light of this goal, it is interesting to see the principal's contrasting behavior during the intervention — while she was strongly involved in creating new vision and practices to promote "meaningful learning" (which aims, among other things, to nurture a collaborative and autonomous learner with critical thinking skills), she preserved hierarchical relationship with her teachers, positioning herself as intimidating and unapproachable at times. Prominent examples of it can be found in the emails the principals sent to the teachers. In one email to all teachers, the principal attached an article she asked them to read it. In the email message, she quoted from the article: "The future is prostrated to be less hierarchical and more collaborative. The teacher will encourage and nurture students' self-efficacy and build a mutual trust between the learner and the teacher." This was followed by her instruction: "Please reply to this email to approve you read the article and inform me personally when you finish updating your (PBL) project plan." In this email message, the new order and the old order exist in parallel. A quoted vision of a collaborative future is signed with a top-down command, as if to say: Create mutual trust and report to me when you do so.

In a second email sent by the principal to the teachers, she asked them to send her their weekly lesson plans so she can go over and comment on them. In a third email, the principal wrote: "As you all know, the Education Minister is promoting 'meaningful learning'. He is addressing not only teachers, but parents as well. Soon you will need to show them that you are doing it." With these words and the subtle tone of threat, the principal strengthened the old order of hierarchy in which teachers need to operate as they are told and expected. She continues to write in the message: "I strongly believe in 'meaningful learning'. Moreover, our school was chosen to demonstrate how we do 'meaningful learning' and to produce a short movie about the process we are going through." Here the principal reveals that she is not a "free agent" either, and that the role of "cooks", starts from well above. She also reveals how the pressure that she is experiencing, to "demonstrate" to her superiors how she meets the new expectations, shapes her relationships with her teachers, and her worldview.

Another example of this top-down dynamics was given in a mid-year meeting that was held in the city hall, with the presence of the mayor, the city superintendent, the municipality pedagogical supervisor and all the city elementary school principals and their academic advisors. The purpose of the meeting was "to present each school's progress on its pedagogical quality goals" (from the meeting's protocol). The mayor sat at the head of a long table, and all the speakers — principals and advisors — directed their presentations towards him. In the presentation, each school had to show how they are working towards their goals and to indicate their achievements so far. At the end of each presentation, the mayor and the superintendent commented on it, praising or pointing out a need for improvement. They invited other principals and advisors to comment as well, but for the most part no one else did. Despite the efforts to create a collaborative platform, the setting was hierarchical, and the ritual was more of reporting than sharing. A genuine attempt to create a new order in the spirit of the "meaningful learning" objectives (given by the MoE), was implemented by practices which not only did promote the new order, but help preserve the old one.

This pressure continued to be evident at the school. At the beginning of an Alternative Assessment and Peer Learning workshop, which took place in the computer lab, the principal asked: "Who read the article I sent?" (A few teachers raised their hand.) "When the supervisors come to visit, I want you all to show how you do meaningful learning." The principal was not recruiting the teachers into a shared vision. She did not speak about the essence of "meaningful learning" or the rational beyond it. Rather, she told her teachers to do it because they need to show to the supervisors that they do it. All that, just before a workshop titled "Peer Collaboration". Another, and almost

comical example occurred after the workshop began and a few teachers were occupied with the computers. The vice principal stood up and shut down the network saying: "Teachers here are doing other things instead of listening, and this is unacceptable." A forceful act like shutting down the network was taking place in a workshop which aimed to create a learning community.

When people are treated as "cooks", most likely they will function as one and vice versa: when treated as "chefs", they would feel ownership towards the process and take more responsibility. In one incident when the teachers expressed frustration due to lack of time, we encouraged them to address it with the principal. After they did, we had the following email exchange with one of the teachers:

-….do you feel that you got some answers today?

-Teacher: We got the same old answers – reshuffle the schedule, stay after hours, work it out between us….as usual.

- And if it was all up to you and your decisions, what would you do?

-Teacher: Maybe I would decide that next month I'm not teaching Geography and make up the hours the following month…you know what, this is what I'm going to do!

As long as the dialogue was a one-way direction (principal instructs — teacher does), the teacher felt powerless and frustrated. Once the teacher was asked to make a judgment, she easily found a solution.

4.4 Teachers' Perception of the Change Process: New Vision vs. Old Regime

The double voice that was heard from above throughout the process was felt by the teachers and affected their perception of the change process. Teachers testified that they received mixed messages and that they were lacking adequate support. As a result, they resented the additional workload the project created and expressed objections: "There is not enough time to do it", "there are too many projects without a set priority", "there is not enough support." One of the fifth-grade homeroom teachers elaborated: "The supervisor is coming next week to my class, and I'm supposed to show her the standardized tests results, but I didn't have enough time to work with the class on it because of hours wasted on this project." The teacher expressed here the conflicting core assumptions about teaching and learning underlining beneath standardized test and a method like PBL: emphasizing significant amount of content vs. emphasizing in-dept inquiry and skills development. Interestingly, this conflict is pointed out by the MoE itself in a guidebook published for educators how to implement "meaningful learning" (Avidar et al., 2015). After describing PBL as one of possible methods, the guide indicates likely challenges a school might encounter while implementing it: "PBL requires adjusting the assessment criteria, to test for knowledge alongside skills and learning habits. This kind of assessment does not necessarily meet the goals of external test such as the Mitzav." (p. 21).

The Mitzav is an external standardized test given to all fifth graders in Israel, testing for knowledge in Language Arts, Math, Science and English as a foreign language. The guide does not offer a real solution to this well-recognized conflict, but rather states that principals and teachers avoid using PBL for the grades being tested that year. This imminent tension was very present for the teachers, who used the words "wasted" and "ruined", to describe the class time devoted to the PBL and can explain why they viewed it as external to the curriculum objectives, and not as supporting them.

The effect of the dualism penetrated into the way teachers implemented the PBL. For example, the teachers strongly objected to letting the students divide themselves into teams, stating: "You can't let them decide about anything." The teachers viewed their students also as "cooks", despite leading a project which at its essence was to

nurture students as “chefs”.

In contrast with teachers’ resentment, the students expressed high satisfaction when asked to describe the project. They recognized and appreciated the new role the project had given them and reflected that they had learned a great deal about teamwork and conflict resolution, as well as environmental issues. Students also pointed to the shared documents as something that helped them work together.

The fulfillment of the projects’ goals and the testimonies for students' significant learning was not enough to change teachers’ attitude towards it. A powerful example is the conversation we had with the English teacher. Getting ready to wrap up the project, she sent us the Powerpoint presentations made by the students and wrote: “You have to see this…this is way above their average level.” When we met, she told us that the students had an entire discussion on the topic in English (which is unusual) and described one student in particular:

-I really didn’t expect it from him…he has a lot of issues and it's hard for him to focus, but apparently he can learn.

How do you feel about the project now? We know you were a bit frustrated along the way.

I’m fine…glad it’s over because it created a gap in the curriculum and we now need catch up. I'm glad we're going back to routine.

This is an indication of the powerful role that the old regime and its expectations from the teachers played even in the change effort, so that despite the students’ performance above their average level and despite the student whom the project brought him back to the learning process, the teacher is relieved to go back to the routine of information-centered agenda and achievement tests.

5. Discussion

The teachers planned and implemented a PBL unit successfully. When it was over the teachers were glad to return to their old routines, despite the recognized improvement and satisfaction of their students. We argue that this attitude was shaped by the dualism that was evoked when the intervention took place.

5.1 Dualism: A Change Process Without a Change

The course of events at the school supports the argument that when a system adopts a new external element, often this process leads to a contradiction within the system, when new elements clash with an existing element. Apparently, technology used in the school did not clash with existing elements. Most teachers used technology in their classroom daily pre-intervention: Smart boards, virtual textbooks and laptops for students. Yet, in line with vast empirical evidence in the literature (e.g., Fraillon et al., 2014, OECD, 2015), the use of technology in the classroom itself did not bring about innovative, student-centered pedagogy. Rather, it was used to support traditional, teacher-centered teaching methods. Nonetheless, the school viewed the assimilation of technology as assimilation of new pedagogy, when in fact the former was becoming part of the existing order. This view is prevalent in Israel (Magen-Nagar et al., 2012) as well as other countries (Fraillon et al., 2014).

The new pedagogy offered during the intervention did clash with the existing regime. The teachers successfully created a PBL unit, a work with “third space” characteristics. Yet, they viewed the whole process as interfering with the “real” goals of teaching as they viewed them and as were expected of them, preparing students for the standardized tests, for example. This perception is a result of life within dualism, two co-existing, contradicting forces: “meaningful learning” and achievement tests.

Dualism was also seen in the way teachers were expected to act: as “chefs” versus “cooks”. The new element

of the teachers as "chefs" was emphasized by the MoE-declared vision. Both the NICTP and "Meaningful Learning" reforms called for promoting the teachers as autonomous, creative, lifelong learners, empowering the teacher to make decisions about the content and the practices of the curriculum. At a surface level, it seems as if this element was embraced by the system at all levels. Specifically, the municipality supported this process and invested in pedagogical counseling, which brought us to school. In the school, special hours were allocated for team meetings to plan and develop new projects. Finally, the PBL we had suggested — which emphasizes the role of the teacher as a curriculum designer — was affirmed by the management.

At the same time, however, a clear hierarchy continued to be maintained between the municipality and the school's management, and the school management and the teachers. This hierarchy affected the teachers' perception about themselves and their role, limiting their ability and will to perform as curriculum designers and dictating the dialogue between them and their students. Hierarchical dialogue was also observed between students and teachers in areas related to content (teachers as information providers) and in areas related to learning process ("you can't let this class choose anything").

5.2 Re-thinking Barriers

All these contradictions "lived together happily": Contradictory practices and values coexisted without anybody seeming to be bothered by them, let alone resolving them. Recall, for example, the evaluation meeting at the municipality, a collaborative forum of principals and education consultants meets with the goal of promoting 21st century skills, alongside the obligation to report to the mayor about progress towards this goal. In the classrooms, novel teaching and learning equipment (smart board, laptops) "lives together" alongside conventional teaching methods. In the computer lab, a peer evaluation and cooperative learning workshop "lives side-by-side" with unplugging the internet connection after teachers did not listen carefully. Similar to the findings of Barab et al. (2003), it seems as if these contradictions live side-by-side in peace.

The only ones who see the contradictions are the frustrated teachers, who often complain about workload and lack of time and priorities. These complaints point out the clashing factors in the system and the complex reality in which teachers must operate. Holding onto traditional teaching and learning practices may reflect not (only) personal preference or belief, but rather a reaction to a system with mixed messages and expectations that at the end of day, despite genuine efforts to adapt to the 21st century, has not ripened enough to make a full transition. This reality, together with traditional mental models of the key players, created a situation of a change process without an enduring change.

5.3 Mental Models as a Complimentary Framework to Articulate Change

The teachers exhibited both first and second order barriers, manifested in their conservative practices and perceptions of teaching and learning and in their frustration about the need to implement innovative practices. However, a situation was created in which the teachers were forced to lead a change process in their classrooms, in which they did not believe.

Teachers are not free agents, but neither is the school's management. The conservative top-down relationship which was observed between the school management and the teachers was observed likewise between the supervisors from the municipality and the school's management. This dynamic was observed also between teachers and students.

While the concept of barriers is useful to explain teachers' rejection of the change process, the concept of mental models better explains the dualistic characteristic of the process, which is more typical in school, where

agents are not free to act solely upon their "barriers". It also highlights the unique phenomena of a change process without a change. Within the latter conceptual framework, our research findings can be viewed as a situation in which the *mental models* of the key players clashed with new elements and created dualism. Our research shows that changing one's action and practices does not necessarily change one's mental models — the deep and often hidden assumptions about the world.

These findings highlight the need to look at the organization's belief system as well when discussing attempts of change. This correlates with McDermont's (1993) argument that the context is part of the occurrence itself, as well as with Serson's (1996) claim that many changes in the education system often fail when there is an attempt to change teacher's behaviors and practices without considering the organization's structures which create them.

6. Conclusions: Process in a Context of Attempting Pedagogical Change

In sum, a successful project of innovation took place in stark isolation: teaching and learning practices designed to nurture a 21st century learner were implemented, while the other structures and behaviors at the school supported a more traditional learning environment. Second order change, challenging the mental models of the key players, faced extreme difficulties when the environment, its structure, routines and behaviors continued to support the existing mental models. The result was teachers who "walked the walk" but did not "talk the talk".

Our findings shed light on the need to recognize the contrasting forces in a change process and to identify what is the real new element entering the system — in our case it was the innovative pedagogy which clashed with existing elements. In situations where components do not align or carry out the same vision and practices, as often happens when systems undergo a change process, it is essential to recognize the conflicting forces. Tensions not only characterized system activity but when recognized can also drive system innovation (Engeström, 2001). Our study also demonstrates the explanatory power of mental models and the limitations of the concept of barriers to articulate change processes. Mental models better capture the reaction of educators, who are not free agents, to the conflicting forces within the system they operate in.

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