The expansive resolution of conflicts of motives: a fruitful avenue to understand the transformation of teachers' practices.

ISCAR Summer seminar
for PhD students & young scholars
Cultural-historical psychology today
Research challenges & practical perspectives
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Reminder of the aims of **ISCAR special section in STEM education**

- Facilitate communication between people interested in STEM Education;

- Develop understanding of scientific concepts within a sociocultural framework;

- Support professional development of educators and researchers;

- Cooperate with academics, researchers, teachers and professionals worldwide

- STEM education anchored in sociocultural theories is a way to pursue human development to act for peace, sustainable development and public understanding.

Some questions addressed in this lecture…

- Does working in a Vygotskian tradition lead us to ask new or different questions than existing traditions within science education research?
- Are there significant epistemological differences in how research is pursued in a sociocultural approach compared to other STEM research approaches like the empiro-realistic one?
- When adopting the premisse that social interaction plays a fundamental role in the development of cognition and that the collective plays a central role in the process of making meaning, how does a researcher deal with it when investigating science education and teachers' practices in the field?
- What are the methodological and analytical challenges we face when adopting sociocultural theories and document complexity?

‘Pure’ subject matter teaching?

- According to Crawford (1996), traditional forms of instructions still reflect 19th century ideas when disciplinary teaching was brought forward to structure university faculties, a statement also reported by Aikenhead (1996).
- Fourez (2002) reminds us that the categorization of knowledge into disciplines to be taught in faculties or in schools is a cultural invention that has taken place over many centuries.
- Study topics having relevance to the lives of students and not just through the study of subject-specific problems (Barma & Bader, 2013).

Science Education
What for?

Person's capacity, in a sociotechnical society, to build for him/herself a field of autonomy, communication and negotiation with his/her environment *(our translation)*.

Fourez (2002, p. 198)

In that light, we question the roles of teachers as agents to expand the potential of human through science education as they face conflictual situations at work.

Challenges at work for science teachers in Quebec (MELS, 2006).

- Science teachers faced challenges in the context of a curricular reform asking them
  - To integrate technological design approaches during class-workshops to support the appropriation of scientific concepts
  - To address sociosocientific controversial topics revealing political, environmental, ethical considerations to be discussent in the classroom.
  - Leave frontal teaching (lecture based class and controlled lab experiments).
  - To assess differently (competency based evaluation based on the student's progress)

A struggle for teachers

- Controversial aspects of the topics (Barma, 2012; Simonneaux & Legardez, 2011)
- Formative years focused on disciplinary content (Barma et al. 2010; Urgelli, 2008).
- Introducing non-dominant activities in schools do not follow a predetermined path (Sannino, 2011).

A competency aiming at fostering citizenship skills in Quebec

- In the Science and Technology Quebec Education Program, emphasis is laid on the development of what is qualified as a democratic, humanistic perspective (Barma & Guilbert, 2006).

- In 9-10th grades, students are asked to construct a systemic representation of socioscientific issues, taking into account
  - different aspects (e.g. social, historical, economic)
  - various points of view (e.g. of environmentalists, unions, politicians).

- This analysis allows the students to examine certain long-term consequences, compare them with short-term consequences and, if applicable, identify the ethical questions at stake.

The complexity of research in the field of teacher professional development

Critical contexts

- Resistance to change
- Questionings
- Contradictions
- Debates

Contexts of discovery

- Desire to experiment
- Modeling new forms of practice

Contexts of practice

- Social relevance of the integration of knowledge
- Community involvement
- Support in practice

- Human contexts are conflictual but the fact that there are conflicting motivations leading to the search for solutions to give a new meaning .

- It's not causality but intentionality.

- Facing a situation, a teacher will make a decision based on its own judgment. His/her actions cannot be predicted in advance.

- As researchers, we must document the search for meaning and the reasons why a teacher engages in change
  - It is through the control of socially constructed tools that a teacher creates new meanings and models new social structures around him.

Teaching strategies as Marxist commodity, use and exchange value

The production of a teaching strategy by science teachers can either aim at:

Have students learn for the test

or

Provide students the opportunity to acquire scientific and technological literacy in a humanistic and democratic way

CONFLICT OF MOTIVATION IS THE STARTING POINT OF THE WILL

Duality is at the very foundation of the volitional act, and this duality becomes especially prominent and vivid whenever several motives, several opposing strivings, clash in our consciousness

(Vygotsky, 1997, p. 167-168).

What do we seek as researchers collaborating with teachers and adopting CHAR?

- A need creates a motivation and has an impact on the way people act (Engeström & Sannino, 2013; Vygtosky,).
- Conflicts and will as starting points of an action where a person gives new meaning to his/her activity.
- Contradictory demands which the participants encounter in their work activity have to be addressed (Virrkkunen & Newham, 2013).

About motives and conflicts

- According to Leont'ev,
  - Motives are based on needs
  - Needs become internal forces that can't only be met at an event.

- CAUTION: Not all need will turn into motive for action!

- According to Vygotsky,
  - As long as a first satisfaction of the need is not completed, the need doesn't know the object toward which it must reach

Freedom to act: is it enough to act?

- The concept of freedom to act in the mind of an individual is not enough.
- What is important is how it will be able to act freely.
- Individuals interpret, contradict, resist and thus express their subjectivity.

Examining science teachers' practice

- **Amidst contradictory motives and choices to make, how does their will form?**
- **How do they gain self-control over a difficult situation in the science class?**

One of the fundamental points of activity theory is that development is seen, not as a series of gains, but as a series of transformations that are rather revolutions in the dialectical sense than a smooth evolution process

(Davidov, 2008, Ilenkov, 1982, Vygostky, 1997, Zaretskii, 2017).

Double stimulation:Vygotsky

- When an individual faces a problematic situation, he turns towards a resource, a pattern, an external object to find a pretext to act.
- The problem is the 1st stimulus, the external object is the 2nd.
- The object can be material or conceptual: it is an artifact which is used to get out of a paralyzing situation.
- Often, a gradual redefinition of the conflict by the subject puts on hold several intentions of action.
- The goal pursued by Vygotsky was to overcome the constraints of behaviorism
- According to him, humans take control through artefacts in order to master their behavior.

Double stimulation

Vygotsky's principle of is fruitful in the understanding of the building of higher mental functions through two series of stimuli. It also explains individuals may deal with conflict of motives

"Double stimulation comprises conflictual aspects, in particular conflicts of motives. Together with the two stimuli, conflicts of motives constitute the core of a strategic setup that human beings establish to intentionally affect their behaviour and the world around them" (Sannino, 2015, p. 1).

Sannino also suggests that conflicts of motives are key components of the method of double stimulation, which is also a principle of agency.

This makes it possible to trace the agency involved in breaking away from a situation of conflict of motives.

- Dealing with contradictory motives by exploiting auxiliary means to make conscious decisions and these decisions into action (Engeström & Sannino, 2013)
- Individuals ascribe new meaning to their activity in order to overcome a conflictual situation (van der Veer & Valsiner, 1991).

ACTIVITY

- Origins in early Vygotsky's work: an explanatory principle to be considered a generator of human counsciousness (Kozulin, 1996)
- Non-deterministic: not a direct response to a stimulus.
- Always moving and seen as an ontological process.
- Richer than our conscience can consider or our analysis to read the situation.
- Dialectic: stabilization and destabilization are its foundations.

Agency

- Broadly understood as encompassing almost any form of the human capacity to act intentionally (Engeström & Sannino, 2013)
- Manifested when people form intentions and execute willful actions that go beyond and transform the accepted routines and given conditions of the activity and organization in which they are involved (Engeström & Sannino, 2013)
- More than just a choice and decision making (Sannino, 2015).

Conflicts of motives as key components of double stimulation

- The conflictual situation constitutes the 1st stimulus and is a necessary element to trigger transformative agency (Engeström & Sannino, 2013).

- For example, a teacher might employ a pedagogical strategy as a 2nd stimulus, investing it with meaning in order to make and act on a conscious decision.

> "duality is at the very foundation of the volitional act, and this duality becomes especially prominent and vivid whenever several motives, several opposing strivings, clash in our consciousness" (Vygotsky, 1997, p. 167-168).

Research project A

Engaging discussion about climate change in a Quebec secondary school: A challenge for science teachers

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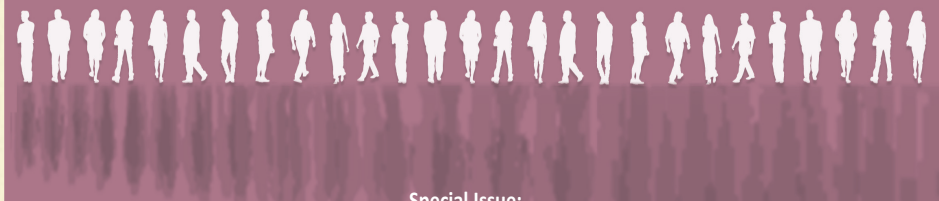

Special Issue:
The emergence of transformative agency and double stimulation:
Activity-based studies in the Vygotskian tradition

Guest Editor:
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Double stimulation as theoretical and methodological framework

2-year formative intervention (2010-2012)
2 science teachers
256 10th grade students

Curricular reform implemented in Quebec
2006

How did the resolution of conflicts of motives by teachers triggered agentive actions and the building of a second stimulus in the form of an open-ended teaching strategy?

Developmental work research as a **formative intervention**

The " second series stimuli" offered in DWR are the conceptual tools of activity theory provided by the workshop facilitators for the purpose of enabling participants in analyzing and interpreting their practices, the objects of those practices, and the organizational features that shape them" (Edwards, 2009, p. 204-205).

Data analysis (interviews, participating observation) used as a **mirror** to help co-model a non-dominant practice.

Settings of the formative intervention

- 2 year-project in a high school of 600 students
  - 256 10th grade students (8 classes)
- Subject science teachers
  - 1- Physics engineer, 5 years of experience
  - 2- Ph.D. in cellular biology, 7 years of experience.
- Research team
  - 2 post-graduate students
  - 1 researcher
- Principal
- 2 members of the science department

Polymotivated problem situation

In order to meet the new curriculum demands, they were being asked to:

- 1) change their teaching style to engage students to respond to open-ended questions;
- 2) address the topic of environment as a controversial issue,
- 3) meet the principal's and the parents' expectations.

In response to a problem, teachers engage in resolution of conflicts of motives and model new pedagogical tools to give meaning to their practice

(Barma, Lacasse & Massé-Morneau, 2015).

Teacher A: I think that our society wants us to make sure that students get good grades. So, we, teachers, think accordingly… make students write their exams and forget about other important things such as critical thinking. But critical thinking is not evaluated so…

There are two clans, no I mean, two extreme ways of seeing the way we teach… Last year, people from the Ministry of Education sent us some assessments for our students. Although it was supposed to be in relation to environmental issues, almost no environmental aspects were touched. It was only difficult content related to theoretical questions demanding to apply a formula.

Researcher: How would you define a controversial issue?

Teacher A: Is it a question where there is no consensus to be found, on which there are opposing views? For example, shale gases, climate change. Do we have to do something about it? Are we responsible? Is it already too late?

Researcher: Are you at ease talking about environmental issues?

Teacher B: I define myself as an environmentalist… no not true… I am not at ease talking about politics… So far, I know there is interest in discussing the environment but unfortunately, I don't think there are projects available and ready to reach 36 students.

CONFLICTS OF MOTIVES IDENTIFIED

Three types of conflicts of motives faced by both teachers emerged from our analysis.

1) teaching strategies
2) the concept of environment itself and its controversial aspects
3) the values promoted at the school.

Methodological and analytical challenges.

1- Which data to gather and select when you address complexity?

2- What is the unit of analysis? The unit of meaning?

3- How do we make sense of the intertwining of the present, the past and the future in the discourse?

Analysis of the intervention

- The first steps in our data analysis made us understand how two science teachers engaged in expansive resolution of conflicts of motives at work with their students (Barma et al., 2014).
- Selection of units of meaning in the 1003 speaking turns : struggles, obstacles, clashes and tensions
- Triangulation was done with ethnographic notes and students' interviews and productions.

Type of ethnographic data collected between 2010-2012

Type of data	**2010-2011**	**2011-2012**
Researcher and student-researcher's ethnographic notes	Research meetings: Researcher, teachers and school principal (1 hour) Student-researcher teacher B (1 hour) Researcher and school science department (2 hours) 16 e-mail Intervention in the classrooms (5 hours)	Research meetings: Research meeting with school principal (30 minutes) 17 e-mail Intervention in the classrooms (20 hours)
Teaching documents	Planning of the teaching sequence Evaluation matrix for communication skills	Planning of the teaching sequence Video of an expert Evaluation matrix: content and communication skills Matrix for peer review
Students productions 1. Snapshot 2. Panorama 3. Closing the investigation 4. Prezi	12 definitions of environment 27 Prezis	26 SNAPSHOTS 21 PANORAMAS 21 PREZIs 65 peer reviewed Prezis
Speaking turns Focus groups	203 for students 400 for teachers	614 for students 603 for teachers

Date	Duration	Participants	Speaking turns (Participation %)
2011/05/25	01:22:29	Student-researcher	117 (29.25%)
		Teacher A	142 (35.50%)
		Teacher B	141 (35.25%)
		Total	**400**
2012/05/08	01:25:18	Student-researcher	94 (26.93%)
		Teacher A	121 (34.67%)
		Teacher B	134 (38.40%)
		Total	**349**
2012/06/14	00:52:27	Student-researcher	57 (37.25%)
		Researcher	29 (18.95%)
		Teacher B	67 (43.79%)
		Total	**153**
	00:51:01	Student-researcher	38 (37.62%)
		Researcher	17 (16.83%)
		Teacher A	46 (45.54%)
		Total	**101**
Grand total			**1003**

-Teacher A: Since the curriculum asks us to talk about one of the four environmental problematic. I think that what is interesting about it is that there is a lot of available information. Some of it is good; some of it is bad.

There is no definite answer. That is where it gets interesting. The students will learn anyway and we have to figure out a way to make it happen.

-Researcher: What to you want to develop with your students?

-Teacher B: My goal is to see that they would begin to understand that what people think is not necessarily the truth.

They must therefore use information to make their own judgment.

-Teacher B: I think that we have to stop putting scientists on a pedestal... as people who know everything, can answer any question, who are superior to every way of reasoning.

DECISION FORMING PROCESS

Accept that no consensus can be found when discussing environment	Choose to change the way to approach environmental issues	Decide to have students debate a controversial issue related to the environment	Engage in planning a new teaching sequence
ACCEPTANCE →	CHOICE →	DECISION →	ENGAGEMENT IN AGENTIVE ACTION

- A ‘rationality island’ is a metaphor used to represent how students elaborate an island of informed opinion amidst an ocean of ignorance in response to a broad question.
- According to Fourez (2002) it can promote students’ autonomy in relation to societal debates.

Rationality island teaching task (2nd stimulus)

Lesson 1	Introduction and presentation of project to students: What is climate change about? Formation of teams
Lesson 2	**SNAPSHOT**: Students share with members of their team their conceptions on global warming or climate change. **PANORAMA**: draw what elements should be considered, identify economic, political, social, environmental, ethical issues related to climate change (investigation)
Lesson 3	Research at the library. Homework.
Lesson 4	Research on the internet. Homework.
Lesson 5	**CLOSING THE PROCESS** and taking position: students decide to investigate scientific concepts they find relevant to better understand climate change. Homework.
Lessons 6 -7	Co-elaboration of the representation of climate change. Homework.
Lessons 8-9	Scientific symposium: teams share their representation of climate change using **PREZI,** debate and participate in evaluating their peers.

RESISTANCE

-Teacher A: They were destabilized at the beginning of our project but now they seem to be adjusting. They all had the same reflex: how are we going to learn, you are not explaining anything! They were upset but they came to understand that they actually learned better this way.

-Teacher B: I live with the frustrations I create. I don't think I can do otherwise.

More conflicts emerge as some are resolved

-Researcher: So, as we may say, there is pressure…for some I mean.

-Teacher B: The umbrella that the school should put above our heads, well, it is pierced in many places. You know, it depends on who complains and how often they do so. Sometimes there are knives being thrown and they end up going directly to the teacher. That's it. There are holes.

-Teacher B: The most difficult aspect is really, really, really that we try to put into place things but we are blocked by our structure. In the sense that we are not able to find adequate support… but at the same time, I understand, we need a proper framework, we need to fit in the school frame…. Yes, management is far from its teaching staff. They have no idea about what is going on in our classrooms.

Project B

Decision-forming processes leading to peer mentorship (2010-2017).

- Seven years of praxis in the field were filled with unexpected and unpredictable events as well as intense moments of collaboration, discussions and problem solving.
- Hundreds of hours of ethnographic work in the schools with teachers and students blurred the boundaries between ‘us’ and ‘them’.
- Essentially linked to the contextual conditions in their schools, depending on the participant’s capacity to resolve problematic situations and engage in creating prototypes along with the documents to support its’ viability, the research team followed a runaway object during seven years.
- The shared object of ‘collaborating to engage in mentorship and support science teacher colleagues’ kept being redefined and reconceptualized in order to expand.

I find teaching science is difficult. I have never fully got used to working with young people who are sometimes ungrateful, and other times very thankful. I came to the conclusion that, if I could not get used to it after all these years, I had to change my practice so they would react differently. (Simon, March 2011).

..... 6 years later....

It's not only that they did something in their classes: they became multipliers. It's rewarding for them because there is not much valorization at the school level. Participating in conferences is good and they have become role models in their community. Other teachers from the school district see their names in the conference program and they think: 'I, too, would like to do that'. We have built a small community at the school district level, together, quietly, not going too fast (Francis, pedagogical counselor, June 2017).

SO WHAT HAPPENED BETWEEN?

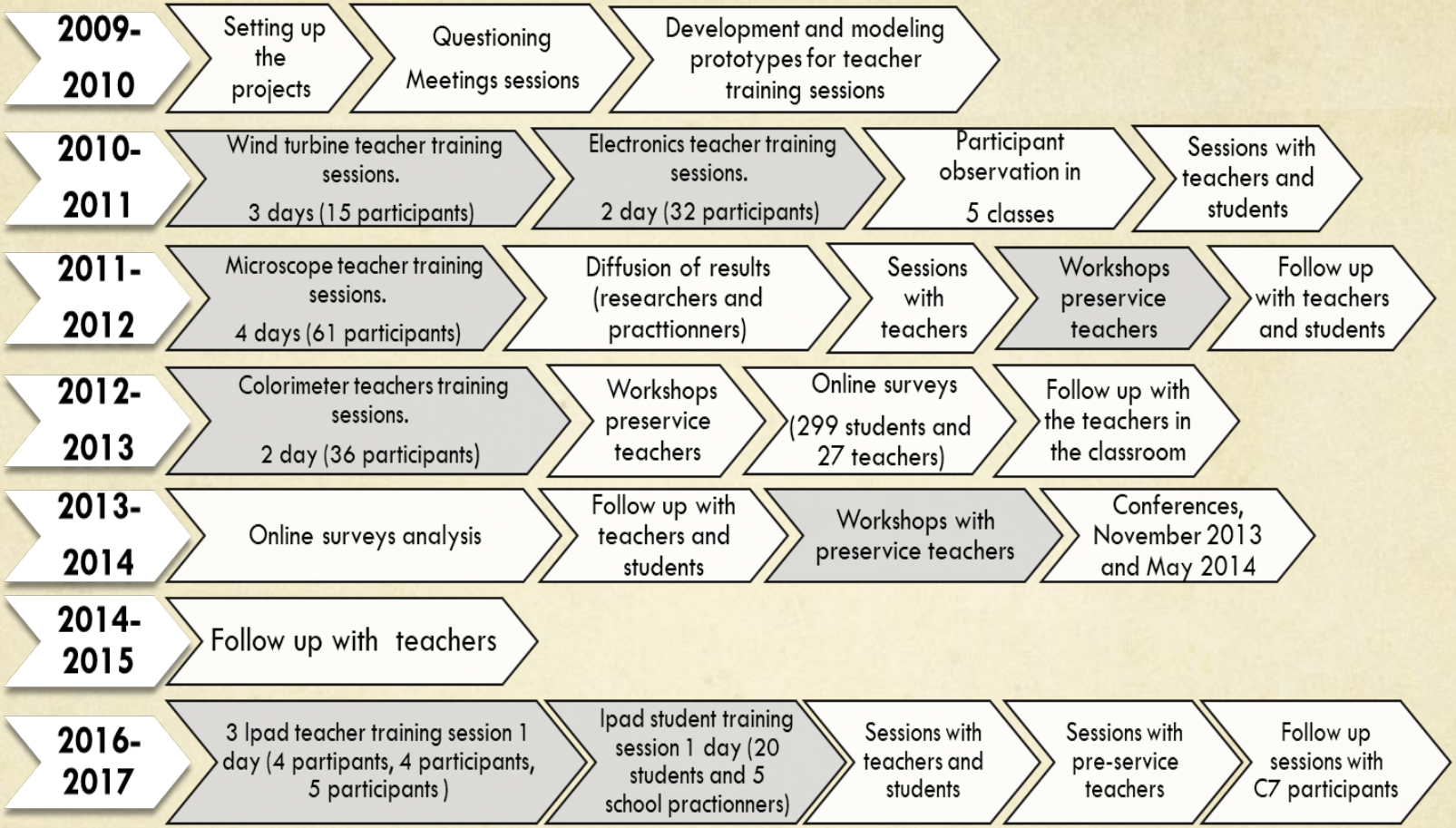
Using dialectical analysis and focusing on the transformative agentive actions during seven years led us to identify three categories of conflicts of motives that were successfully resolved in order to expand the professional mentoring activity and make it a success:

1) critical contexts related to questioning and resisting change;

2) contexts of discovery leading to proposing new forms of learning and evaluation situation;

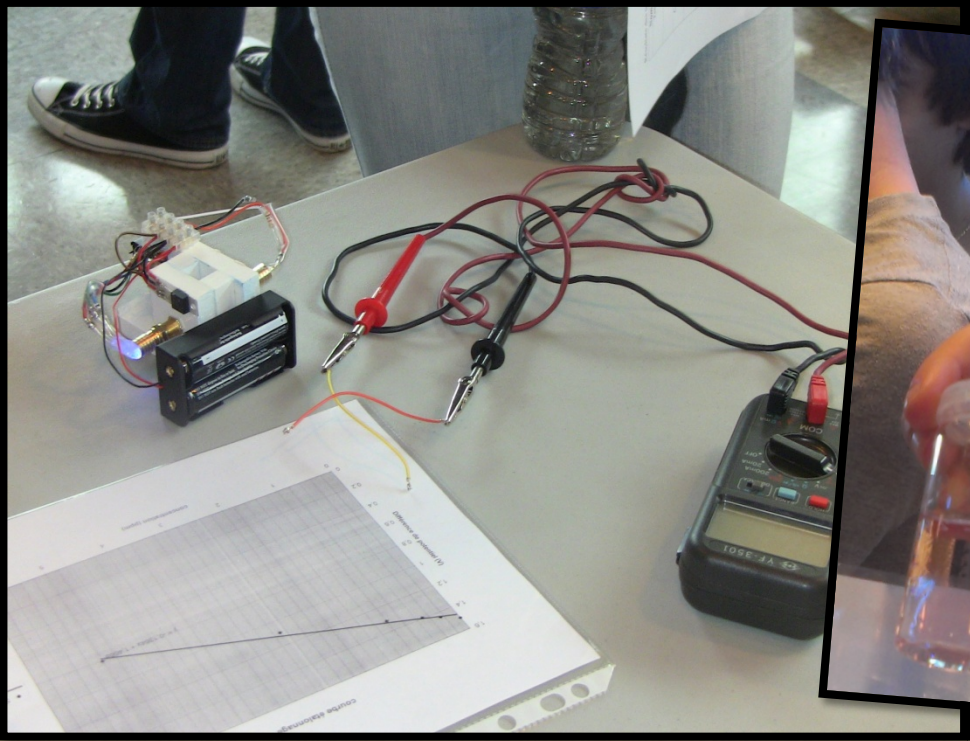
3) social contexts of practice relevant to the broader science teaching community involving relational agency and broader expansion of the activity of mentorship

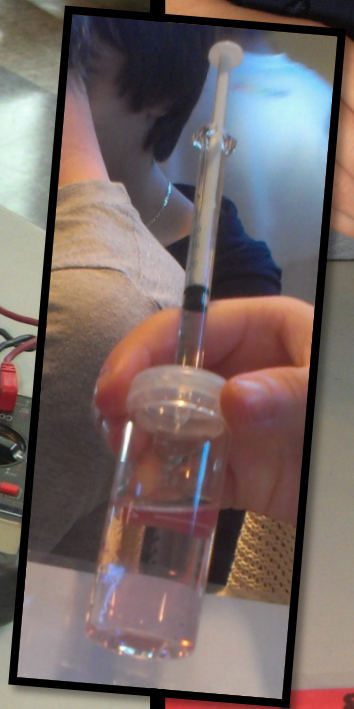
One of the leading teachers involved in training his peers



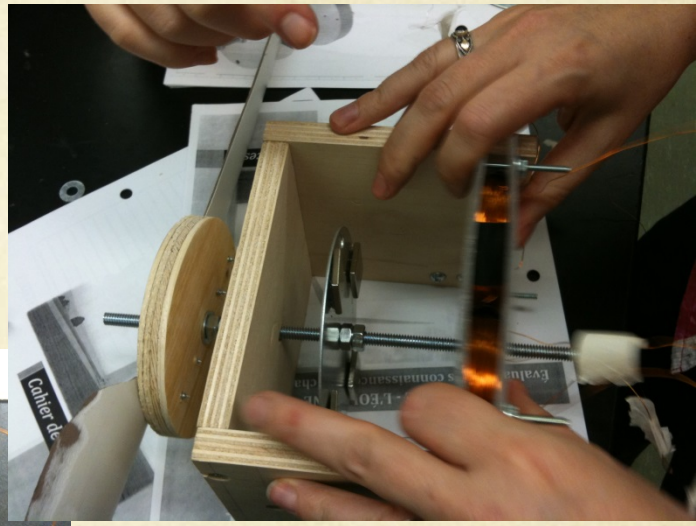
Building site 7 (2009-2017): an overview of the DWR and the iterative research interventions (qualitative and quantitative) between teacher professional development workshops (gray) and research activities (white).


PO4
NO3






Attention !!!
Aimants néodymes x 8
Prendre une feuille sur les informations importantes des aimants.



Data analyzed and used to prepare the sessions with teachers (2012-2013 and 2013-2014)

	School years	
Type of data	**2012-2013**	**2013-2014**
Questionnaires		Online questionnaire : teacher (27) Online questionnaire : students (299) Online questionnaire related to training sessions : students microscope (132) electronic (78) colorimeter (35) wind turbine (73)
Sessions (audio and videotaped)	Researchers- Teachers (2) Researchers – Professional (1) Researchers - Professor (1)	
Ethnographic notes	14	18
Photos and videos	120	
Teaching documents	Colorimeter : 34	
Administrative documents	Colorimeter : 5 Meetings reports : 4	Follow up documents : 2 Consents form : 6 Recruitments letters : 2 E-mails :3
Speaking Turn	349 : researchers 204 : teachers 73 : professionals	

Data analyzed and used to prepare the sessions with teachers (2016-2017)

	School years	
Type of data	**2015-2016**	**2016-2017**
Questionnaires		Online questionnaire : teacher (37) Online questionnaire : students (301) Online questionnaire related to training sessions : students microscope (148) electronic (79) colorimeter (84) wind turbine (149) iPad (13)
Sessions (audio and videotaped)		Researchers- Teachers (2) Researchers – Professional (2) Researcher – Students (4) Researcher – University Students (3)
Ethnographic notes		9
Photos and videos		
Teaching documents		iPad:
Administrative documents		Meetings reports: 2
Speaking Turn		

Overview of the sessions with participants

Date	Duration	Participants	Speaking turns (Participation %)
09-02-2011	00:02:57	Researcher A	5 (71.43%)
		Teacher A	2 (28.57%)
		Total	**7**
24-02-2011	00:12:45	Researcher A	18 (51.43%)
		Teacher A	17 (48.57%)
		Total	**35**
28-03-2011	00:38:42	Researcher A	58 (50%)
		Teacher B	57 (49.14%)
		Researcher B	1 (0.86%)
		Total	**116**
08-05-2012	02:10:30	Researcher A	177 (29.75%)
		Researcher C	15 (2.52%)
		Teacher A	92 (15.46%)
		Teacher B	154 (25.88%)
		Professional A	157 (26.39%)
		Total	**595**
15-05-2013	00:37:28	Researcher C	89 (44.5%)
		Researcher D	15 (7.5%)
		Teacher A	96 (48%)
		Total	**200**
15-05-2013	01:10:57	Researcher C	68 (44.16%)
		Researcher D	13 (8.44%)
		Professional A	73 (47.40%)
		Total	**154**
17-05-2013	01:13:04	Researcher D	89 (38.86%)
		Researcher C	32 (13.97%)
		Teacher B	108 (47.16%)
		Total	**229**
Grand Total			**1336**

Some premisses

- Theory and practice interact with one another and stimulate each other (Davydov, 1990).
- Concept formation occurs via a process in which theory and practice are constantly interrelating with and remodelling one another (Engeström, 2011).
- In response to a problem, teachers can model new pedagogical tools to give meaning to their practice (Barma, Lacasse & Massé-Morneau, 2014).

Documenting discursive manifestations of contradictions to illustrate…

- need that creates a motivation and has an impact on the way people act. (Engeström & Sannino, 2013).
- conflicts as starting points of an action where a person gives new meaning to his/her activity.
- contradictory demands, which the participants encounter in their work activity (Virrkkunen & Newham, 2013).

Contradictions

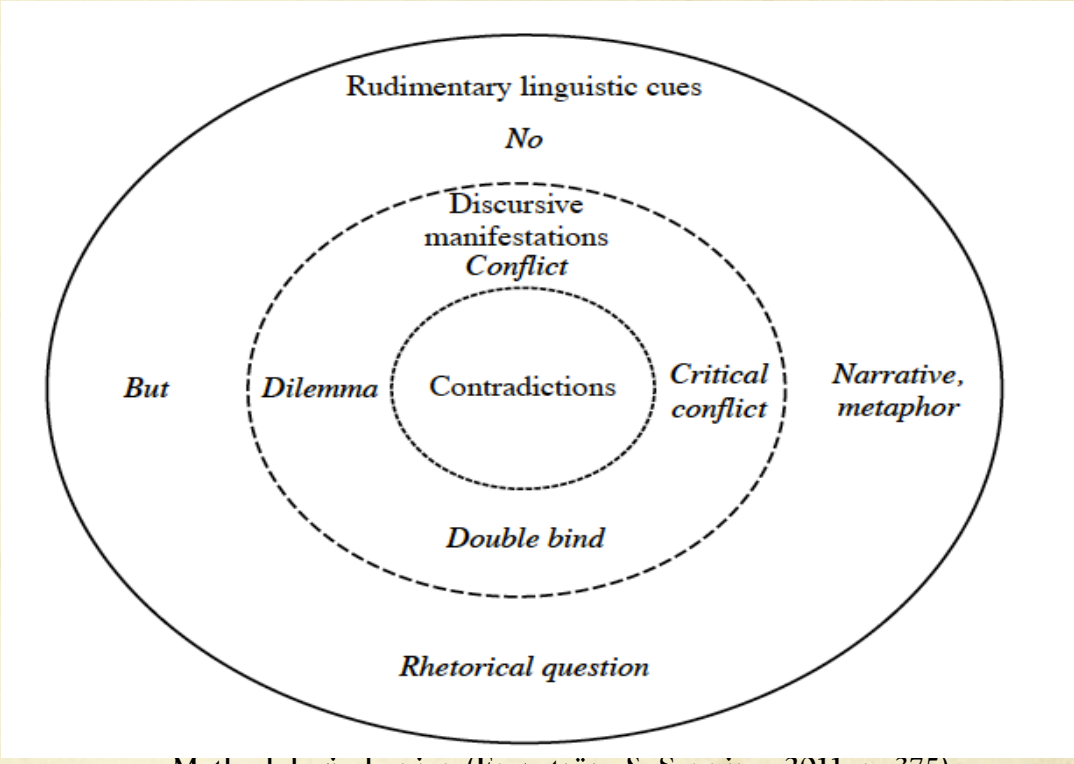
- They result in recurrent tensions embedded in the activity that constitute the unit of analysis
- Not directly accessible: need to move to another level to understand how they historically accumulated.
- Their resolution is done through the practice
- They are instrumental to understanding the intent of the activity and its development (agency)

(Engeström and Sannino, 2011)

Analytical approach

1- Using dialectical, linguistic and emotional criteria, discursive manifestations of contradictions are identified in the discourse.

2- Identification of the primary contradiction as the driving form of the activity.



Methodological onion (Engeström & Sannino, 2011, p. 375)

FIRST STEP IN ANALYSIS: selecting dialectical units of meaning as types of discursive manifestation of contradictions.

Dialectical unit of meaning: presence of opposing forces

FIRST STEP IN ANALYSIS: selecting dialectical units of meaning as types of discursive manifestation of contradictions.

Dialectical unit of meaning: presence of opposing forces

Discursive manifestations of contradictions in the 2011 session

Dilemma	*But you almost have to talk about two things, if we talk about the program or the assessment, that's the dilemma.* *[2011_TB_236]*
Double Bind	*In fact, I didn't understand the reform when it happened. And then I was a bit lost, so... It's why I got involved...I tought I would attend training sessions.* *[2011_TA_354]*
Conflict	*I would have liked it to be a student evolving in the actual reform... However, I consider the assessment not easy for students, it is not fair to all.* *[2011_TA_371]*

Discursive manifestations of contradictions in the 2013 session

Conflict	*We had problems with the performance of the computer, but it has no relation to what he did. It is the school board that provide us with a computer not powerful enough.* [2013_PA_186-188]
Dilemma	*Well, I think some had no problem with the activity, others did not understand the problem.* [2013_TB_507]
Double Bind	*For the coming years, it's something we need to improve...we need to integrate electrical concepts.* [2013_TA_56-57]
Critical conflict	*That's it. It's lower than that. It is not. There is nothing positive. Worse ... there's never anyone who says "Wow, that's wonderful, it's great you're doing this, I have never, ever heard something like that.* " [2013_PA_432-433]

CONFLICTS OF MOTIVES

Two types of conflicts of motives faced by both teachers emerged from our analysis.

1) The definitions of science and technology and the possibilities to better lint them in their teaching activities

2) Teaching strategies

DECISION FORMING PROCESS

Accept that no consensus can be found when discussing the way to integrate S& T	Choose to change the way to approach integration of Science and Technology	Decide to have colleagues engage in practical training	Engage in planning teachers' training
ACCEPTANCE →	CHOICE →	DECISION →	ENGAGEMENT IN AGENTIVE ACTION

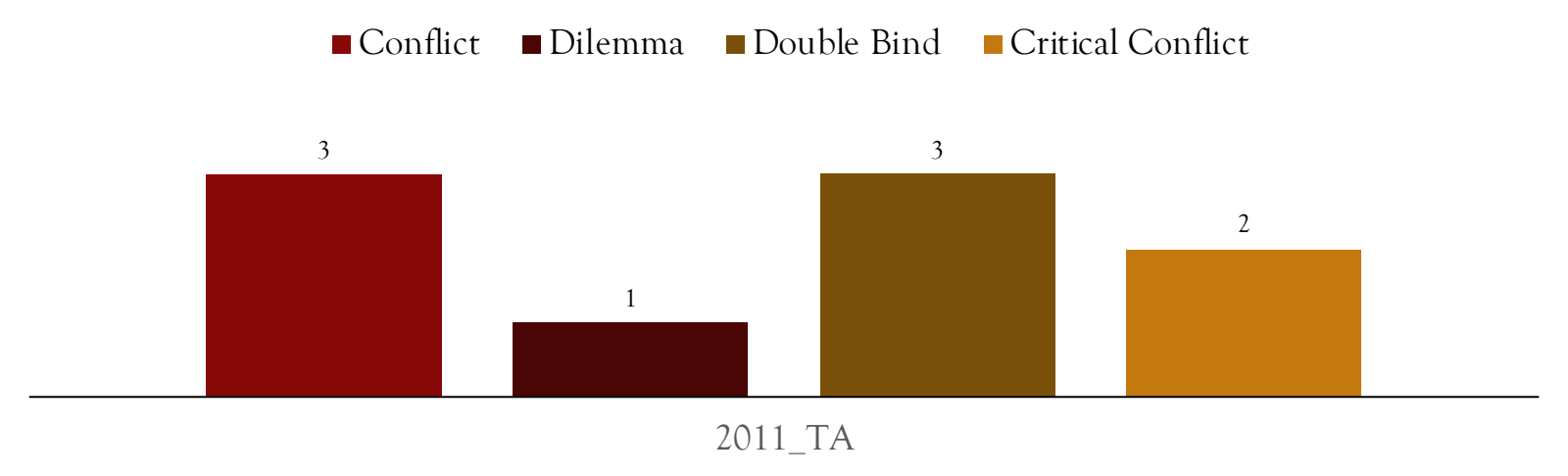
Inner Contradictions: Teachers' Activity

Contradiction in	Verbatim	
Outcome	*When I started teaching science, I wondered in what way the students could benefit from the projects. I was not convinced. So I decided not to engage in projects and focus on content of the new science program. The students hated it. [2012_TB_109-112]*	Teacher B talking after the pertinence of producing a prototype
Object	*I thought to myself: This is complicated, I'm not that good. I teach science badly. I have limits…This means that when I want to find the answer, I consult the ministerial exams. I know that this is the main standard for the government to see if the students are good or not. I set aside the project that I propose to students but on the other end, if I show our project to anyone who doesn't teach science they see links between the task and the scientific concepts. [2012_TB_114-121]* *The problem with assesment is that it kills our creativity and our will to improve our practice because we remain stuck in the present.*	Teacher B reflecting on the meaning of his practice
Division of labour	*For sure, there is a lack of communication between me and TB but mostly because we could not find free time to work together. So, we each work separately but then we really tried to share our work [2013_TA_320-324]*	Teacher A reflects on division of labour

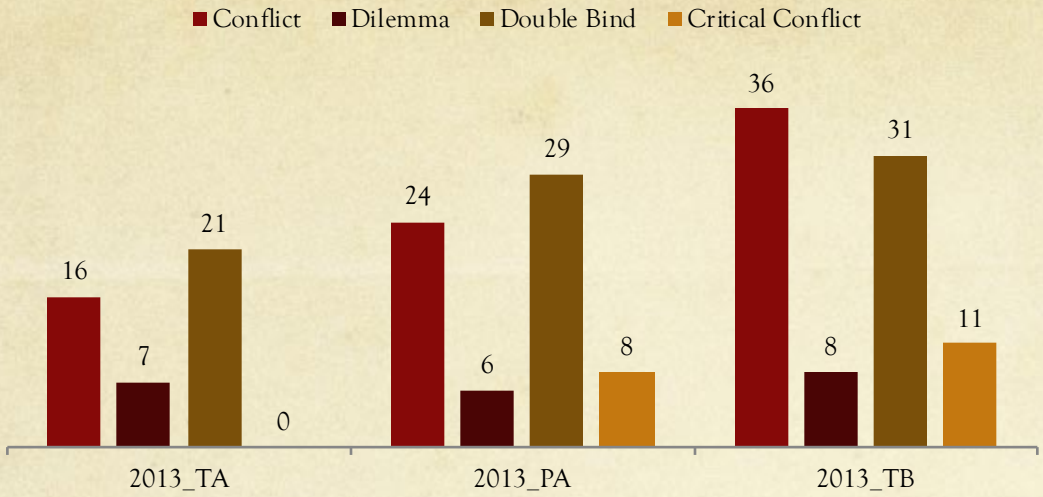
Resolving contradictions: some examples

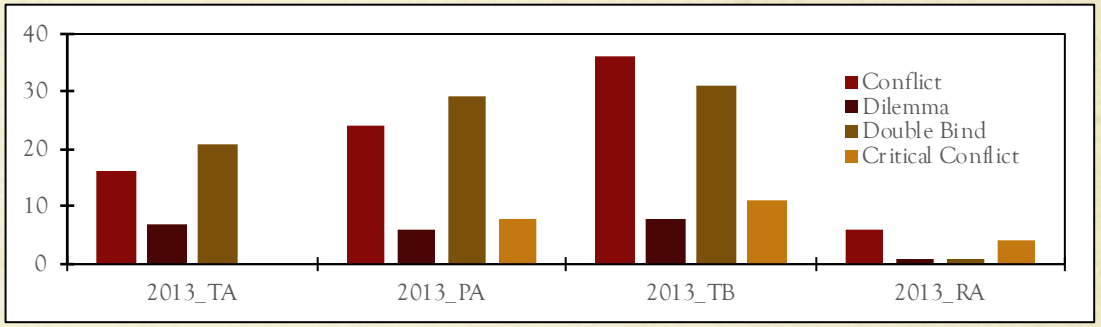
Contradiction in	Verbatim	
Outcome	I have the impression that many of my students have change their opinion about themselves.They now tell me they feel in control when engaging in workshops, that practical work gives them self-esteem and before they felt like second wheels.	Teacher A reflecting on the impact on students.
Tools	When you go to see your principal because you have an idea, you better make sure it will work because he is backing me up. I put 150$ on my credit card. I took the risk…. My principal can't do that… [2012_TB_475-480]	Teacher B deciding to take risks to make his plans work.
Rules	We have coupled two lessons in order to help students finish their projects. It is an interesting accommodation.	Teacher A reflects on changing the usual schedule and his collaboration with a peer.

Trend in the recurrence of discursive manifestations of contradictions

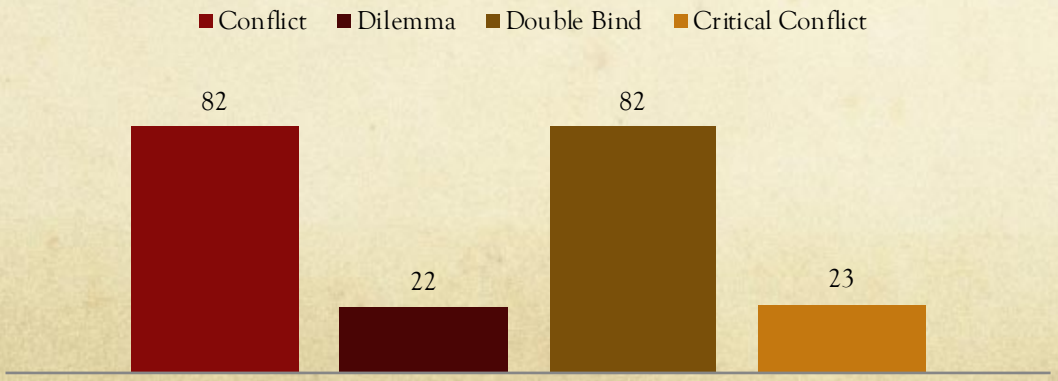


Date	Duration	Participants	Speaking turns (Participation %)
09-02-2011	00:02:57	Researcher A	5 (71.43%)
		Teacher A	2 (28.57%)
		Total	**7**
24-02-2011	00:12:45	Researcher A	18 (51.43%)
		Teacher A	17 (48.57%)
		Total	**35**
Grand total	00:15:42		**42**





Trend in the recurrence of discursive manifestations of contradictions (Total)



At first we went blind. The wind turbine we created was the first project and almost the only project that existed in the province [right after the implementation of the curriculum].

We did our best to try to understand how to work in a workshop and how to integrate the evaluation aspects at the same time. I was working a little bit with my hands but not much, I was not competent with woodwork and nul with electronics, I liked teaching theory.

We work more the same way now. It has changed so much over the years. Now it's more electronic, computer, 3D printer, it's beyond what we did at first. We pushed it so hard, we took at a lot of different paths. We had to adapt. Our first workshops seem outdated now: it is more computer based than hands-on using machines and tools'(Jane, June 7th, 2017).

DOUBLE STIMULATION AS A METHOD TO SUPPORT THE DEVELOPMENT OF AGENCY

When implementing the new ideas created in the *[formative intervention],* the practitioners encounter obstacles due to contradictions between the dominant logic of the activity and the logic inherent in the new solution.

The new idea develops further through the creative resolution of these contradictions that are different in different contexts.

(Virrkkunen & Newham, 2013)

Supporting the expansion resolution of conflicts of motives

- My role as an interventionist: 'Provoke and sustain a collaboratively led expansive transformation process'.
- The contents and course of the intervention are subject to multi-voiced negotiation. The subjects gain agency in the process and take eventually charge of it.
- The analysis of the expansive resolution of conflicts of motives demonstrates that working over the conflicts of motives requires; 1) time before the participants reformulate a second stimulus to cope with the evolving conflicts;
- 2) to reach another layer in the community

To wrap up...

- In both research settings, transformative agentive actions were triggered by conflicts of motives.
- Identifying conflicts of motives in the discourse of the participants has proven fruitful: their resolution seems necessary to trigger agency and engage in taking decisions.
- Their resolution made the building of the 2nd stimulus possible (new teaching strategies, new artefacts).
- Unfolded over a long period of time: resistance was expressed (teachers, students, parents, principal).
- In both settings, more conflicts emerged and reached another layer (expansion of the borders of the new activity).
- Bold actions of transformative agency require the involvement of communities beyond individual practitioners.

More questions arise from methodological and analytical issues.

- Documenting complexity in a specific sociocultural settings requires from a researcher: adaptability, indepth investigation and a lot of time and patience.
- Units of meaning vs unit of analysis?
- How do we make sense of the intertwining of the present, the past and the future?
- What do the recurrence of tensions tell us?
- How do we make sense of inner contradictions?
- Is it helpful to trace the formation of agency?

Findings

- The identification of the types of tensions encountered by the leading teachers has allowed us to better understand the inner contradictions.They come out as recurrent systemic tensions in the teachers' activity.
- The contradiction in the production of the object reveals the driving force of the activity.
- The production of teacher's training sessions was a success but over the years, contradictions in division of labour and rules had to be overcome.
- Although we have focused on teachers, we have found that what motivates them is the high interest of students for the workshops and their increased interest in their science classes.

THANK YOU!

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Perezhivanie: sense of social development (Rey, 2016)

- The restructuring of needs and motives and the reevaluation of values are basic factors in the transition from age level to age level (Vygotsky, 1998, p. 296).

- The understanding of subjectivity from a cultural-historical perspective demands an advancement of the studies on the concepts of perezhivanie, sense and social development and the recognition of human psychological processes and formations as subjective productions defined by integrative emotional-symbolic experiences as they are lived by the individual in different moments (Rey, 2016)

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Investigating the concept of Perizhivanie (Jornet & Roth, 2016)

- Perezhivanie denotes the unity|identity of person and environment, and thus also is a universal category of human development. It is the cell of human development as commodity exchange is the cell of bourgeois society.