A Heuristic for Mindfulness in Innovative Education[1]

Maurício Pietrocola

Abstract

The goal of this text is to study the reproduction and transformation of practices in the teaching and learning of science. The context of the study was a research project conducted in Brazil among high school physics teachers who introduced new curricular contents and methodologies of teaching and learning in their classroom. The objective is to understand the limits and possibilities of change in teachers' practices and the risk associated with this change. I advance the notion of innovation that must be seen as an movement of change in the direction of better education as desired by the teachers, thus implying a conflict generated against the traditional established practices. We assume that the success these teachers experience in teaching in an innovative way is due in part to the awareness they reach in dealing with the risks and conflicts in classroom practices. The goal is to connect the experience of these teachers with the mindfulness studies. Attention to the feelings that came during the context of innovative education could help other teachers that tried to implement innovation in their classroom. For that reason, this paper develops a heuristic to be used with in-service and pre-service teachers willing to support them to be aware of the emotions coming from the context of innovation where risks are always present.

Keywords - Innovation . Teacher preparation . mindfulness. heuristic

M. Pietrocola
Department of Methodology of Teaching, Faculty of Education, University of São Paulo,
Avenida da Universidade 308, Sa˜o Paulo, SP 05543-900, Brazil
e-mail: mpietro@usp.br

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INTRODUCTION

Becoming a teacher is a process that involves a set of contingent events and is immersed in intense emotional flow. I vividly remember my first day as a regular high school physics teacher in 1985, just after I obtained my degree in physics and my certification to work in high-level basic education. The context was singular, not only because I was asked to replace a teacher fired during the third month of the school year, but also since it was a school at which I was a former high school student: a private German institution, even though I am not of German descent. After having studied in a public school until middle school, my parents devoted tremendous effort to support me in that elite private high school. A greater percentage of my schoolmates came from the upper class, in contrast to the few of us who came from the middle class. Indeed the differences between us were not so different in the classroom, although it became clear, during the first party, that we lived in different worlds. The homes, cars, and other possessions of my classmates showed that our social and financial conditions were unequal. The differences didn't prevent these worlds from overlapping beyond the school itself. The soccer team we had organized was one common social field where social boundaries didn't exist.

This German school left an impression on my personal life history. These components made my start as a teacher an unique moment in my live, a context charged with many different emotions. Many of my formers teachers became my professional colleagues. The same principal was still employed and became my boss.

The topic of my first class in May 1985 was *vectors* and how to operate with them in physics problems. It was a very simple subject for someone like me who has studied physics for more than four years. Nevertheless, it took me more than one week of studying to feel ready to face my students. The class was not big, composed of fewer than 25 students aged between 14 and 15 years old. The night

before my first day I did not sleep well, and the class started on Thursday afternoon at 4:00PM.[2] I was very nervous but pretended to be calm and confident. The class was the longest 45 minutes of my life. There was a kind of silence in the air during the most of the class time, similar to what had happened during the first minutes of a playoff game. Students were also immersed in a high emotional climate, as I could easily observe in their faces and in their body language. They looked at me and tried to interpret me just as I was trying to do with them. After the first class was finished, I had another class of the same subject to teach. This one ran smoothly. I maintained a little more confidence and relaxed. Even if it was not as fun as being with friends, the fear I had felt during the previous class diminished. The students were not the same, but I quickly adapted to this new classroom as though it was the first.

I have many other memories of those first years as a teacher, especially in connection with episodes involving students' behavior, some misleading in the solving of physics problems and in the management of available time of classes, attendance of parents' meetings, and establishing relationships with the faculty members of the school. All of these episodes were charged with emotions. I particularly remember one student because he spent the greater part of the first month challenging my authority in the classroom. His name was Luiz. It is unusual that I remember a student's name; normally I have very bad memory for names and am very good at remembering faces. However, in this case, I remember both the name and the face. He was a very thin young man who sat every day at the back of the classroom, bringing nothing more than a notebook and a pen. He looked directly at me in a very aggressive way, with direct eye contact and body projection to the back of the chair. I always felt that he was waiting for a false pass or misunderstanding phrase spoken to correct me. It is important to specify that, at that time I was 23 years old and appeared much younger than this. I had to face that student three times a week and I felt scared of seeing him until the day I decided to speak with him after class. My perception at that time was that the behavior of this students put my

[2] It is important to say that, in Brazil, the schools normally run for half period of the day, morning or afternoon, with some students also take evening courses from 7:00PM to 11:00PM.

command in check and that it could reduce the confidence the other students had in me. I had a quick but decisive conversation with the student, stating basically that, since we would be together during the year, we would have to find a way to co-exist. I remembered asking him to stop confronting me during every class because I was the teacher and I would be keeping my stance with his approval or not! The conversation was immersed in a bad emotional climate; thus, I had to control myself because my voice and my body began to shake many times as a result of the excessive emotional energy I couldn't absorb. The student stopped challenging me. I guess that he was looking for attention, or maybe he needed some limits, like most boys and girls at that age do. Perhaps also I used my power of teacher to compel him to submit to the rules I imposed. It was not a negotiation, and I regret having acted in that way!

The four additional years I spent in that school were different in many aspects. The memories are much more diffused, and I can even remember some students' names and faces from some of my classes. Nevertheless they are not so clear and don't evoke a coherent set of images, feelings, and proposes like the first year I taught.

I think it is important to relate this episode because it is a salient part of my history as a teacher. It emerged from a special moment of my life where I was not confident in assuming my professional duties. And it differs for the most of the others moments in my history as a high school teacher, when I was much more confident and feeling safe inside the classroom. I chose this moment to start this chapter because it reveals a contingent and emergent situation in the historical process of becoming a teacher (Sewell, 2005, p. 197).

The narrative I have made here is not unaffected by the present moment. This means that it is not an objective transcription, but mainly a personal and actual historical reconstruction of an event in my life. Without a historiographical methodology to confront my report with other reports and other sources of data, it is hard to separate what really happened at that moment from the projections of my desires, fears, and anguish. Even so, this is the way that moment of my professional life seems to me

now. It is not **the** history of my beginning as a high school teacher, but **a** history of it! And the way I tell that history reveals my perception of elements that make sense in my personal experience as a new teacher.

The problems I would like to analyze in this chapter deal with the history experienced by teachers throughout their careers as educators. I have decided to discuss the commitments, duties, and constraints involved in these pedagogical practices as belonging to the history of teaching and learning of a specific discipline (in my case, physics). That first day/year in school shaped my understanding of the process involved in teaching and helped me learn a lot about myself, my students, the school, the pedagogical schemas present in class, and most of all the emotions felt during the process of acting in a new social structure.

The emotions of this experience are very present as I write this text now. That episode from the past resonate in me in the present moment, like two physical system with similar frequency transferring energy one to the other. This phenomena in science is called "physical resonance". In my case it could be called a phenomena of "social resonance" with transfer of emotions (Collins, 2004). It was a mixture of fear, anger, and happiness related with a sense of duty to take control of a situation inside the classroom that was escaping me. Why I am so impressed by the images and memories of events that occurred 29 years ago? Perhaps the emotions I felt in those moments have operated as catalysis[3] in my mind.

A second episode, which occurred in the same German school, happened during a process of selection of physics textbooks for all classrooms. We had a meeting of all four physics teachers to decide questions about the curriculum and textbooks. The textbook in use was the same one I used as a student.

[3] Catalysis is a chemical process of the acceleration of a chemical reaction by a catalyst.

At that moment, in addition to my duties as a teacher in that school, I was a master's student in a science education program at the University of Sao Paulo. Since I was intensely involved in research about science education, the textbook in use made no sense to me regarding the new pedagogical approaches. I brought another textbook[4] to the meeting to be evaluated by my colleagues. Most of them knew of that textbook and its different pedagogical approach. It was more humanistic and more conceptual and maintained less of a focus on problem solving. It seemed to be more adapted to the needs of students than the former textbook, which was practically a workbook, with a very small section devoted to meanings in science, the impact of physics in society, and a lot of problem solving. I tried my best to persuade my colleagues to adopt this new textbook without success. Since I was a younger teacher in the group (in the sense of both age and experience), my position was easily overtaken by their arguments. The main one was that the former textbook was more adaptive to the standards we had at that moment. But my impression was that, beyond this argument, they had a desire not to change the way they taught. A joke was made that I was a "salesman" for the authors of the new textbook, and despite my intense arguments in favor of this new textbook, it was not adopted! I was frustrated and felt like Don Quixote fighting for Dulcinea. I quit my position at that German school in 1988 when I went to Paris to start my doctoral course in History and the Epistemology of Science.

The experience I had in that German school started to make sense when I came back to Brazil in the middle of 1992. I was hired in the Physics Department of a Federal university at the South of Brazil to work in a course for pre-service physics teachers. Receiving the duty to teach in education and pedagogical courses, I had the chance to develop the curriculum, strategies of teaching and learning, lab sets, analyses of textbooks, and other related areas.

Having analyzed textbooks with the students (future teachers) I have realized that the physics textbook most used in Brazilian schools at that moment continues to be the one I used as a high school student at the German School for which I fought to change. This fact alone has less significance since

[4] In 2008 that textbook became a best seller in Brazil.

any book can be re-edited or at least updates. But to my surprise, the collection (it was a set of three textbooks) was 90% similar to the books I used. The differences came mainly from the design, the cover, and color used to draw pictures and print photos. As I continued to teach at the college, that collection continued to be a best seller in the textbooks market. Until 2008, this collection was the most used among high school students in all of Brazil. Even if there was more than a dozen other textbooks on the market, this was the most chosen by physics teachers.

The episodes I have described above make me think about the stability of the educational system that make a textbook collection so enduring. I have two other episodes that could add repertoire to this question, but before I present them, I would like to explore the "stability of the educational system" as a cultural notion. My perception is that the longevity of textbooks and practices in school (not only in the physics domain) lies in the stability of the educational system. Thus, this stability also explains the difficulties faced by a new teacher when he conducts his regular work in a school.

THE REPRODUCTION, TRANSFORMATION, AND STABILITY OF EDUCATIONAL SYSTEM

The narrative described at the beginning of this text emerges at the heart of many other situations I have faced in my long professional life. Nevertheless, these facts have impressed me so deeply that I can remember them vividly even today, and I am able to make connections with other aspects of the teaching and learning processes. These can be analyzed in the dialectical perspective of *reproduction* and *transformation of practices*, mediated by contingencies that happen inside the classroom considerate one of the systems/fields of social life[5]. On one hand it is a picture of the way

[5] Following the French educators, it would be called a *didactic system*

new teachers are trying to reproduce practices and patterns of a tradition they want to be part of. It is the predictable aspect of the classroom practices. On the other hand, it reveals a succession of facts that contributed to my personal identity as a scholar, working with research in science education. In this sense, it is a contingent fact of my personal professional life that allowed me to transform my own practices, becoming critical about some traditional patterns in science education and persuading me to work to help teachers who were in my field of action to transform some of their practices, too.

Identity is a current trend in science education, and my personal history is a testimony of how it is forgotten in many sets of fields and contexts. First, as a student in a German school and late as a high-level teacher in the same school and finally as a teacher of teachers at the university level, all of these personages coming back to the same field, but bringing to each cycle different perspectives of what it means to teach, learn, and learn to teach. My own identity as a teacher and the image I hold about other teachers are constructed on the basis of this process of the permanent revision of my memories. Tobin let this aspect clear stating the following:

"As individuals think back on what was accomplished in those fields, memory traces reconstruct what happened in much the way that a highlights reel is put together. Events that stand for enactment in a field are reconstructed and it is perhaps in association with these events that individuals construct images of "self" in particular fields. Obviously these constructed images are based on a reduced data base and are subject to ongoing revision as an individual returns to a field over time." (Tobin 2014a, pg. 135)

I will forge out my analysis of these and others episodes from a socio-cultural perspective. Culture represents the way human beings act in any subset of social life. It involves a combination of material and technical practices and standards of conduct, values, and behavior patterns (Whitaker and Bezzon, 2006) that are structured in different semiotic modes (Geertz, 1973). The construction of this

system of practices is historically determined. Educational institutions, schools, and classrooms are subsets of those kinds.

One important requirement to be fulfilled by a definition of culture is the ability to explain the *stability* of social systems and at the same time the possibilities of *changes*. In my opinion, and those of others dedicated to the theme, culture is an important construct to understand social life if it could explain how changes are possible in the way practices or actions happen. In this sense, social life is the process of reproduction of practices and patterns. As never totally predictable and always contingent, cultural systems are indeed exposed to transformations. A theory of change in social life needs a theory of social structure that is less determinist and more multiple, contingent, and not homogenous than those proposed by the structuralists of the 1960s[6].

I adopt the perspective of Sewell, for whom culture has to be understood "as a dialectic of system and practice, as a dimension of social life autonomous from other such dimensions both in its logic and its spatial configuration and as possessing a real but thin coherence that is continually put at risk in practice and therefore subject to transformation" (Swell, 2005, pg. 169,). Thus, when cultural incompatibility is stressed by the influence of external but also internal movements, deeply rooted problems emerge in the system and practices established.

Sewell's definition of culture came from two perspectives: a Geertzianian one which emphasizes the meanings and understating made inside a system of symbol and practices, and a Sahlinsian (Sewell, 2005) one, through which Sewell finds a way to frame the process of transformation of cultural systems defining the multiplicity of structures and the concept of an "event," which indicated the moments in which a cultural structure is reshaped. For him, culture comprises a system of schema and resources that are shared by a community or social group. Any culture is an

[6] About the structuralism, see for example the introduction of Giddens, 1984.

open-ended system with a thin coherence and ever-present contradictions. This means that its borders are weak in allowing systems to overlap each other.

In his words:

"Cultural structures... should not be seen as corresponding to distinct "societies" – because it is so often impossible to specify where one society or culture ends and the next begins – but rather as corresponding to spheres or arenas of social practice of varying scope that intertwine, overlap, and interpenetrate in space and time. This would mean that for any given geographical or social unit, the relevant structures would always be plural rather than singular."(Sewell, 2005, pg. 206)

For Sewell, events are "unique and contingent happenings and are subject to the vagaries of human will" (Sewell, 2005, p. 197). He regarded an event as analogous to a rupture of a coherence trajectory. At first glance, structure and event could be seen as opposite: structure is a kind of metaphor that implies permanence, order, and solitude, while an event is connect with the accidental and unpredictable. Sahlins explains the antagonism of both notions as follows:

"It seems that 'event' and 'structure' could not occupy the same epistemological space. The event was conceived as anti-structural, the structure as nullifying the event... structure is to the event as the social to the individual, the essential to the accidental, the recurrent to the idiosyncratic, the visible to the invisible... the comparable to the unique." (Sahlins, 1991, 40)

Using this point as a departure, Sewell shows the way Sahlins conceptualized a relationship between structure and event. For him, "Sahlins recast the meaning of the contrast, attempting to transform the unequal and radical opposition between structure and event, into a more balanced relation, in which each category implies and requires the other" (2005, pg. 199)

In others words, we could follow the syntheses Sewell made, saying that structures define and shape events, but also events define and shape (and sometimes redefine and reshape) structures. This is the core idea which supports the pair "reproduction and transformation" of structures. Tobin and

Ritchie define this relation between reproduction and transformation of culture, highlighting the idea of the interpenetration of cultural structures:

"As individuals conduct social life, they enact culture in fields, comprised of structures, including actors and what they do. Fields do not have boundaries and, as a result, they interpenetrate. In this way structures emanating from particular fields become resources for action in other fields." (Tobin and Ritchie, 2012, pg.118)

This defines the contingent moment that became important to understand the contraction and changes of meaning inside the cultural practices include the pedagogical practices too.

Using this sociocultural framework, the classroom is defined as a cultural space composed by a set of moments of enactment of specific schemas and resources proper for the culture of teaching and learning. It could be called "didactic culture" (also with a correlated didactic system composed by schemas and resources) that specifically connects to the schemas and resources belonging to the practices of "teaching something to be learned by someone."[7] It could be seen as a cultural system belonging to the educational realm where symbols and meaning were shared by a community in a coherent way, as proposed by Geertz (1973). But the actors in the educational realm enact culture in reproducing patterns of the system while also transforming it, because the schemas and resources could be appropriated in different ways by these actors (teachers and students), and there is always the possibilities that schemas and resources from others cultures will interfere with it (Sewell, 2005).

Revisiting the narrative of my debut as a high school physics teacher, in the practices of a novice educator, the challenge is to incorporate schemas and resources belonging to a didactic structure and facing events that disrupt this structure in reshaping it at different levels. I have had the chance to tell my personal history as a novice teacher many times to friends and colleagues within the profession.

[7] Chevallard, 1989.

It has being done in a sense of anecdotes of a young teacher having to face his first class and the lack of confidence one normally has when starting a new job. Nevertheless, I think there is more to consider in this case. In Sewell's terms, it was a event that emerged from a much longer period in which the task was more a reproduction of the school system. This was to happen in the beginning of the teacher career that reflected emergence, contingence, and the process to enact cultural patterns.

Coming back to these memories and reflecting on them, I realize that there are many different aspects that made that event really unique in my life. One of these is that the first classes seemed more like a arm wrestling match between the teacher (me) and students, each side using cultural resources to empower themselves. I was using fear (a human resource in Sewell terms) that could come from the grades I was able to provide and the punishment the school allowed me to impose on the students. The students using human resources, for example asking me a difficult question or seeing if I was able to control the behavior of the class (demanding silence when was speaking). My lack of previous experience made me afraid and emotionally sensitive. It is important to note how unaware I was about the reasons that make that context emotionally loaded. Facing a classroom for the first time is normally a challenge for any teacher, even if one has a lot of hours of theoretical study about teaching and learning behind him or her and some hours of co-teaching activities. The moment you start as a regular teacher could be considered a rite of passage. You have all the complexity of the process of teaching and learning to be managed in addition to the formal aspects related to the school administrative commitments. The theoretical knowledge normally fades in the multiplicity of the aspects of a real classroom. In moments like this, the most useful schema of action and resources came from previous practical experiences. But there is a contradiction in this claim: one needs previous practice in teaching and learning to put teaching into practice! This contradiction I think is one of the challenges novice teachers face to become professionals of teaching and learning. The need for specific practices to enact in a classroom normally came before any possibility of previous reflection. It is a characteristic of

many professional activities where there is a need for practical skills beyond the level of discourse, and many times this second level of consciousness is disrupted.

Michel Serres[8] made a very beautiful narrative about the community of fisherman in the North region of France (Normandy) that has the ability to find a special place to fish far from the cost. At a time when there was no GPS or sonar equipment, they knew how to locate themselves in the middle of the ocean without any kind of support from stars in the sky, islands, and coastal references. The most interesting thing is that, when asked to explain how they could arrive at that place, the answer was normally very naive, as if it was possible to "see" a path in the open sea. It could be called a kind of "intergenerational knowledge." Growing up inside a community of fisherman, they learned how to navigate by "learning in being with the others fisherman"[9]: fathers, uncles, and other relatives. Indeed a culture was always an enactment, being reproduced and transformed. These days, there are probably no more fisherman able to find this place and fish without the help of new devices like GPS and sonar. With the new resources being incorporated day to day in this fisherman community, the transformation has led the practices being transformed and new schemas of action adopted by social actors. It is a case in which resources came from other structures and overlap the structure in place at that cultural system, resulting in a different system of schemas and resources that actor enacts.

The episode about the choice for a textbook in the school at which I worked could be interpreted in the same way. The textbook is a material resource for the physics teachers to enact didactical culture. In that case, the adoption of a new textbook would have implied a radical transformation in the cultural system of our small community of teachers. This means that the new schemas of action will need to be put in place; in other words, new cultural enactment will be required. The resistance – reproduction of structures in place – of my former colleagues could be understood in

[8] This story was told by Gerard Fourez in Florianópolis, Brazil, during a PhD course. It is important to know that Michel Serres was a sailor before he became a philosopher.
[9] Heidegger, M. (1996). A state of *passivity* in the sense is to be open to learn or to be receptivity to learning.

the dialectic of agency/passivity. In that moment I was using my agency to try to transform the cultural system, because the introduction of a new resource will imply new schemas of action. In the opposite direction, my colleagues were trying to keep the system the way it was, sustaining the old resources that will keep the same schemas of action. Their passivity caused them to fight against me to reproduce the system in the way it was.

In trying to explain the role of social actors and agency in the face of social life, Antony Giddens discussed some aspects of consciousness that are present in any kind of social practice. Thus, he highlights the importance of understanding the conscience that human agents have about their action in social life. In his words, "actors have, as an inherent aspect of what they do, the capacity to understand what they do while they do it. The reflexive capacities of human actors are characteristically involved in a continuous manner with the flow of day to day conduct in the context of social activity" (pg. xxii/xxiii). He called this "knowledgeability" (Giddens, 1984 pg. 375); i.e., everything actors understand (or believe they understand) about their actions and the actions of others in the context of his action and the others involved in it. This knowledgeability allows the production and reproduction of this action. But reflexivity operates partially at the discursive level, because the knowledgeability of actors includes tacit as well discursively available knowledge. Giddens calls the tacit process of reflexivity "practical consciousness." He completes that idea of practical consciousness with the notion of "Routinization," which sheds light on forms of action that are enacted automatically, without a level of discursive consciousness. The greatest part of day-to-day social activities are made during routines, because the nature of social life is very recursive. He presents three types of consciousness humans being have about what they do: *discursive* consciousness, *practical* consciousness, and *un*consciousness. Normally these three levels of consciousness are present in all activities of social life.

The recursive aspect of social life is built for the most part from the situations by a process of entrainment, in being with others who know how to do it. The passivity is connected with the recurrence of life. These situations, or the sets of situations, are put in action without the need for reflexive thinking. In this sense, Giddens says that "practical consciousness consists of all things which actors know tacitly about how to 'go on' in the context of social life without being able to give them direct discursive expression" (1984, pg. xxiii).

The routinization explains an important part of a teacher's life. The question to be proposed is thus: how did this process start? As I have explained above, being with others in the area of action defines the main idea of the entrained process to be done. However, the process of becoming a teacher happens in a particular way. The numbers of hours in co-teaching that I have mentioned above are normally insufficient to frame the way teachers incorporate the routines needed in teaching and learning practices. To avoid being put in jeopardy, they normally access a period of their own history as a student when they are learning in being with other, more experienced teachers. This is normally a much longer and much more effective process in practical examples than any other period in courses to learn to teach. The experiences as a student have a strong power to frame the way one conceives his own action as a future teacher. For that reason, the greatest part of news strategies of teaching and learning at the pre-service courses succumbs to the force of practical consciousness received from the previous experience that new teachers have as students. The routinization act in the direction keeps the mind free for the contingency facts of life. As Giddens states:

"Because, I think, the apparently minor conventions of daily social life are of essential significance in curbing the sources of unconscious tension that would otherwise preoccupy most of our waking lives." (Giddens, position 284 – Kindle version)

My colleagues fought against the adoption of a new textbook, embodied in a practical consciousness, because I am quite sure that the arguments they offered to refuse the use of the new

textbook were not fair. They have argued on the basis of the good results we had had with the other textbook in previous years. But in fact, my interpretation is that a new book, as I have written before, would imply a radical transformation in their professional practices. This interpretation fits well with the difference between the practical and the discursive level of conscience. As Giddens states:

"Chief among these others concerns is the provision of conceptual means for analyzing what actors know about why they act as they do, particularly either where they are not aware (discursively) that they know it, or where actors in others context lack such awareness. These tasks are primarily hermeneutic in character, but they are an inherent and necessary part of social life." (Giddens, 1984, position 221)

It is important to note that a practical perspective must be considered in that case (choice of the new textbook in that German school), since it is not possible to extract generalizations from discursive reports because the motivations reside in the unconscious dimension of the actors.

In general, a large part of the work in the classroom was involved in practical level, which means that the flow of day-to-day activities in a classroom has to be considered a didactic routine done with tacit knowledge. This means that things teachers really do inside the classroom are only partially captured at the discursive level. This kind of situation makes it difficult to transfer knowledge received from pre-service or in-service courses directly to a classroom situation. This is because these courses operate mainly in a discursive level. This situation could explain, in part, why I have many memories of my first year as a high school teacher. The experience that I have was in fact the process of being put in the flow of day-to-day pedagogical activities. It was also the moment at which the tacit knowledge and the practical consciousness started to be framed. In my case, the knowledgeability came partially from the courses I had in my pre-service courses at the university but mainly from my previous experience as a high school and university school student in physics. The actor has the capacities to

understand what he or she does. But this understanding is only partially conscious, just because the "routinization" process involves a lot of tacit knowledge and a related practical consciousness.

My reactions/responses to the events that I have faced during 1985 was a combination of many acts supported by my previous experience as student since I was able to follow my former teachers' enactment. As I have seen the way they react/response to specific situations of classroom I was able to reproduce the didactical system (been passive). But on the other hand, I had a repertoire of a few acts supported by the discursive available knowledge that came from pre-service courses that I have attended before. Both kinds of reaction/responses entertained a dialectical relation that could be seen as a pair of reproduction/transformation of patterns belonging to the didactical culture I was starting to enact.

INNOVATIVE EDUCATION, MINDFULNESS, AND SOME ASPECTS OF TEACHER WORK

The work intervened by teachers could be defined as uncertain, emotional, and attentional demanding (Pinto, 2005). Besides the fact that the work of a teacher is filled with these ingredients, the moments of a break/disruption are normally more affected by peaks of uncertainty and negative emotions and require a large amount of attention. My own experience as a teacher gives support to this claim. Although my narrative is completely personal and not extensible to other teachers, I guess the greater part of teachers could make personal narratives with similar content of emotions, uncertainties, and demands of many types. My goal is to grasp these moments in view of the fact that the workloads of emotions could make differences in the way teachers will thrive in their profession and personal lives. One of the most important points is to keep stress away from daily duties in order to experience a more healthy life.

In this sense, I would like to specify a bit more what I understand as a "break/disruption" in the historical profession of a teacher. The first and inevitable disruption for any individuals studying to be a teacher is to teach in real conditions. This is a moment any teacher will never forget. But in most

cases, the nuances and empowerment behind these facts lived in a not always clear and conscious mind. In my case, I have had the chance to attain a high level of awareness of my first experience of teaching, seeing that I became a university scholar, working with pre-service and in-service science teachers for many years. It happens to be part of my actual duties to think about the way one becomes a teacher. This means that my work gives me the chance to come back to my own history to be aware of the process I was unaware of previously. Along the years, I started to pay attention to the role emotions could have in the work of new teachers. My personal narrative at the beginning of this text was a recitation of how I had overcome uncertainties, emotionally and attentionally demanding, as cited by Pinto and attained a routine of work. The adoption of a routine of action involved the ability to enact schemas and resources in the pedagogical cultural system you are in and establish fluency in the classroom. In this sense, routinization is vital to the psychological mechanism, whereby a sense of trust or ontological security is sustained in the daily activities of social life. Seeming that I had no real experience with what was going on in the classes at that time, my ability to accomplish the required routinization was very low. This could explain, in part, why my first experience as a teacher in a real classroom involved a high emotional climate.

There is a dialectical relation regarding the fact that each teacher/student has had an opportunity to experience the ambience of a classroom as a student. It is given them the possibility to project for themselves a yardstick to be followed when time comes to be in the classroom. And this is the good side of the story, since at the same time it frames expectations of what must be considered a good teacher, creating strong emotional pressure over the first classes. Moreover, becoming a teacher in a school where you were a former student, as I did, makes the task much more difficult. On one hand, it could be possible to know in advance the position the school's principal had in regard to the inadequate behavior of students – the way Luiz (and other students who confronted me in my first month at the high school) put himself in the class was unacceptable in that school. On the other hand, to be able to anticipate expectations and patterns of being a good teacher increases the responsibility and makes me

much more likely to fail. Failure would be, in some sense, disappointing the greater part of my former teachers, the principal, and other faculties members that continue to stay at that school. This point makes emotions reach a high level of anxiety. Thus, it was not difficult to understand why I put so much energy into preparing myself for that first class. Just now, having had the chance to write this paper, I had some aspects that were present at that time come to my mind and allow me to have more **compassion** toward myself and to new teachers who face similar situations. The way I have found to support myself at that moment comes from my memories, but I am sure that it could be easier if I had been prepared in advance and had received some tools in the pre-service course to help me manage that situation.

Another type of "rupture" occurs when teachers, after overcoming the initial difficulties in assuming the commitments of the real classroom, decide to change or were pushed to do it; i.e., they have to change the way they normally enact schemas and resources in a didactical system, including realizing that the way he normally teaches is not well successful or being submitted to a curriculum reform. This was a field of study that interests educational policy makers. Generally it is hard for a teacher to redefine his or her pedagogical style of teaching after having attainted a moderate standard of routinization. After all, there was an expenditure of energy to incorporate the routine, patterns, and meanings inside the classroom. This means that changing a routine costs a lot!

It is important to further explain the notion of innovation, because the main problem presented in this text is how to manage an innovation in the classroom. First of all, I could say that there is a connection between the notion of change and innovation related to frequent and repeated tasks in everyday life: any innovation implies a change, but only some changes imply innovation. In our social life we are involved in a process of reproduction and transformation. Because contingencies and emergencies are always present, changes are part of our daily lives. For example, when I leave my home to take my car to work and I realize that it is not functioning, I have to change the way I get there. Taking a cab or calling a friend could be a change in a routine that I am committed to do every

day. This change may be adopted as a new routine because I realize that taking a cab is more practical than driving every day to work or because that friend lives so close to my home and it is better to share the expenses with him. Nevertheless, if one day I decide not to take my car to get work anymore and I bought a bicycle to ride there, this is a decision that involves reflection and evaluation about the way I get myself to work. In this case, I have made an *innovation* in the way I get to work. The construct "innovation" in this text means a change that was the result of a previous decision. The axiological dimension of the enactment is the background of an innovation because it was made on the basis of a reflection and evaluation that involves some values. The axiological dimension may have origins in a personal context, as in the example of changing the car for a bike, or in a collective context, as in the decision to use a bike as a result of a city policy to reduce carbon emissions. In a sense, a innovation intends to be more permanent and part of the reproduction of the cultural field. But since transformation is always present, there is a high level of adaptation and change in the process of an innovation that make the transformation always present.

Studies about the educational innovation related to professional practices of teachers came from the late 1960s (Bush, R., & Gage, N.,1968). Even dominated by behaviorist frameworks, the results point to the need to pay attention to the behavior patterns, personal commitments, and institutional organization. Fullan and Hargreaves (1992), decades later, claim that an innovative project which is not adopted and education models whereby some place is dedicated to the beliefs and practices of teachers have a low chance of success. The role of teachers is particularly important given that, in general, they are the most sensitive and responsive part of any curriculum innovation process. The need to involve them in projects is essential (McIntyre & Brown, 1979). This is one of the risks of the non-adherence and/or non-understanding of the proposed innovation by the teachers (Fullan & Hargreaves, 1992). The chances of success increase when the resolution for change comes from within the education system and is not perceived by teachers as an imposition (Terhart, 1999). The perception that teachers hold the

capacity/ability to innovate and take risks that ensue weighs against the implementation of the innovations (Lang et al., 1999).

Innovation is an important construct to study education because it is possible to confront it against the idea of *tradition or routine*. Recently, the studies on the history of education present school, and mostly the classroom, as a place where practices and resources are well adapted to support teaching and learning in a strict sense. The so-called "traditional education" results from historical process where a system of symbols, practices, and resources were built to be self reproduced (Bourdieu, P., & Wacquant, L., 1992).

My personal report about the way my former colleagues at the German school opposed the adoption of a new textbook supports the existence of such a "traditional way of teaching." This refers to the process of the reproduction of established pedagogical structures and being part of a routine. In this sense, there is no judgment *per se* in being a traditional teacher or in teaching in a traditional way. Moreover, reworking is hard, since the routine places us in a secure cultural field. Most teachers are unaware about this routine they are involved in. It is the process of "naturalization" resulting in routines that gain the status of a "natural way" of practices in a field. The **judgment** of the correctness of practices and attitudes inside the classroom come from the teachers themselves, from the students, from the faculty members, from the family, etc. Students are normally critical of the way they are taught. Nevertheless, they prefer to be taught in a traditional way because the activities and practices to enact in classroom are more predictable. This means that differences/changes in enacted schemas and resources in a didactical system are understood as a perturbation of a natural order that should be rejected. This situation generates a **conflictive scenario** for teachers insofar as they are not prepared to stop reproducing this system. Sometimes, however, their personal experiences inside the classroom show how unadapted the traditional way of teaching is. In claiming different uses of resources or/and practices, teachers develop a feeling of **inaptitude**, **frustration,** or even **shame** against a supposed

"natural educational order." Thus, teachers have to pay a debt in terms of emotional capital in deciding to make their classes more adaptive to the needs of students or the demands of the new curriculum. This conflictive situation is the source of problems in health and the deficit of wellness. Most teachers are not aware of these conflicts and continue to feel bad during their entire careers as educators.

Some of my preliminary works (Slongo, I., Ricardo, E., & Pietrocola, M., 2003; Pietrocola, M. , 2005). have given a start to understanding the conflicting scenario of the novice teacher and experienced teachers in innovative contexts have to face. Also the work of Ken Tobin and his squad of research puts a lot of emphasis on the relation between emotions and teaching and learning. This means that, beyond the technical aspects of teaching and learning, educating a teacher involves helping them to deal with this workload of emotions and the inevitable uncertainties when facing classes and students. Educating teachers to do their professional and personal work in a more peaceful way and not to allow emotions to cloud their conduct is probably a neglected aspect of teacher education and professional development. As Tobin (2014a) states from his ongoing research, "becoming aware of the unaware can provide participants with things to think about and possibly change" (pg. 142). Becoming aware is connected with the reflexive process which Bourdieu boldly invited social scientists to use in their research. In his terms, *reflexivity* entails the systematic exploration of the "unthought categories of thought which delimit the thinkable and predetermine the thought" (Bourdieu & Wacquant, 1992, p. 40).

The relation between aware/unaware and the reflexivity is the core of studies in **mindfulness**. Recently introduced in the educational scenario, mindfulness studies have showed how our patterns of rational thinking could be modified in the direction toward more harmonic levels in which the mind becomes more reactive to bad emotions. Kirk Warren Brown, Richard Ryan, and J. David Creswell (2007) defined mindfulness as "receptive attention to and awareness of present events and experience" (p. 212). For Tobin and Ritchie, "Brown and his colleagues explained that mindful compared to

conceptual processing involves a receptive state of mind in which attention is oriented toward registering facts observed, shutting down habitual processing, and making efforts to be present in the moment" (Tobin and Ritchie, 2012, p. 125). In the case of teachers in conflicting scenarios, this statement could provide an antidote to the overload of bad emotions and sense of frustration. This is because being in the moment helps an individual avoid the temptation to compare the present situation with standard elected on the past or projected to the future. It is a way of putting yourself in a non-judgmental position.

Tobin (2014) claimed the following:

"being less emotional, mindful individuals have greater: control over their thought processes; awareness of experience while being immersed in it; objectivity; tendency to defer judgment; likelihood to act as ecological stewards; levels of cooperation with others; and social attunement" (pg.143). Mindfulness training is advantageous for mental health, well-being, physical health, self-regulation, and interpersonal behavior.

Another aspect is that attachment to emotions could reduce focus, productivity, and physical well-being (Brown and Ryan, 2003). Usually both new and experienced teachers in innovative situations are involved in a great level of emotional demand. This could explain why teachers in this context are generally very low productive, being reactive to the innovations proposed and tempted to return to old patterns. Mindfulness would permit these teachers the type of attention that includes others' opportunities to be in the moment through openness, acceptance, non-judging, non-reactivity, curiosity, and compassion (Baer and Sauer 2009). These qualities are required when we are involved in a change of conduct, when unattended facts are present without prompt solutions to put into practice.

In this sense, mindfulness training for teachers may be seen as a way to develop mental habits which "include tendencies to gather data through all of the senses, to be aware of and reflect on experience in a non-judgmental manner, to be flexible when problem solving, to regulate emotions and be resilient after setbacks, and to attend to others with empathy and compassion" (Roser et al., 2012, p.

167). In the same direction, Powietrzynska extended the benefits of mindfulness to students also. She stated that mindfulness programs "appear to train and refine attention, promote emotional balance, and help students develop a capacity for self-regulation." (2014a,pg.79)

As I have stated before, the novice teacher and the innovative teacher in general have difficulty implementing a routine in the classroom. Routinization is the first obstacle new teachers have to overcome in order to established fluency in the enactment of practices in the classroom. Nevertheless, this obstacle is not only of a technical scope, but also of an emotional one! Lack of fluency in a classroom is often associated with high levels of emotional intensity and low levels of mindfulness Powietrzynska, M., Tobin, K., & Alexakos, K. (2014). Thus, it was desirable, that, when stressed, teachers should be able to self-regulate in the presence of the class and the stressor itself. An important set of research regarding educational ambiance, the *Mind and Life Education Research Network*[10]*,* supports the benefits of mindfulness practices: "these include self-regulatory skills associated with emotion and attention, self-representations, and prosocial dispositions such as empathy and compassion" (MLERN, 2012, p. 146).

Back to my personal memories as a new teacher, I realize now that part of my anxiety before my first class at the German school came from the fact that I was not mindful. One week before my first class I tried to anticipate the problems I would face during class. During my teaching I was trying to enact patterns that I have seen my former teachers apply in the past. This mechanism follow me for most of the beginning of my career as an educator, whether in high school or at the university level. I was applying a process of continuous judgment with the past and the future, trying to be prepared for the uncertainties inevitable present in my profession. If I could have exercised a more mindful way of being in the moment, I think I could have been happier than I was in all of the moments of change in my professional life.

[10] A group consisted by neuroscientists; cognitive, developmental, and educational scientists; and educational activists.

Experienced teachers face similar problems. Since the routine is established in their professional lives, the unattended elements and the bad emotions connected with them are normally obscured from their pedagogical horizon. But when innovation appears as an opportunity to make aspects better or merely different, the bad memories of the past come back. This means that the bad moments normally lived during the routization reappear in the process of innovation. Again, a mindful trained teacher could avoid the negative emotional appeal from returning when they are normally fragile and uncomfortable.

The compassion toward ourselves is one of the keys in a process like this, when one normally feels a lot of pressure to enact models that are in fact impossible for a beginner. It is valuable for the beginner in the sense of being new teacher or beginner in the sense of being an experienced teacher who makes the decision to innovate. For that reason, the opportunities offered by the studies on mindfulness could help teachers to live more graceful and peaceful lives.

DEVELOPING A HEURISTIC TO MINDFULNESS TO INITIAL AND INNOVATIVE TEACHER

Teachers better prepared to experience the challenges of the classroom are those normally aware of the difficulties they have to face. Mindfulness is one of requirements to become more *conscious* and *focus* on the present situation, avoiding the risk to be attached to moments in the past and to projections for the future. *Attachment* is one of the most important barriers teacher face when enacting new schemas and resources. Thus a teacher could be attached to many elements: to the goals that are far from the present moment in classroom, i.e., the standards to be reached in a curriculum and tests/evaluation that their students must encounter in the final period of the school program (both are in the future), and to the way they normally work (routine) or to the models they once saw succeed in the classroom when they were students (both are in the past)! It is very difficult to suspend the *judgment* in

this kind of situation, and we have teachers that suffer while continuously comparing themselves to models that then make them experience bad emotions and anxiety.

It is important to note that a large part of our emotions lives in our unconscious minds (Jonathan Turner, 2002; Randall Collins, 2004). Within this text, I have discussed situations involving new demands to enact schemas and resources during class that generate an overload of emotions, mostly with negative valence. In this sense, it is important to make teachers aware of these emotions. One of the ways to deal with a lack of awareness and to help teachers exercise reflexivity is to use *tools* that highlight some characteristic that is an important construct to allow participants to become more aware of them. Tobin (*2014a*) refers to these tools for given constructs as *heuristics*. He presents examples related to two important constructs: *coteaching* and *cogen*.

"Based on our ongoing research, we developed lists of characteristics for coteaching and cogen and asked participants to think carefully about each characteristic in relation to their own conduct. The following are examples of heuristics we developed for cogen: I am respectful to others; I try to get others to contribute to discussions; I try to make sense of what others are saying; Others have opportunities to speak as much as I do; Others try to make sense of what I am saying; and I maintain focus. The following five-point scale is provided for each characteristic: 5 Very often or always, 4 Often, 3 Sometimes, 2 Rarely, 1 Never or very rarely. In addition, space is provided for participants to comment in regards to their experience with each characteristic." (2014, p. 8)

Note that the heuristic was usually constructed using characteristics present to the reader in the forms of assertions (see the phrases in the extract above). Thus, there is a typology of uses of heuristics willing to develop awareness. Powietrzynska specifies the four uses of a heuristic as a tool in any kind of intervention:

"The **first** use is as a low-grade intervention... where we ask participants to complete the heuristic thereby making them aware of the characteristics and their relative occurrences.... A **second**

use of the heuristic may be for planning where individuals involved in an activity, such as *coteaching*, use the characteristics and plan accordingly so that the relative occurrence of those characteristics could be targeted to reach desirable levels. **Third** is the use of the heuristic as a framework for *interpretive inquiry* concerning what happens in a social field... used to describe what is happening in the science classroom from a hermeneutic phenomenological perspective. A **fourth** use is in undertaking landscape studies. The presence of the rating scale allows a heuristic to be used to portray landscapes (descriptions of the amount of mindfulness that crops up) for individuals and/or collectives." (bold added, 2014b, p. 14-15)

In a research study conducted by Tobin and a group of researchers in a public college in the Northeast with 19 pre-service and in-service science teachers of diverse cultural matrix, heuristics were used to develop mindfulness practices. Powietrzynska explained the decision made for the first type of heuristic (see citation above) to develop mindfulness in the following terms:

"We decided to introduce mindfulness into the class through the use of... low-grade intervention related to a construct illustrated in the heuristic by a set of characteristics, which are salient to the contexts in which the construct is applicable." (Powietrzynska , 2014b, p.2)

The heuristics were based on the some dimensions of mindful action. The table below shows a set of ten dimensions of mindful action .

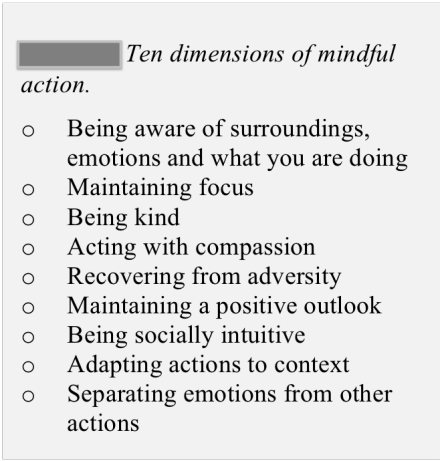

Figure 1: Extract from Powietrzynska (2014b, p. 13)

Tobin and Ritchie (2012), citing the research by Baer, Smith, Hopkins, Krietemeyer, & Toney (2006), present another way of categorizing dimensions of mindful action and the characteristics of a heuristic, related to the table below:

Constructs and Practices Associated with Mindfulness

Non-reactivity to inner experience	I perceive my feelings and emotions without having to react to them.
	In difficult situations, I can pause without immediately reacting.
Observing/ noticing/attending to sensations/ perceptions/ thoughts/feelings	I pay attention to sounds, such as clocks ticking, birds chirping, all cars passing.
	When I'm walking, I deliberately notice the sensations of my body moving.
Acting with awareness/ automatic pilot/ concentration/ non-distraction	It seems I am "running on automatic" without much awareness of what I'm doing.
	When I do things, my mind wanders off and I'm easily distracted.
Describing/ labeling with words	I have trouble thinking of the right words to express how I feel about things.
	I can easily put my beliefs, opinions, and expectations into words.
Non-judging of experience	I think some of my emotions are bad or inappropriate and I shouldn't feel them.
	I tell myself I shouldn't be thinking the way I'm thinking.

Table 1: Extract from Tobin and Ritchie (2012, pg. 125).

After many changes, the heuristic concerning the mindfulness construct became a list of 31 characteristics, showed in the table above (Malzorzata, 2014 chp10, p. 15):

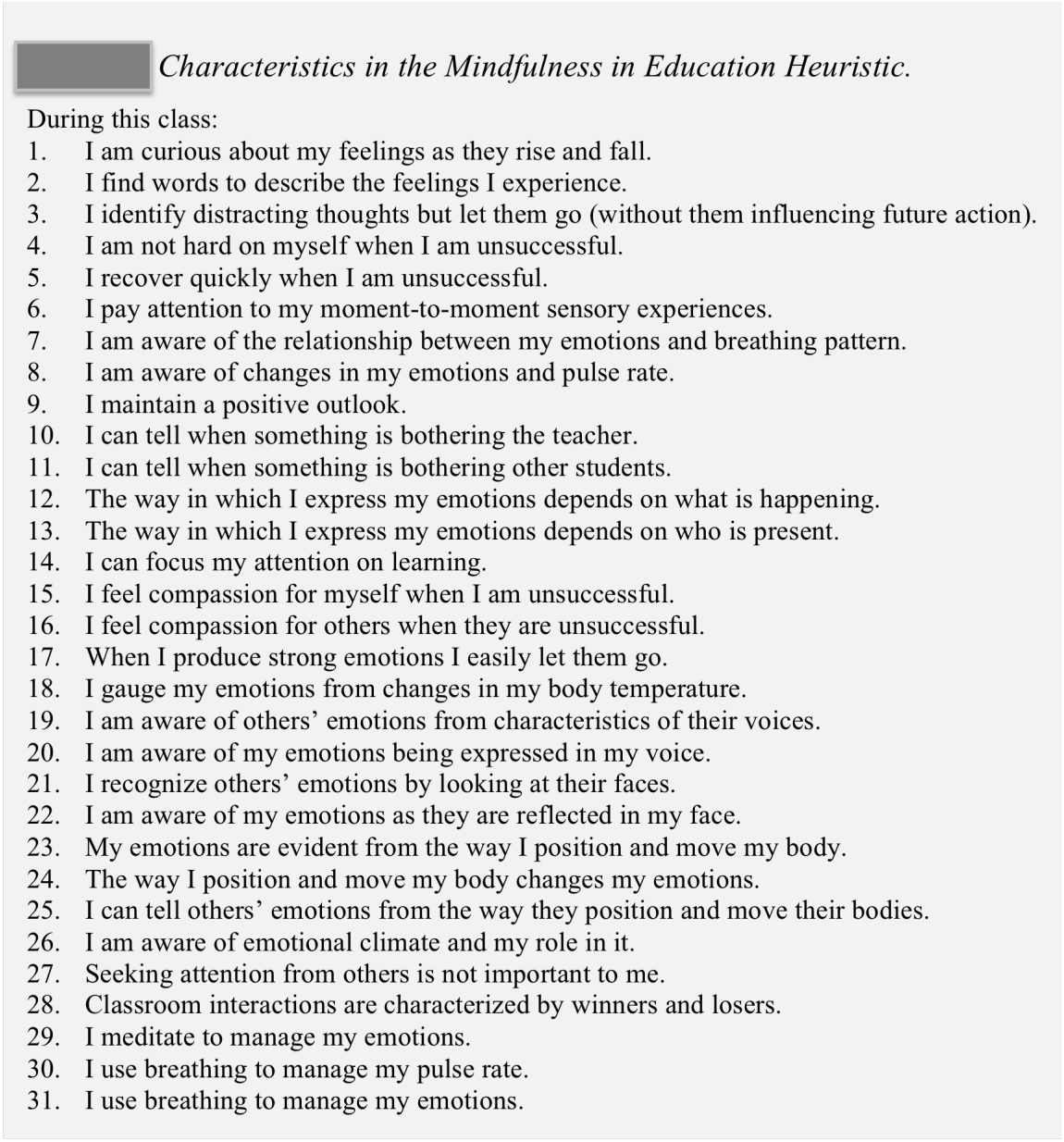

Figure 2

A heuristic is meant to be a malleable tool to fit into any context. Its flexibility also lies in its multiple uses as presented in the extract above. Some authors use the term "shape shifter" to describe the flexibility a heuristic has to be adapted to the context in which it is supposed to be used (Tobin, *in press*). This means that space is provided to researchers and participants to offers clues, intentions, needs, difficulties, and perceptions to be part of the characteristics used in the heuristic.

The context that interests me is that during which new teachers and experienced teachers face innovative ways of teaching and learning. I have had the opportunity to present my position regarding similar challenges faced by new teachers and experienced teachers in innovative situations and how these could be similar. The heuristic I expect to develop is based on i) the Educational Heuristic presented above, ii) my own theoretical and practical experience with pre and in-service physics teachers, and iii) information obtained from experienced physics teachers who have participated in a research project to update contents in the curriculum of São Paulo State in Brazil. It is important to note that these teachers have decide to join the group themselves, meaning that they are willing to change the way they normally teach and have joined our group of research at the University of Sao Paulo.

The results I summarize from my personal work with pre- and in-service physics teachers is presented below:

Summarizing my theoretical and practical experience with pre and in-service and teachers	
A	There is a lack of **compassion** among students and teachers in the context of innovation
B	The teacher must have **compassion** toward himself and to other teachers when facing innovative situations.
C	Teachers are normally **attached** to accomplishing a required routine in the classroom
D	Teachers need to keep students in their zone of control
E	Teachers need to be **aware** of the role of emotions when engaged in a new routine.
F	Emotions like fear, anger, and happiness are normally related to a sense of **duty.**

G	**Judgment** of the correctness of practices and **attitudes** inside the classroom came from the teachers themselves, from the students, from the faculty members, from the family, etc.

Figure 3

Research about experienced physics teachers in the context of curricular updates

The research our squad group at the Faculty of Education was involved in presents a larger content innovation project connected with the physics curriculum of high schools in São Paulo. The objective was to support teachers to introduce the contents of Modern and Contemporary Physics in the classroom. The survey study sought to evaluate the limits and possibilities of implementing teaching sequences concerning the concepts of Quantum Theory, Special Relativity, and Elementary Particles to 15-17-year-old students in six São Paulo public schools (Brockington et al., 2008). Similar studies were conducted that sought to evaluate the teaching strategies in a modern and contemporary content in basic education. For example, Ambrosis and Levrini (2007) dealt with the teaching of special relativity in Italian schools with the secondary education teachers using university textbooks. For the authors, innovations must be understood from the teachers' perspective in order to assess what needs to be done to make these changes possible. Ogborn (2005) introduced a way to deal with the complexity and scope of the theory of relativity, proposing a four-step teaching strategy. This enables the teacher to adapt to the demands and needs of studentsTherefore and within this perspective, that research had to identify how a physics teacher manages a didactic/pedagogical innovative situation involving the contents of modern and contemporary physics. The main questions present in this research are as follows: what are the teachers' perceptions of the innovation process in which they have participated? The answers given by these teachers were used as an information source for defining the characteristic of the heuristic to be used in the context of innovative education. I will explain the way we obtained the data concerning

that question and in the sequence a sample of the teacher's answer that I think is related to the seven dimensions of mind action (Figure 3) that I think are important to the construct we want to built.

The data collection and analysis were obtained from the group of six high school physics teachers, four males and two females, with teaching experience of between 5 to 20 years. This teacher came to be part of the research squad through a announcement made on the website of the secretary of education in Sao Paulo. Many teachers applied and we have selected six, because we have six scholarships to support participation in the research. The participants collectively worked in implementing Teaching and Learning Sequences (TLS) on modern and contemporary physics in their own schools. The TLS were developed some years previously in another research project with another group of high school physics teachers and researchers from the University of Sao Paulo. The goal of that second project[11] was to adjust the TLS built and implemented in the regular classroom to finally develop an instruction material to be available to other teachers on a web site.[12] They were advised by a group of researchers during the years 2007 and 2008. This group's profile is particularly relevant because it is closer to the context of in-service teachers. We were interested in understanding how this material was appropriated and adapted by them in order to make good use of them in overcoming the obstacle of viewing it as unfamiliar material to their environment and their traditional practices.

We adopted a qualitative approach similar to that used in the analysis of the STTIS project (Pinto, 2004). The data for this work was taken from semi-structured interviews. It was in that moment teachers were asked about their motivations and difficulties while implementing the innovative TLS. The interviews were conducted around five aspects: 1) the reasons for their participation in the

[11] "Inovação Curricular em Física: Transposição Didática de Teorias Modernas e a Sobrevivência dos Saberes" – in English from a free translation: curricular innovation in Physics: didactic transposition and the survive of knowledge

[12] The material is now available at the following web address: http://www.nupic.fe.usp.br/Projetos%20e%20Materiais

innovation project, 2) concepts on teaching modern physics, 3) changes in their professional practices, 4) obstacles and difficulties, 5) recommendations to other colleagues.

For the propose of constructing the heuristic, I took the answers and interpreted them using some statements collected from the first part of this text. These statements were built from the analyses I have made about the way new and experienced teachers face novelties. It is important to note that, in the interview, the teachers were asked to respond regarding their experience implementing TLS of Modern and Contemporary Physics. The four categories presented above were extracted from the answers.

I) Becoming aware of an existence of a tradition that shapes teachers' practices in the classroom.

Teachers realize that they belong to a traditional didactic system in physics teaching. Awareness lets them break the schemas and use the resources included in this system. However, the boundaries of the didactic system are not so rigid. They acquire the disposition to break from traditional practices and adopt new strategies of teaching. Although the existence of possibilities for change exist, these teachers realize that they have to be prepared to teach in new situations.

The quotations below, extracted from the answers from teachers during the interviews, provide some examples of their claims:

"I look differently at the possibility of developing a curriculum from another subject" (P5).

"teachers... should become aware that they do not need to closely follow the curriculum... leap over some steps without any detriment" (P2).

"one must be prepared to do something different"... "before, one looked more at [physics'] content and now looks at other things" (P4).

"once we finish up at the university, we keep teaching in that tradition... you finish getting into a tradition, even if you desire to innovate... we do not have the same habits... a thing of habit... tradition…" (P3).

II) Revise power and resources into a teacher-students-knowledge relationship - teachers' practices and students' practices change.

Students shift roles in the classroom. "Bad" students acquire interest in physics, and the "geeks" get were lost trying to deal with new types of activities. Teachers realize that some of the traditional resources were no longer operational inside the class. For example, students are no longer able to receive "failing" grades without a very strong justification by the teacher; this was seen by the teacher as a loss of power inside the classroom. But in contrast, many other things were seen as resources to be used in class beyond traditional ones. Power came from new resources; *motivation* became a new resource to be used in class, and subjects were chosen from the zone of interest of students.

Teachers perceived that traditional schemas of action have to be changed. One of the most important changes happens in the very traditional list of physics content to be taught. It was possible to teach in terms of students' competence and abilities.

The quotations below were extracted from the answers from teachers during the interviews and give some examples of their claims:

"the geeks... doubted; [they said]: "this here is not class, it is not... but at the end they start to join [the others in activities]... at the end they start talking, and you have much more interesting discussion" (P4).

“when you want to work with the students’ skills, with competencies, you want to get them to become citizens... will read, will argue... be critical if you choose a content that for him doesn’t matter, it is more difficult.. and modern physics is relevant to them…” (P3).

“I would say that today motivation is more important than behavior; some people are still concerned with behavior, and you only, because we no longer have that power over the assessment, control grades, today motivation is the interest, and if you have not a subject of interest they [students] do not participate... [it] is a tragedy... (P3).

III - *Accept the risk of failure during the transformation*

Teachers identified their awareness on their capacity to manage the risk of failure; they felt prepared to teach in a different way. It was possible for anyone to break with the schemas and practices established, because self-confidence came with the awareness.

The quotations below were extracted from the answers from teachers during the interviews and give some examples of their claims:

“...I think the guy has to be willing to do something different, I think... what I'd tell someone... Take the risk, you will not miss anything, at least you will gain something.…” (P5).

“The new teachers who join the group... they were surprised… I did not realize they could work... well, I have had a great surprise, it involved much more than I thought… they were getting involved.…” (P3).

IV) *Not to be alone/supported from a group with the same intention/peers and advisers*

The teachers were able to identify their own needs and felt prepared to face problems. The access to the expertise of other teachers and from the researchers was important to manage the classroom complexity.

The quotations below were extracted from the answers from teachers during the interviews and give some examples of their claims:

"I had something to learn, I had doubts, I had to ask" (P5).

"continuing education and discussion groups" (P1)

"They [teachers in general] should join a group... because alone... he will fall in the traditional, it does not... teachers have no time... it is very difficult for a teacher alone (P3)

Last extract:

"it was hard to me to image the modern physics, without the traditional bias. I thought it as an adaptation, and I realize that there is a totally different possibility... I am aware of the idea of didactical transposition*... I have changed my conception about the possibilities to teach modern physics, and traditional one too" (P4)

The table below summarize the teachers' claims:

Summarizing Teachers Practices as an Innovative Educator	
a	Becoming **aware** of an existence of a **tradition** that shapes teachers' practices in the classroom.

b	Revise **power** and **resources** into the teacher-students-knowledge relationship – teachers' practices and students' practices changed.
c	Accept the **risk** of **failure** during the transformation
d	Not to be alone/support from a group with the same intention/peers and advisers

Figure 4

THE MINDFULNESS IN INNOVATIVE EDUCATION HEURISTIC

Based in the experienced practices by the participants and me, as shown in Figures 3 and 4 and the list of characteristics in Figure 2, I built the *innovative education heuristic*. It was a process of adaptation and an insertion of items, using the possibilities offered by the previous work made in building heuristics. In the brackets, I will indicate the i) number(s) of the original characteristic issues, if any, from the educational heuristic (Figure 2) and ii) Letters of correspondence to teachers' practices in Figures 3 and 4, if any. After each characteristic a code will appear; for example, [23; a] means that we have taken question 23 from the *education heuristic (Figure 2)* plus a claim from *Summarizing Teachers Practices as an Innovative Educator* (Figure 4).

CHARACTERISTICS OF MINDFULNESS IN INNOVATIVE EDUCATION HEURISTIC -[13]

During day-to-day activities:

1) I am curious about my feelings as they rise and fall. [1; –]

[13] A first version of this heuristic received strong collaboration of Laís Perini and Fabio Marineli, from the PhD Program of Education at the University of São Paulo.

2) I identify distracting thoughts but let them go (without them influencing future action). [3; –]

3) I find words to describe the feelings I experience. [2; –]

4) I am aware of changes in my emotions and pulse rate as well in my voice and reflections in my face. [8, 20, 22; –]

5) I recover quickly when I am unsuccessful. [5; –]

6) I pay attention to my moment-to-moment sensory experiences.[6; –]

7) I gauge my emotions from the changes in my body temperature.[18; –]

8) My emotions are evident from the way I position and move my body.[23; –]

9) The way I position and move my body changes my emotions.[24; –]

10) I am aware of the relationship between my emotions and breathing patterns. [7; –]

11) I use breathing to manage my emotions.[31; –]

During innovative activities:

<u>About my students and my classes</u>:

12) Assessments, through any mode/method/tool, measure how much a student learned .[–;a]

13) I judge a bad decision to replace curricular traditional contents for others more relevant for students education. [–;G]

14) I am aware that students react differently when I change my teaching approach in class as expressed in their faces, voices, and body positions and movement. [8,20,22; G]

15) I feel compassion for my students when they are unsuccessful.[16; A]

16) I am aware of changes in my emotions when the class is not in my entire control. [26; D,b,E]

17) Seeking attention from students is not important to me. [27; D]

18) I can tell when something is bothering my students.[11; b]

19) I am aware of the emotional climate and my role in it as well the importance it has for the good development of classes.[26 -adaptation; E]

20) I feel that exchange experience with other teachers helps me to be aware of my action in the classroom. [–;a,d]

About my own perception in class:

21) I judge myself when I have trouble in class. [4 adapted; G, E]

22) I am curious about my feelings when I am not confident implementing some class activities.[1; F]

23) I feel motivated to conduct innovative activities even when I am not completely confident. [–;c, E]

24) When any innovative class produces strong emotions in me, I easily let them go.[17 adapted; a]

25) I express what I feel and think when I face difficulty with contents and teaching strategies. [–;G, F]

26) Even when I recognize potential risks in class, I can focus my attention and keep going. [14;c, C]

27) I am aware when I am "running on automatic" without much awareness of what I'm doing. [-; a]

~~28)~~ I feel it is difficult to abandon activities I used previously to teach. [–; C, b]

29) I feel compassion for myself when I am unsuccessful in teaching in an innovative way. [15 ;B]

~~30)~~ I feel compassion for others when they are unsuccessful in teaching in an innovative way. [15 ;B]

31) I am hard on myself when I am unsuccessful in a class activity I have carefully prepared. [4;B]

32) I recover quickly when I am unsuccessful in teaching. [5 adapted;b]

FINAL REMARKS

The goal in this text was to study the reproduction and transformation of practices in teaching and learning of science. based on a personal report of my own experience and the work I have done with in-service and pre-service teachers, we theorize teacher preparation in terms of acquiring schemas and resources belonging to field of educational culture, called the didactical system. Presenting patterns and tools, the didactical system is a field in which teachers have to enact a culture in a specific way. On the one hand, I emphasize the difficulties a novice teacher has to face in managing the schemas and resources of this field for the very first time. On the other hand, once a teacher reaches the level of controlling the enactment of this field, it is difficult to move away from that method in making changes in the teaching and learning practices. Using the term traditional education/practices, I try to highlight that there is a secured place where teachers and students could enact culture in a way that both feel comfortable and in control of the duties and activities to be done.

The notion of innovation was introduced to contrast the reproduction of practices in classroom with practices that break or disrupt an established tradition. Even assuming that reproduction and transformation are a dialectical pair that always come together in the process of making a culture, I assume that, during an innovation, there is a desire to break with an established order based on a conscious and evaluated decision. An innovation is a moment of transformation, but at the same time involves a deep desire to become reproducible.

The risk is an important part of the process of innovation, because transformation is always involved in an emotional climate linked with many different feelings, such as fear, guilt, happiness, and sadness. For that reason, the mindfulness study approached the emotional dimension associated with innovation processes. The development of a heuristic based on the experience of successful teachers that have innovated in their classroom could help other teachers that were trying to implement innovation in their classrooms. The heuristic developed must be useful for in-service and pre-service teachers' courses and could support them to become aware of the emotions coming from the context of innovation where risks are always present.

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