

AN ACTIVITY THEORY APPROACH TO STUDY BARRIERS OF FACULTY REGARDING TECHNOLOGY INTEGRATION IN HIGHER EDUCATION

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Abstract

Information and communication technologies are instruments for supporting new ways of teaching and learning. Nevertheless, its impact concerning scope has not reached the expected level. This strain between benefits and impact has been inquired from the perspective of barriers of teachers to use technology. Ertmer's approach establishes first-order and second-order barriers as hinderers for teacher's adoption of technology. The study intends to answer what are the barriers existing in the so-called enthusiastic faculty teachers regarding technology integration in Education? Findings call for a reconceptualization in the study of barriers arguing that the teaching process is a complex and dynamic activity that needs to be examined from a collective perspective. Cultural-Historical Activity Theory is the theoretical framework used in the study. It concludes with the necessity of overcoming the existing dichotomies between enthusiastic-resistant teachers, the intrinsic-extrinsic barriers, and claims for passing from an individual to a collective approach to ICT integration in education.

Keywords: Barriers, information and communication technology, first-order, second-order, activity theory, higher education, teachers.

1 INTRODUCTION

While some studies shown evidence of the benefits of using information and communication technology (ICT) in education [1], others are not confident about its scope and impact in educational institutions [2]. Technology is recognized as an instrument supporting new ways of teaching and learning [3] that improves memory retention, increases students motivation, promotes collaborative learning and interaction. However, the impact of ICT in education has not reached the expected level. Financial investments in professional development and infrastructure have not been enough to assure a substantial integration. The distance between benefits of technology in learning and its impact regarding widespread and scope has been mainly studied from the barriers of teachers for ICT integration approach [4]. It poses on the teachers the essential role of being the frontier for applying technological innovations to the teaching and learning process [5]. The study of barriers has contributed with categories, extensive lists, and proposals for overcoming limitations. A longitudinal study from Hew and Brush [6] shows a list of 123 barriers organized in six categories: resources, knowledge, skills, institution, attitudes and beliefs, assessment and the subject culture. A detailed categorization presented by Groff [7] describe barriers in terms of legislative factors; district/school-level factors; factors associated with the teacher; with the technology-enhanced project; factors related to the students; and factors inherent to the technology itself. Ermert's [8] first and second-order barriers to change with technology approach is perhaps the most widespread to study limitations of ICT integration in education. It is based on Brickner's [9] understanding of barrier to change as "the extrinsic and intrinsic factors that affect a teacher's innovation implementation efforts" (p. xvii). Ermert considers first-order as extrinsic or external factors affecting to teachers; e.g. lack of computers or lack of time and second-order regarding intrinsic or internal circumstances; e.g. resistance to change, lack of interest, and lack of confidence. The central role of the teacher as the main actor for ICT integration has led to studies on barriers considering it as the nearly exclusive unit of analysis. In research, the approach has been mainly operationalized through survey-based studies to identify the existence of barriers to particular context and strategies to overcome barriers. As a result, categorization of barriers as internal and external has led into two different and usually separated lines of research and development of strategies for overcoming barriers. On one hand, educational institutions invest in technological equipment; professional development; hiring new technical staff, and development of policies to reduce first-order barriers. On the other hand, research has explored on the attitudes and beliefs of teachers as pivotal for overcoming second-order barriers, but still separately from the first-order type. Ermert's [8] analysis remains in the individual agency of teacher for achieving change and diminish their relation with context to "a process of coordination between teachers and context to fit

from within their personal teaching context” (p. 48). Conversely, human behavior is grounded in culturally, tool-mediated, collective, and historically developed activities [10]. In terms of the teaching process, the introduction of technologies has become an artifact created by humans that mediate human activity. However, the use of technologies as teaching and learning mediator tool is not homogeneous for all teachers. The study of barriers has led to a teachers’ categorization according to their attitudes, beliefs and behavior toward technology use. Categorization, in general, names teachers as enthusiastic and resistant. The article analyzes and discusses mentioned topics in depth in order to answer the research question state for this study: what are the barriers existing in the so-called enthusiastic teachers regarding technology integration in teaching and learning activity? It reflects on the characterization of the subject of the activity; the enthusiastic teachers’ activity system configuration; and the first and second level of inner contradictions in the enthusiast’s teaching activity.

2 CULTURAL-HISTORICAL ACTIVITY THEORY FRAMEWORK OF ANALYSIS

Cultural-Historical Activity Theory (CHAT) is the theoretical framework used in the study. CHAT [11] considers the human activity as the complex tool-mediated process of a subject in its relation to an object to achieve an outcome. Furthermore, that mediated activity is also influenced by other members of the subject community, by rules, and by the division of labour. All those constitutive components are organized in a triangular scheme namely the Activity System (AS) [11] (Fig. 1). CHAT considers the object-oriented, collective, and culturally mediated human activity as the basic unit of analysis. Thus, not only the subject perspective describes the surrounding reality. Conversely, a complex reality can be depicted by echoing the voices of the others constitutive elements of the activity.

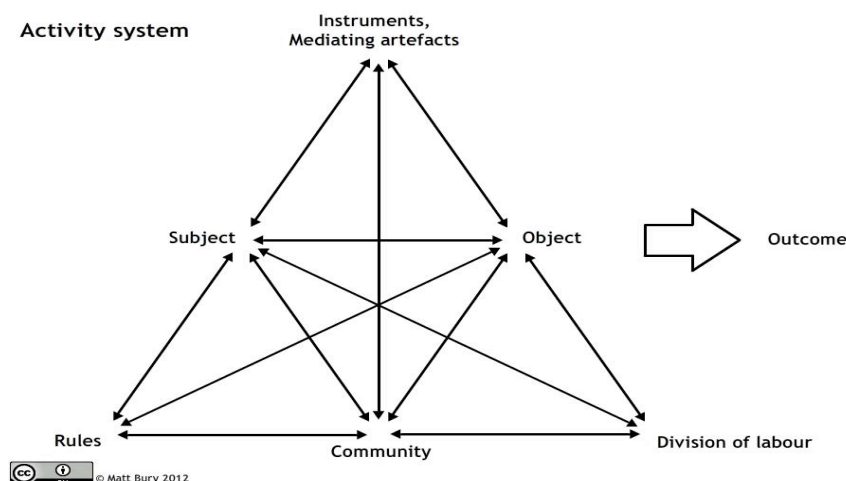


Fig.1. A complex model of an activity system by [12]¹

In CHAT, the subject is the doer of the action [13]. It is the individual human or group whose doing is taken as the point of view of analysis. The subject is who is working towards an object to gain an outcome [14]. The subject must be seen as close related to the object. The activity system becomes an indivisible entity for human activity analysis. It will be then defined regarding the object. According to Leontyev [15] “the activity is a process of intertraffic between opposite poles, subject, and object”. The object is then considered the constituent feature of activity; the driving force which in a secondary moment is taken by the subject to carry out the activity [15]. A third constitutive element of activity theory is the tools. Tools can be material artifacts or symbolic signs. They mediate the relation between the subject and object and took part in the transformation of the object into a desired or unexpected outcome. They can enable or constrain the activity [16]. Rules are the norms that control actions and interactions contained by the system [16], and community pertains to the actors and multiple individuals or subgroups, who share the object [16]. The community may also be considered as the other actors who provide a circumstance for the task the subject is going through [13]. Finally, division of labour refers to the implicit and explicit organizations of a community as related to the transformation process of the object into the outcome [17].

¹ "Activity system" by Matbury - Own work. Licensed under CC BY-SA 3.0 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Activity_system.png#/media/File:Activity_system.png

2.1 Contradictions in CHAT

The CHAT fundamental concept of contradiction refers to the historically evolving tensions that can be found and dealt in activity systems [18]. They are of primary importance for the developmental potential of CHAT to the extent they make evident how to affect the natural pathway of the activity. Are driving forces for transformation [18]. According to Engeström [11] there are four levels of inner contradictions in human activity:

- Primary: When more than one value system is affecting the subject and brings conflicts in the activity. Within each and any of the nodes of the activity system;
- Secondary: When subjects encounter a new element of an activity and the process of assimilating into the activity brings conflicts. Between two or more nodes within the Activity System;
- Tertiary: When subjects face problematic situations adopting new beliefs coming from a new method for achieving the object;
- Quaternary: When subjects encounter changes to an activity that creates conflicts with adjacent activities or between two or more neighbouring activity systems.

3 RESEARCH CONTEXT AND METHODOLOGY

National University (UNA) is a state university in Costa Rica with around 16000 students and 1500 faculty professors. As part of its policies and strategies UNA has an ICT unit [19] namely UNA Virtual [20]. Its primary objective is promoting the ICT integration in the teaching and learning process. Its target population is the faculty teachers, and its main strategy is the continuing professional development which integrates the technological and pedagogical components [20]. As a result, in the last years, the number of faculty teachers using technology has increased [20]. However, the experience in UNA does not remain quite different than previously mentioned regarding the amplitude of educational initiatives with technology. A wide range of limitations constraints the institutional activity of teaching and learning with technologies. A traditional viewpoint of barriers place faculty teachers as almost the exclusive responsible for integration or not of technology. In first-order barriers, teachers have nothing to do to solve the problematic situation and in the second-order they have all to do. Such categorizing has led to a type of analysis that lacks considering the interaction of human subjects with the material world. In the extrinsic type of barriers, the stated solution has been increasing budgets [8] to resolve problems. In the intrinsic type, research has looked more profoundly into teachers' attitudes and beliefs as a base for change [21], [22]. Studies regarding attitudes and beliefs have derived into categories of teachers as enthusiastic [19] to name those who express willingness to integrate technology in daily work and resistant to those who are more cautious, distant or totally unfavourable toward technology uses. Categories were a point of departure for the study methodological reasons. Data was collected using a focus group technique. In total six focus groups were organized. Four of them were integrated by enthusiastic teachers toward technology use. The call for these focus groups was possible through UNA virtual department who keep lists of teachers identified as regular users of technology, with a constant interest in technology, regular participants in training activities and having projects or individual initiatives of ICT integration. 23 professors were invited and 16 accepted to participate. The other two focus groups were integrated by resistant teachers toward technology use. Lists of candidates to participate were provided to the researcher by authorities of academic departments who know the faculty teachers profiles regarding uses of technology. An invitation to attend was sent based on that lists. From 32 professors invited 4 participated in focus groups. For both types of focus groups, faculty teachers are from different educational backgrounds, varying years of experience in teaching and different departments. There were no specific criteria regarding age, gender or faculty affiliation. For the following section of analysis and findings, the activity of teaching in higher education was taken as the point of departure. Thus, teachers become the subject of the activity to the extent that is the human entity whose practice is taken as the point of view for the analysis. ICT is considered a physical tool or artifact introduced as an activity mediator. The subject characterization was based on the two categories previously mentioned. In other words, the activity; the subject; and ICT are the three essential elements assumed in advanced. The remaining constitutive components of the activity will be identified as a result of data analysis.

4 DATA ANALYSIS AND FINDINGS

The six focus groups were recorded and transcribed verbatim using NVIVO 10. Each constitutive component of the activity system became a category for analysis. Categories were created in NVIVO 10, and transcriptions were analysed using the Activity System Analysis (ASA) [23]. Once the data was organized into categories, it was proceeded to find patterns for each category through the data. The first step was the subject characterization, a secondary step the activity system configuration and finally an inner contradictions analysis.

4.1 Characterizing the subject of activity

The characterization of the subjects is based on attitudes expressed in the focus groups and initially categorized as enthusiasts or resistant teachers. According to Hogg and Vaughan [24], “an attitude is a relatively enduring organization of beliefs, feelings, and behavioural tendencies towards socially significant objects, groups, events or symbols that can be described regarding affective, behavioural and cognitive dimensions” (p. 150). Enthusiastic teachers show, regarding the affective dimension a feeling of dominance and preeminence over technology use. These feelings are evident in extracts like, “*nobody is going to stop me*”, “*if somebody says no, I say yes*”, “*I like to be challenged*”. They are not afraid of enterprise new activities and look for solutions to overcoming the problems they face. As teachers, they have an open attitude to learning on technology not only from the students or other colleagues but their own activity and experience using ICT. Those feelings can arise as a result of previous experiences not only as teachers but in another context of their life. Enthusiastic teachers mention situations that shaped their feelings and emotions. For them, family upbringing experiences, concrete experiences as university students or in their workplace situations allow them to have a feeling of courage expressed in statements like “*if I have overcome such a hard situation, I can with this*”. Teachers use terms as passion or resilience for characterizing how they feel regarding technology use. For them, the affective component has a strong influence on the behavioural dimension in the sense that feelings and emotions determine how they act. Enthusiasts show a permanent participation in activities related to technology and education, they are technology explorers, curious and helpers with colleagues. When technology does not work or fits they look for alternatives, intend to resolve problems by themselves at least in an initial moment, and if the problem persists they do not have any hesitation in asking for help. They enjoy doing, and they seek for move up to the next level of adoption [25]. The relation between affective and behavioural components is denoted in the step forward they give from the “*discourse to the practice*”. That practice goes beyond the use of technology in the classroom. Enthusiastic teachers transfer the uses of technology to other academic activities like research or social projects. Such behavior leads teachers to accumulate more experience. Positive results give them a sense of achievement and self-efficacy [26] guiding to the next attitude component of cognitive dimension of attitudes. Cognitive dimension embraces beliefs and knowledge of persons regarding objects, groups, events or symbols [24]. Enthusiasts refer to technology as a friend, something that they can take advantage for teaching. They are convinced of their benefits despite when they face some limitations. Technology becomes essential to their practice, a vital resource to the edge that they cannot imagine teaching without technology. On the other hand, resistant teachers show regarding the affective component, some level of fear when using technologies caused for the possibility of things go wrong with students or with variables like teacher’s assessment. They feel lagging in relation with other teachers, guilt with their students and frustration. In one of the focus groups with resistant teachers, one of them said: “*No, no I have to do it (to use technology), because of my students. More will come, and new generations will need it more, and they will know more, As I told you, three years old kids using the smartphone, so one has to do it, even though...(a disapproval gesture)*”. Another characteristic of this type of teacher is that they look for defensive mechanism looking into the collectivity. For instance, they compare themselves with other teachers at the same level or lower, or look for an external reason to explain backwardness as age or dislike toward technology. Furthermore, a feeling of disgust appears in resistant especially when they think about technology as a tool with adverse effects on their personal life. The affective component does not flourish fluently in conversation with resistant teachers. Rather, attitudes are more evident in the behavioural and cognitive dimensions. The behavioural component takes the form of an unfavourable response [27]; a state of amotivation where they do not perceive a relationship between their behavior and its subsequent outcome [28]. That static position can be caused by beliefs rooted in their field background. A professor mentioned referring to his/her colleagues in their field “*for many is difficult changing a teaching method, a whole complication, imagine what would be entering in a digital age*”. Resistant link their behavior of not using technology with their previous feelings or emotions toward it. A teacher mentioned, “*It has been difficult for me because I am not such a good friend of*

technology". This type of teacher would dispense of technology without hesitation and consider the traditional forms of teaching as better arguing that *"is the way how I learned"*. In this case, behavioural responses are consistent with feelings and emotions. In the cognitive component of attitudes, resistant teachers' beliefs become a result of previous and mainly negative experiences from others experiences they have observed or when technology uses affects their rooted beliefs. Negative beliefs reinforce negative behaviours and feelings become beliefs. For instance, some teachers believe that online teaching is for lazy teachers and that a teacher teaching online has lower workload and not accomplish their obligations regarding time. All those assertions are expressed without have had the experience of being an online teacher. Conversely, the experienced online teacher's beliefs are totally the opposite. In both types of subjects enthusiastic and resistant attitudes are, as mentioned by Jain [27], more or less consistent. As expected the enthusiastic behavior is consistent with their beliefs and emotions. At some extend this could be used as a base for depicting and organizational structure or a predictability of behavior [27]. However Lapiere & Lapiere [29] study shows that attitudes not always predict behavior. Complex relations among attitude dimensions and external actors to the subject call to reflect on the existence of fixed categories or tagging of teachers regarding technology uses.

In the activity of teaching with technology as a mediator artifact enthusiastic teachers' attitudes are long-lasting but not everlasting. Some of them experimented a feeling of loneliness a disappointment and a decrease of enthusiasm. An enthusiastic teacher depicted his/her struggle as *"facing windmills"*. That feelings or emotions are caused by external agents as resistant colleagues, department authorities or departmental or institutional policies. Thus, a decrease in the levels of enthusiasm for technology use can be noticed. Such changes in feelings can also have effects on behavior. Some teachers decide not to continue using technologies, or they stuck on the same level of adoption [25] limiting their innovative practice. In one of the focus groups, a professor called to this *"a personal rebellion"* referring to his/her negative to attend professional development activities. Feelings, behaviours and negatives experiences, affect enthusiastic teachers' beliefs as well. After some time integrating technology they consider ICT integration as a strenuous activity, especially when the activity becomes collective, and there is an influence of other actors as resistant colleagues or authorities. When that occurs they recognize the need to reinforce positive feelings trough external recognition as official letters or economic rewards and sharing experiences with other enthusiastic teachers to *"re-take the emotion"*. Despite this work will not go further in the analysis of attitudes in resistant teachers due to its focus on enthusiasts' contradictions it worth to mention that similar disparities were found in resistant teachers as well but in a different direction. In other words, the so-called resistant also expressed signals of conflict among emotions, behavior, and beliefs, their mainly distant emotions, behavior and beliefs trough technology are not static. The clearest example relies on one teacher who strongly suggests *"I moved from being sceptical and critical to defender of the learning management system"*.

4.2 The activity system configuration for enthusiastic teachers

In CHAT, the object is the trigger of the activity. The object and the subject have a coexistence relationship. Students become the object of the teaching activity when teachers are the performers. To accomplish the desired outcome of student learning using technologies as tools enthusiastic teachers express motives. In CHAT, the motive is embedded in the object of activity [30]. Some motives found in the study are the development of more interaction in class context, more dynamic and engaging classes for supporting students learning. However, at some point, the motive may change. Some teachers use technology not for students learning but to facilitate their teaching practice or other tertiary motives like reducing the paper consumption. One of the teachers that showed a higher level of enthusiasm indicates: *"...look, with the virtual room I can use the same forums I used last year...so I have two groups of the same course, so I design the virtual room for group 1, and then I import everything in group 2. That makes my work easier. The virtual room saves me tons of work"*. The activity outcome was characterized as the students learning, student's productivity improvement, and problem-solving regarding a topic and skills development including learning of technology itself for professional goals. According to [11], an activity must not be understood in the basic conception of the relation between an individual subject and the object mediated by tools [31]. Rather, human activity is collective; culturally and historically affected by rules; shared with a community and delineated by a division of labour. In the extent that enthusiastic teachers use technologies in teaching activity, then it will be possible to describe what are the potential rules, the community members and the division of labour that affects their activity. In other words, to realize what are the possible elements causing barriers. The following rules emerge from

data as affecting teachers' uses of technology, educational curriculum; the institutional pedagogical model; teachers' assessment and professional development policies; academic freedom; and institutional guidelines. Moreover, the professional development offering; the time accomplishment control; workload; a regulation oriented management; technology policies; professional recognition systems; and power relationships. Regarding the community members, enthusiastic teachers see their activity influenced by their colleagues especially for those who do not share the same emotions, beliefs and behavior toward technology. Moreover, the institutional technology department affects their ICT integration as well as university authorities on different levels; from department leaders to the University board. Other administrative units are also part of the community as supporters or retarders of the activity. Some of those units are: the ICT unit [19]; the institutional department of curriculum; the evaluation and professional development department; and the local technology staff. Finally regarding community, multiple surrounding units in charge of administrative, legal and financial processes are also identified by teachers as having some level of influence. About the division of labour four types, characteristics can be identified regarding to who is in charge of curricular changes to integrate technology, a plethora of responsibilities in the department, delimitation of responsibilities assumed by teachers regarding the students, unclear definition of responsibilities of authorities and other department staff. As mentioned before a clear depicting of the activity system of enthusiastic teachers enables to finding the limitations to ICT integration through a contradictions analysis.

4.3 Contradictions of enthusiasts in teaching activity with technology

Contradictions must be understood as historically formed. According to Engeström and Sannino [32] they cannot be observed directly from data but identified by their manifestations. To use the appropriate conceptual framework, in the following lines will be presented the discursive manifestation of contradictions obtained in focus groups with enthusiastic teachers. Engeström and Sannino [32] state the four basic manifestations of contradictions as a dilemma, the conflict, the critical conflict, and the double bind. Dilemmas were found in data when the teachers' set of beliefs are affected by external forces. In this regard, one teacher mentioned: *"at some point I asked myself if all that tools I was using match with an intelligent intention of what I wanted to achieve in my part of the curricula"*. This expression reflects an incompatible evaluation [32] between his/her internal position as a user of technology and a new possible or desired position. The dilemma appeared initially on an individual level becoming collective when she/he refers to his/her department experience. For example, *"I refuse to continue doing virtual room if the use is as a document repository because in my department experience that distorts the concept of virtual course"*. The teachers move from dilemmas to conflicts showing an effusively disagreement and criticism. One of them said, *"...my concern is...if...we have the capacity for that discussion...we can teach LATEX (mathematics software), the technical part, but why are we using it? We are not discussing that"*. Double binds are also present in enthusiast discourse. A teacher who reflected on the impact of technology on his/her students as high school teachers questioned, *"Are they thinking on curricula? No, they are only thinking in CMAP Tools"*. Rhetorical questions characterize double bind manifestations of contradictions involving not only the subject but other participants in the activity. Double binds are situations that cannot be resolved by an individual alone [32]. In the collected data manifestations of contradictions, patterns were found within the value system of enthusiastic teachers and toward other constitutive components of the activity. In other words, those are manifestations that could derive in primary and secondary inner contradictions in the activity.

5 DISCUSSION

The discussion section encompasses three main arguments emerging after approaching to barriers of enthusiastic teachers in ICT integration adopting a Cultural-Historical Activity Theory perspective. It is argued a necessity for (1) overcoming the existing dichotomy between enthusiastic and resistant teachers; (2) an acknowledgment of the complexity of the activity of teaching with technology; and (3) overcoming the existing dichotomy between internal and external barriers as a lens to study barriers of teachers in ICT integration.

5.1 The dichotomy between enthusiasm and resistance

The classification of teachers according to their beliefs or behaviour toward technology use in teaching process has been used for research purposes, plan developments and with implementation purposes in higher education institutions. In a recent research Cifuentes [9] contrast the critical positioning of teachers against technology uses and concludes that critic toward technology is not an exclusive trait

for resistant. Rather, it appears in both types of teachers. Despite Fullan [33] conceptualizes resistance in terms of an opportunity to learn from it, he does not rescind of the concept. In the practice, such categorization has led to emphasize the gaps among faculty teachers regarding their implementations initiatives and participation in professional development activities. One of the teachers in the focus groups mentioned his positive experience with technology and referred to resistant colleagues in the following terms: “...I cannot see how somebody cannot follow in the same way I did”. Furthermore, categorization increments formal and non-formal power relationships situations. Even among enthusiastic teachers, power relations can be hinderers for technology implementation. An enthusiastic teacher refers to his experience in these terms: “...I was trained, and I received my diploma four years after the course because the person in charge of training was my colleague in my department, he/she, was the only one working on technology, and he/she did not want another one”. Categorization of teachers also affects the practice when collective initiatives are proposed by enthusiastic. The refusal of resistant to participating leads to the creation of exclusive groups among enthusiastic and exclusion of resistant. For the former this situation derives in an affectation of the object and outcome of teaching activity. As found in data, when the activity of teaching and learning with technology becomes beyond the classroom enthusiasts can suffer opposite forces against their activity, coming not only from other teachers but also from other components like rules and community. The complex relations manifested in the subject characterization section clearly support the assertion that enthusiasm and resistance are not fixed categories. There are intermediate levels of enthusiasm and a variety of levels of resistance. In fact, a teacher who is not necessarily resistant could be labeled as such by colleagues or authorities. However, such non-uses of technology can rely on ignorance and not in reluctance. Moreover, enthusiastic could, at some point exhibit resistance in attitudes and behaviour. In the case of enthusiastic that reduction of enthusiasm is induced mainly by external actors. Robertson [34] proposes six themes in which resistant teachers evidence such resistance: (1) resistance to organizational change, (2) to outside intervention, (3) to time management problems, (4) to lack of support administrations, teacher’s perception, and personal and psychological factors. However, at some point enthusiasts also experiences some limitations on this categories. Mumtaz [35] argues that the category of “resistant teacher” is a stereotyping of the profession based mainly on the ignorance of a teacher work. A similar argument can be applied for enthusiasts. “Enthusiastic teachers” category is a stereotyping of the profession based on the lack of knowledge of the activity system and limitations affecting them.

5.2 The complex configuration of the activity of teaching with technology

CHAT see human activity not only as the relationship among the subject, tools, and object. Rather, it is affected by certain rules; a subject community; and a division of labor [11]. Even in the classroom level teachers’ activity is influenced by the students, a teaching curriculum, and a timeline. In the classroom level or even in next levels “enthusiasts” create tools to overcome limitations. In one of the focus groups an enthusiast teacher discussed with other about the time they expend in students attention in a virtual course. The teacher said, “...In my case, for instance, I never do that of being pending of answering to the students; I clearly state the rules of the game. Communications with the teacher are in the virtual room, by written”. The enthusiastic creates the needed tools to accomplish the goal. That also happens when they face limitations in higher levels. Referring to the process of getting the course program approval, a teacher mentions: “When they said I cannot (teaching a virtual course), I tell them (to heads of department) put it in an official letter. If they do not, I teach it”. That kind of solutions solve a particular problem in a particular moment and teacher will face the same limitation once again affecting the long-term intention of using technologies. As can be inferred, the central conflict for teachers ICT integration arises when the teaching activity becomes collective. To put it differently, when others constitutive components of the activity play a decisive role. In the next excerpt of the dialogue between two teachers and the researcher clearly denotes the influence of other colleagues as part of the community, on an enthusiastic teacher proposal of technology integration:

T6: I proposed to create a hybrid curriculum for the bachelor degree, but they do not accept it

T5: And... why not entirely virtual?

T6: Ahh... because they do not want to, they do not allow me, they do not allow me!

R: Who? The authorities?

T6: No, in this case, my own colleagues.

Rules are other component affecting enthusiastic teachers' activity. They take the form of formal institutional or departmental guidelines, new or historically accepted. Rules can also be informal and accepted ways of doing things in the subject context. Regarding rules a teacher comment as follows: *"We received a directive that we cannot more than X virtual hours per course"*. Several entities can be listed in each constitutive component that affects in different manners the outcome accomplishment and account for the complex configuration of teaching with technology. Complexity is even greater due to the dynamic quality of the object. In some cases, teachers use technologies because they pertain to a department when the guidelines force teachers to use ICT. About above a teacher mentioned, *"I can see how people (colleagues) reluctantly accept because there is no other chance, they have to teach virtual courses because it is stipulated as such and if they want to teach here..."* This case shows two different subjects, with two distinct objects in the activity of teaching using technologies. In such a situation both activity systems have their configuration regarding components and their own internal limitations or tensions that can restrict the outcome.

5.3 The dichotomy between internal and external barriers to teachers

The study of limitations as a result of external actors on teachers regarding uses of technology might not be separated from the internal ones. Human activity must not be seen as a separation between the internal and the external world or as a separation between internal beliefs and the surrounding physical world. Moreover, from my point of view, the concept of barrier in itself has an implicit meaning of physical impediment. Merriam-Webster dictionary defines barrier in terms of a hinderer of movement or action. Such a conception can derive in difficulties to overcome. A movement from the study of barriers to the study of tensions or historically accumulated contradictions is a platform for a broader and comprehensive analyses and understanding of the technology integration phenomenon. Dee [36] revision of literature in the period from 1983 to 1996 aiming to answer the reason of the gap between the actual and expected use of technology found that teachers' attitudes and professional development were two of the major barriers. Both remain as significant barriers in a similar review 15 years later [37]. After an extensive revision of literature in the topic, I argue that study of limitations remains static. Ermert [8] argues on the scarce discussion to clarify the relationship between types of barriers or to delineate effective strategies for addressing them is relevant. However, new approaches must be applied. From Ermert's point of view, first-order barriers are extrinsic to teachers meaning that overcoming does not rely on the teacher. In other words, there is nothing that teachers can do to defeat such a barrier. She considers extrinsic barriers easy to measure and relatively easy to eliminate allocating money. Nevertheless, the present study shows how from an activity point of view there are external components to the teacher that affects their teaching practice with technology. Guidelines, traditions, opposite views from members of the community and problematic division of labour influenced positive or negative the fluent development of the activity, and they cannot be resolved with money allocation. In the previous section of data analysis, some evidence was presented on the existence of first and secondary levels of contradictions. Some excerpts of the dialogue with enthusiastic teachers exemplify it: *"...when I was the coordinator of my department I fought all the time with the unit of technology because The Internet never worked"; "Now there is a policy of using open source. PSPP is an open source software, but the graphics are not the same" or "I teach in the fourth year when the students are in the fourth level the do want nothing to do with technology in the LMS"*. Other mention experiences like, *"something that I am really worried about is that some things have changed here, you feel tie, so I get angry"*. Contradictions analysis helps to reduce the difficulty of understanding extrinsic and intrinsic barriers separately. What is more, contradictions are referred in CHAT as driving force of development. Its meaning is not restrictive but developmental. According to Illiyenkov, 1997 contradictions are "the principle of its self-movement and... the form in which the development is cast" [11]. From a developmental perspective contradictions in teaching and learning with technology can be potentially addressed resulting in a transformation of the activity and achieving improved outcomes [38].

6 CONCLUSIONS

The presented study has shown a new perspective of analyzing retarders in teachers and institutional integration of technology in teaching and learning process using CHAT as a lens of analysis. The subject analyses show the difficulties of labeling teachers as enthusiastic or resistant and the complex system surrounding the teaching activity of the formers. Two conclusions can be asserted, (1) the necessity of moving toward a more comprehensive unit of analysis that considers the collective, culturally-mediated and historically conformed human activity of teachers; (2) the complex

relationships among teachers' attitudes and the context no matter the level of integration of technology. A further analysis of the different types of teachers and their respective activity systems is required to discover the tertiary and quaternary levels of contradictions and promote changes in ICT integration. The study also evidenced limitations of "enthusiastic" teachers for moving to the next level of integration, a zone that is not yet constructed but that is not individual anymore.

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