EPISTEMOLOGICAL CONCEPTS FOR TEACHER DEVELOPMENT IN VIRTUAL ENVIRONMENTS AND IN THE TEACHING–LEARNING PROCESS FOR VISUALLY IMPAIRED STUDENTS

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Keywords: Teacher Development, Virtual Learning Environment, Visually Impaired.

Abstract: The purpose of this paper is to reflect upon the teacher development process in a virtual learning environment as well as to link this process to the teaching–learning contexts of visually impaired students. In this perspective, the paper addresses two objectives which, although distinct, are connected by the same theoretical–epistemological reference, pointing to language as an essential tool through which individuals constitute themselves as historical and cultural subjects. The conclusions tend to show that the formation of teachers in virtual learning environments may favor the construction of new knowledge based on dialogic and collaborative network communication. In this sense, it is possible to build a construction space of the senses for the visually impaired in learning processes utilizing educational strategies which also allow for dialogues and the construction and diffusion of knowledge.

1 INTRODUCTION

The term epistemology may be understood etymologically as discourse about knowledge. Literally, it means the Theory of Science; however, the term has been reduced to Theory of Scientific Knowledge. Habermas (1982, apud Franco 2008) states that, after Kant, the Theory of Knowledge slowly disappeared with the disruption of the relationships between philosophy and science. Yet, an attempt is made through epistemology to study the origin of knowledge, how to use it, and how to determine its value.

We understand that reality is complex; therefore, the possibilities and perspectives of knowing it are uncountable. This may make us rethink our epistemological positions. According to Abreu Júnior (1996, p. 39), "… *entrar no cenário da complexidade implica compreender que o conhecimento, qualquer que seja ele, é limitado e não oferece garantia absoluta de compreensão completa e definitiva da realidade*"[1]. Morin (1999) says that we are physiological, biological, social, cultural, psychic, and spiritual beings, and this means that complexity is that which tries to understand the articulation, identity and differences of all these aspects.

The perspective of complexity leads us to reflect on the single and absolute truth imposed by the positivist theory of science. Yet, what is truth when faced with a complex, multi-dimensional reality? What is the emergence of today's world? In the complex view of the world, scientific knowledge is only one of the possible interpretations of reality or

[1] Author's translation: "entering the scenario of complexity implies understanding that knowledge, whatever it may be, is limited and offers no absolute guarantee of complete and definitive understanding of reality".

Pereira de Souza E., Pinto Sena C. and Carvalho de Oliveira Soares C. (2010).
EPISTEMOLOGICAL CONCEPTS FOR TEACHER DEVELOPMENT IN VIRTUAL ENVIRONMENTS AND IN THE TEACHING–LEARNING PROCESS FOR VISUALLY IMPAIRED STUDENTS.
In *Proceedings of the 2nd International Conference on Computer Supported Education*, pages 29-36

one of the forms of representation of knowledge. We might say that reality, from this perspective, is constructed and – why not say it? – defined by the relationships between things.

In this sense, we understand that the context of relations becomes the focus providing meaning to the instabilities marked by the actions of the individuals participating in the process and, therefore, represents the continuity of constantly evolving facts. Reality, then, stems from actions, i.e., from a process of individual and collective construction, thus establishing a systemic thought in relation to the process as a whole.

Morin (2003) says that one of the principles to understand complexity is the systemic principle which links the knowledge of parts to the knowledge of the whole. Thus, the whole is more than the sum of its parts. This epistemological position allows us to have a broader understanding of the world, of people, of knowledge, and of science.

It is this perspective that this essay adopts, in two distinct moments: (a) our questions concerning the preparation of teachers to use Information and Communication Technologies (ICT) in education and (b) the aspects related to the teaching–learning process in the broader sense of understanding what learning is and the questions concerning how the visually impaired can make use of ICT as facilitators in the representation of knowledge by using a teaching–learning process based on Problem Based Learning (PBL)[2] methodology.

In the first part, the study will address the formation of teachers in relation to the following issues: How is it possible to approach teacher development to enable them to use ICT in education, maximizing the potential of technologies and of virtual learning environments as a space for self-development, taking into account the need to deal with subjectivities, to deal with others and all their differences, providing a space that will allow for reflection about the action and, within this action, the development of a dialogic space? But what is formation? How can technology favor teacher development?

Some years ago, several investigations (Almeida 1996, Moraes 1999, Axt 2000) were conducted to understand how the use of technologies has changed the educational context. Much has been said about the importance of teacher development towards this end. We understand that teacher development, research, and the construction of knowledge are inter-connected concepts that operate together within the broader context of teacher development.

In the second part, we will address learning in general and its relationship with the construction of knowledge, guided by the following issues: What is learning? How does PBL behave as a teaching–learning strategy? How can ICT collaborate in the representation and diffusion of the knowledge generated for a visually impaired audience?

We understand that, although we grasp reality in a complex way and, therefore, do not exclude any theory that may help understand the reality under investigation, there is the need to take a theoretical–methodological–epistemological stand, defining, even if temporarily, a starting point from which to present our ideas.

In this quest for a theory (or theories) to provide a foundation for this study, we have had the opportunity to listen to many voices, re-visit some of the authors that were part of our professional and academic journey (e.g., Bakhtin, Freire, Vygotsky, Piaget, Wiener), to be introduced to many others (e.g., Morin, Maturana, Haberman, Nietzche), and to maintain a dialog with them.

The text is organized around five parts. Initially, the formation of teachers will be addressed. The following sections will concern language, learning and development, important aspects both for the formation of teachers and the teaching–learning process of the visually impaired. Finally, conclusions and reflections will be presented.

2 TEACHER DEVELOPMENT

When we refer to the development of teachers to use ICT in schools, it is important to describe the delimitation of the topic in this broad field of possibilities. We believe it is necessary to choose a space, a time, and the subjects because it is impossible to know everything in the world as well as their transformations (Morin, 2003). We have opted for a multi-referential epistemological concept which views all human knowledge as relative, partial, and incomplete (Froes, 2001). We can thus see that the topic chosen for this study is like a hologramatical figure where each part presents characteristics of the whole, that is, the part integrates the whole. This delimitation corresponds

[2] PBL is an educational strategy which attempts to encourage the student to become the constructing agent of his/her own knowledge, guided by a teacher. It is systematized in a 7-stage cycle (reading the problem, brainstorming ideas, systematization, formulation of questions, definition of goal, evaluation of process, follow-up). These stages occur during tutorial sessions and meetings of the members of the tutorial group. Each group is composed of a teacher and an ideal maximum number of 10 students (see Santos et al. 2007).

to the study of the construction of a dialogic space as a methodological proposal for a collaborative communication network in the continuous development of teachers, enabling them to use ICT in education. Given the complex nature of the object of this study, this topic will allow us to observe the phenomenon in its continual motion. Vygostky (1998) states that to study something historically means to study it during the process of change.

From this perspective, it is necessary to articulate our understanding of teacher development, since authors provide various views in this field of research (Nóvoa 1995, Kincheloe 1997, Pimenta 1999, Macedo 2000 & 2006, Schon 2000, Pimenta & Anastasiou 2002, Josso 2004). Teacher development is understood, in this paper, as a process that views the subject as the constructor of his/her own history, a development that seeks an active role for the teacher, one based upon the experience of living the dialectic tension between theory and practice (Freire, 1997). It is a phenomenon which occurs within the subject as he/she relates to another person. Therefore, development is experiential, connected to moral, ethical, and political values, and views the subject as the learner. We may say that learning is what gives foundation to teacher development. Araújo and Moura (2008) state that "*a qualidade profissional se assenta não apenas no saber ensinar, mas na relação entre aprender e ensinar*[3]".

We understand that teaching is inseparable from learning, and therefore, teacher development must be based on the quest for the construction of knowledge, for continuous learning, for creativity, and for collaborative production, stemming from the challenges presented in our daily lives, from the contact with the object of the work, and from the reflections about one's own experience

It is observed in the available literature on teacher development that much research and teacher development projects are impregnated with the empirical concept that knowing how to do something is enough for the configuration of formative processes. However,

> *... o resultado da formação não se produz na forma de uma finalidade técnica, mas nasce do processo interno de constituição e de formação e, por isso, permanece em constante evolução e aperfeiçoamento [...] Nesse sentido, tudo que ela assimila, nela desabrocha. Mas na formação, aquilo que foi assimilado não é como um meio que perdeu sua função. Antes, nada desaparece na formação adquirida, mas tudo é preservado. A formação é um conceito genuinamente histórico* [...] (Gadamer 1997).[4]

If we consider a teacher's practice as a historically constructed social practice, it will be realized as praxis, in a dialectic process, becoming different from the merely technicist process composed of a succession of methodological procedures (Franco, 2008).

Teacher development in the perspective of this study, in relation to the interconnectedness of theory and practice, points to language as the essential tool through which individuals constitute themselves as historical and cultural subjects. Through language, several senses are put into play. For Bakhtin (2000), the conflicting and therefore ideological aspect of language highlights the importance of the process of understanding meanings which takes place dialogically, in a plot that presupposes the simultaneous existence of reflection and refraction of multiple social voices.

Habermas (1982 apud Franco 2008) says that there is no possibility of individualization without socialization, as well as no socialization is possible without individualization. In this sense, the voices, the interactions, what is said or left unsaid, the meeting with the other in the dialogic space, may favor the development of teachers and the assignment of new meanings to their practices, because the subjects of the dialog construct each other and, together, construct the text and its meanings.

Based on the theoretical concepts of Mikhail Bakhtin and Lev Vygotsky, we can broaden our horizons and create new methodological, analytical, and study paths, starting from language and the context lived by teachers in virtual learning environments (the dialogic space).

3 LANGUAGE

Human sciences study people in the process of expression and creation. Studying people independently of texts, that is, of the language they create, means to locate them outside the sphere of

[3] Author's translation: "…professional quality is consolidated not only in knowing how to teach, but in the relationship between learning and teaching."

[4] Author's translation: …the result of (teacher) development is not produced in the form of a technical end, but springs from the internal process of constitution and development and, thus, remains in constant evolution and improvement […]. In this sense, all that is assimilated, blossoms. Yet, in development, that which was assimilated is not a means that has lost its function. On the contrary, nothing disappears in the acquired development; everything is preserved. Development is a genuinely historical concept [...] (Gadamer 1997)

human sciences. For Bakhtin (2000), it is not possible to understand people, their lives, their work, their struggles, except through the use of sign-texts already created or to be created.

From a social–historical perspective, the interaction or the relation between subjects is made possible through language. Although words – the ideological signs by excellence – are mediators of the dialectic process between the individual and the social (Jobim e Souza & Kramer 2003), language does not limit itself to and come to an end in words. Language is "*tudo o que en-caminha e movimenta*" (Heidegger 2003 p. 163) and "*é antes de tudo um meio de comunicação social, de enunciação e compreensão*" (Vygotsky, 2000, p. 11)[5].

Vygotsky (2000) defines two processes for how this language-discourse works: "exterior" as a process of transformation of thought into words (materialization of thought) and "interior" as a process that is realized from outside to inside ("evaporation of language in thought").

Language is an integral part of the subjects themselves as they interact with others during situations requiring discursive communication, and their awareness, their knowledge of the world, in fact their very selves. The subjects complete and continuously construct each other through their own and their peers' discursive practices. Throughout his/her own history, then, the subject constitutes him(her)self as s/he hears and takes ownership of his/her peers' words and discourses (parents, friends, classmates, teachers, etc) transforming them, in part, into his/her own words. In this sense, Bakhtin (1979) states that it is not words that we pronounce or hear but rather truths and lies, things that are good or bad, important or trivial, pleasant or unpleasant. The word is always loaded with an ideological or experiential discourse

Bakhtin shares the Marxist principle that people transform the world and are transformed by it through the utilization of tools, as in a two-way street. He attributes to language the role of "essential tool" in describing its transformational ability and its function as a psychological tool in the organization and constitution of subjects. He also points out the organization of discourse as a determining factor in the relationships between individuals involved in any type of interaction.

In the ideological culture of modern times, monologism[6] is still present, and dialogism counters it (Barros, 1999). Dialogism is about the relationships that are established between the self and the other in discursive processes constituted historically by the subjects who, in their turn, constitute themselves or are constituted by these discourses. Consequently, dialogic and dialectic approach each other although they can not be confused, since Bakhtin will discuss the self that is realized in the we, inserted not in the synthesis, but in the polyphonic nature of the relationship which comes to light through language (Brait, 2001)

Dialogism is viewed as the interactional space between the I and the you or between the self and the other.

We understand dialog not only in the narrow sense of face-to-face conversations, but also in the sense of a broader communication system connecting subjects to contexts. While dialog is usually defined as an exchange or discussion of ideas, in harmony, we must also consider the dimension of dialog in the territory of conflict and tension (Bakhtin, 1979). In this way, a dialog can be defined as a great union of voices and various intonations – dialogs between people, texts, authors, feelings, lives.

In the dialogic space, it is through interactions that meeting the other occurs, mediated by language and, therefore, conflicts may arise as well as the creation of affective bonds. The affective dimension takes a central role, both from the point of view of the construction of the person and of knowledge, that is, emotion plays a mediating role in the learning process (Wallom, 1986). Emotions mean the first recourse in the interaction with the other.

Maturana (2002) says that the fundamental emotion that makes the history of mankind possible is love. The word *love*, according to him, has been devalued, and the emotion that this word translates has lost its vitality as a result of overstating it as something special and difficult. Love is the foundation of social relations and is part of human life. When we talk about love, we are talking about the acceptance of the other as a legitimate partner in companionship. Human relations are social if they are born out of love, in the acceptance of the other. "Therefore, loving is allowing space for the recurrent interactions with the other, in which

[5] Author's translation: "everything that leads and moves" (Heidegger 2003, p. 163), "it is foremost a means for social communication, of enunciation and comprehension" (Vygotsky 2000, p. 11).

[6] Monologism, based on Bakhtin's literary theory, is the opposite of dialogism. "According to Bakhtin, in monologism the author concentrates in himself all the processes of creation; he is the only center radiating awareness, voices, (…). The monologic model does not accept the existence of a responsive and isonomous response to the other". (Bezerra 2005, p. 192).

his/her presence is legitimate, no strings attached" (Maturana 2002, p. 67).

This notion of love given by Maturana helps us think about the utilization of ICT as an interaction tool among teachers, between teachers and students, and among students. For dialogs to happen, the presence of the other and his/her acceptance in the dialog is indispensable. The role of the other is vital to give meaning to the dialog because, whenever we speak or write, we do it keeping in mind the other person in the dialogic chain. The other will interfere, conditioning the self. It is impossible to have human development without alterity, without the other being part of my space in the world, constituting me ideologically and making me complete.

3.1 Language and Teacher Development

Teacher development seeks to contribute to the formation of sensitive people, teachers who can act as intermediators between theory and practice, concerned with learning to learn.

In this sense, in the dialogic space created in the virtual learning environment, dialogs, the verbal interactions in the discussion forums, in the chat rooms or via other interfaces, may be seen as the interactional and dialogic space that can contribute to the development of teachers. By observing the speeches[7] in the dialogic space, it is possible to see that each speech is unique, each utterance is different from the preceding one or the next one, creating something new. This allows us to notice the uniqueness of the dialogic situation. Each testimony is loaded with emotions, with life experiences, something that is at the same time individual and collective/social. According to Monteiro (2008), inspired by Nietzsche, the exercise of writing has a formative force. The written texts talk about overcoming limitations. Therefore, the production of a text may become a privileged moment of development. The written text, in the virtual environment, favors network communication, the meeting with the other located on the other side of the dialogic chain, providing the opportunity for a change of context.

3.2 Language and the Learning Process based on Problems

The teaching–learning process based on problems fosters learning to learn, the continuous quest for answers to questions that arise during students' group work. This non-virtual space is a space for dialogs, for the exchange and discussion of ideas (brainstorming), for the systematization of facts and ideas, for new questionings. It is where knowledge is constructed individually and collectively. Through the use of ICT, this space can be expanded into a virtual learning environment, one in which PBL methodology can also be applied. In any case, whether it be face-to-face or virtual, it is possible to talk, to establish peer communication, respecting the space for the exchange of ideas, respecting emotions, individualities, abilities, and limitations.

Concepts as well as behaviors are constructed. Human language (differently from animal language) can adapt itself, is able to attribute new meanings to new sounds, images, words, or oral or body language (Wiener, 1954). Through language, we intend to establish the relationship between the body of knowledge generated by the visually impaired in the tutorial sessions (e.g., meetings scheduled by PBL where teacher and students meet to discuss a particular problem). This language, or the representation given to it, needs to come close to the logic and comprehension abilities of the visually impaired, allowing for the exchange of ideas between those students and the non-visually impaired.

4 LEARNING AND DEVELOPMENT

According to Vygotsky (1993), learning allows the awakening of an individual's internal processes and, therefore, fosters development. The actual course of the development of thought does not go from the individual to the social, but rather from the social space to the individual. For the Vygotsky, learning and development are inter-related. Furthermore, it is believed that the subject, when facing a problem-situation, already has previous knowledge that can not be ignored, and that learning must be linked in some way to each individual's level of development. It is in this sense that the concept of Zone of Proximal Development (ZPD) arises.

The ZPD presented by Vygotsky can also help us to understand interactions, the mediations and learning that occur within a virtual or a collaborative learning space. According to Vygotsky (1998, p. 112), ZPD is the

> *[...] distância entre o nível de desenvolvimento real, que se costuma determinar através da solução*

[7] The word "speech" represents, in this text, any and all expressions of the subject in the virtual environment, whether it is written or oral.

independente de problemas, e o nível de desenvolvimento potencial, determinado através da solução de problemas sob orientação de um adulto ou em colaboração com companheiros mais capazes[8].

According to Vygotsky (1998, p. 110), the level of actual development is the level of development of mental functions that are established as a result of the completion of certain cycles of development. In this level, the subject is mature enough to solve problems independently because the functions involved in the resolution have matured.

Learning is the relationship between the actual and the potential level of development; it is the capacity of the subject, through socialization, to interact with others, to solve problems which could not previously be solved individually. The ZPD is characterized, therefore, as the path the individual will travel on to develop functions that are in the process of becoming mature and which will become consolidated functions, established in the actual level of development. This zone is characterized as being in a psychological domain in constant transformation, explained by the fact that the human being is constantly learning, therefore in constant change. The possibility of change in the performance of an individual through the interference of another is fundamental to Vygotsky's theory. Social interactions are extremely important for the process of construction of human psychological functions (Soares, 2005).

The study of teacher development starting from the interactions in the dialogic space, as well and the study of the teaching–learning process (PBL) for visually-impaired students, presupposes the study of the subject in his/her daily relationships, in his/her dialog with his/her peers and with him/(her)self, a subject whose cognitive processes are also focused on his/her professional and personal development. This is the reason that the study of learning (the construction of knowledge in the formation of adults) requires the consideration of aspects such as subjectivity, intuition, and affectivity as important factors in the development process.

4.1 Learning and Development in the Formation of Teachers

Teacher development deals with the learning processes of adults, workers, educators, and teachers. In this way, the interactions that occur in the virtual space created to make possible the dialog among teachers constitute a social space for learning, and consequently, for development. In this space, teachers are given the opportunity to see and feel like learners because, as we mentioned before, development is experiential and, although it happens in the subject, it arises from his/her relationship with the other in a historical–cultural process.

In the case of teachers, we may consider that the actual level of development corresponds to the body of knowledge consolidated during their professional trajectory, while the potential level of development corresponds to the body of knowledge that can be acquired (or not) with their peers. And it is in the ZPD that the actions for their development should occur. The virtual learning environment as a dialogic space may become a space that maximizes ZPD by allowing teachers through language – the sign by excellence – to discuss and share their dilemmas, problems, solutions, achievements, and subjectivities, all through the network, favoring the construction of knowledge and the reassignment of meanings for pedagogic knowledge. This will consequently foster their development, with their own needs and perspectives as the starting point.

Teacher development, in this concept, makes us consider the teacher as a subject who constructs knowledge historically, starting from their presence in social–cultural groups and spaces, contributing with their learnings from the academic world or from their day-to-day experiences, learning through their interactions with the other, in the inter-connection of contexts, of languages and of constructed knowledge about and for their profession.

4.2 Learning and Development in PBL

PBL has been used as an educational strategy for all age groups, from children to adults. The central element in PBL is the problem (Mamede & Penaforte, 2001). In order to solve it, group learning is encouraged, although time is provided for individual learning, for internalization, for reflections about the concepts and ideas approached. In this sense, internal dialogs are encouraged, in special dialogs with peers, with the teacher (who plays the role of counselor) or with classmates. This learning space, face-to-face or virtual, generator of collaborative work, allows the students to assign meanings, contextualize learned points, experiment with the exchange and sharing of information, leave

[8] Author's translation: […] distance between the actual development level, which is usually determined through the independent solution of problems, and the potential development level, determined through the solution of problems with the guidance of an adult or in collaboration with more capable partners.

the area of comfort (actual development level or what is already known) towards what can be learned and known with the other (potential development level).

Similarly to that described in above in Section 4.1, the actual level of development corresponds to the body of knowledge that has been consolidated by the student during the course of his life, while the potential level of development corresponds to the knowledge that can be acquired (or not) with peers. And it is in the ZPD that the planned PBL actions should occur. "*A noção de zona de desenvolvimento proximal favorece as interações… e fundamenta uma proposta de educação para a diversidade*" (Hernández & Ventura, 1998)[9].

In this sense, diversity and interaction can be given preference by PBL with the support of ICT, broadening the possibilities of exchange between the subjects (the visually impaired) and extending their skills. An environment where they can experience the PBL methodology and construct a representation of the knowledge generated may favor this dialogic space and potentialize the ZPD.

In this proposal, the teacher is not at the center of the process. The dynamics of the method occur through the roles played by the students in the tutorial sessions or outside them and in their interactions. The teacher becomes the mediator in the process. This dialogic space may happen in face-to-face meetings or with the support of ICT in a virtual learning environment.

At each new session (meeting with peers), students are at a new level of actual development (Zone of Actual Development), facing again a space that fosters exchanges, fresh points of view, and new perspectives about the problem addressed. It is a continuous cycle in which the acting upon the ZPD in each session is never the same because new knowledge and different questions arise continuously. This constant evolution is the result of the previous dialogic process in the ZDP and the process involved in individual searches and researches.

5 SOME (IN)CONCLUSIONS

From the interactions, the exchange, and the meeting of the self and the other in the dialogic space, several meanings can be constructed and reconstructed because the construction of meanings is, by definition, endless (Bakhtin, 2000).

The theoretical discussions and the epistemological options described here point to language as an essential tool through which the individual constitutes him/(her)self as a historical and cultural subject.

We consider a network dialogic and collaborative communication, supported by a virtual learning environment, a proposal that may favor the construction of knowledge in the teacher development process.

Group sharing (also dialogic and collaborative), whether or not supported by a virtual environment, fosters the development of logical reasoning, positive attitudes related to diversity and heterogeneity, commitment to group work, to the self and to the other, bringing people closer both as professionals and ordinary people.

These are some of the initial reflections to think about the possibility of developing teachers through the utilization of a dialogic space that works as a resource capable (or not) of constituting itself as a collaborative and significant environment for the construction of knowledge by using the "voices" of the subjects – language – as indicators of possible changes in the context. It is also an opportunity to consider the inclusion of the visually impaired through educational strategies that favor their learning capacities as well as their digital inclusion through the use of virtual learning environments that broaden their capabilities, allow for mutual understanding, fosters dialog and the construction and diffusion of knowledge.

[9] Author's translation: "the concept of zone of proximal development favors interactions … and provides a foundation for an educational project geared towards diversity".

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