

COMPLEX EDUCATIONAL DESIGN: A COURSE DESIGN MODEL BASED ON THE COMPLEXITY THEORY

Maximina Maria Freire
Catholic University of São Paulo - PUCSP
Brazil

Abstract

This article aims at presenting a conceptual framework which, theoretically grounded on complexity, provides the basis to conceive of online language courses that intend to respond to the needs of students and society. This paper is introduced by reflections on distance education and on the paradigmatic view underlying great part of language courses in Brazil. From these considerations, it is argued that the complex paradigm offers steady foundation to conceive of a unique design concept. The *complex educational design* is then described in its constructs and features. To conclude the article, implications on this model are drawn and taken into account.

Introduction

One of the biggest contemporary challenges seems to be reaching a harmonious integration of social practices with the educational ones. In Brazilian schools, as far as the teaching of English as a foreign language is concerned, it has been quite common to witness the use of non-contextualized structural activities which do not reflect the reality of students and of their communities. As mentioned by Freire (2009),

Although inserted in the same socio-historical context, schools and society do not seem to follow the same direction and speak the same language: Schools are predictable, strictly attached to principles. They preserve prescriptive language and have a one-way behavior pattern that perpetuates the transmission of disciplinary fragmented knowledge. Society, on the other hand, is dynamic and unpredictable. It prioritizes multiple and simultaneous media resources and languages, as well as a transdisciplinary knowledge network, which is constructed, co-constructed, deconstructed and actively reconstructed all the time throughout life. (p.16)

Features of such a scenario – which have been influencing face-to-face courses, tend to reverberate on the creation of online learning environments and, as a consequence, subtly impose to an innovative setting unambiguous marks of traditional educational practices.

Distance education has been defined and extensively researched (Keegan, 1996; Silva, 2003; Moore & Kearsley, 2005; Moore, 2007; among others). In general, the studies available emphasize its role as a genuine variety of education through which teaching and learning occur. A critical reflection

upon distance education's main characteristics suggests four specific qualities, which, in my opinion, deserve to be stressed:

- its possibility to overcome any spatial and geographical distance to bring near an interlocutor who may stay either next door or on the other side of the world;
- its capacity to defeat temporal barriers and allow synchronous and asynchronous interpersonal communication;
- its ability to simultaneously attend large number of students and include them in the same online classroom; and
- its potentiality to deal with different learning styles and work-related rhythms to somehow cope with individuality and subjectivity.

The qualities expressed above – *spatial*, *temporal*, *inclusive* and *subjective*, respectively – not only define the nature of distance education but also provide teachers and designers with a wide range of alternatives to organize and implement online learning programs. Articulated with other features, they reveal that virtual environments offer unique opportunities to creatively deal with technological tools to come up with new educational practices – the ones that may shorten up the gap we have been noticing between society and education, as previously mentioned.

However, despite the environmental potentiality, we perceive that many *delivery courses*¹ proliferate on the web, particularly when English as a foreign language is the object of study. This label (assigned on purpose) indicates that such courses are depicted by a low level of teacher-student interaction and, no rare, no student-student communication is contemplated. In general, automatic answers and predefined tutorials are provided to the students who receive little or no comments on individual performance. Besides that, aspects of students' reality or daily routine are not addressed nor are their needs and expectations, for as *non-tailor-made* courses they are directed towards an idealized target audience. These courses are grounded on content-based syllabuses in which the linguistic component is fragmented and gradually developed from the easiest to the most difficult subjects. Moreover, there is strong emphasis on language structure through *drill-and-practice* non-contextualized exercises that aim at memorization and reinforcement. Some of these courses provide online tutors to clarify doubts on request and technical support to help students with equipment or software difficulties. Undoubtedly, these online courses are focused on form and do not view foreign language as social practice.

Courses like the ones described above respond neither to the students' nor to the society's needs. They do not take into account that learners want to use foreign language for communicative purposes in genuine social situations in which they play specific roles and, by the same token, society expects them to perform social functions by adequately using the mediation of (foreign) languages. Considering these arguments, it is not difficult to conclude that the theoretical orientation and the design of such online language courses should be reconsidered, particularly because there is a powerful network of

technological tools involved in the learning process thus impacting on the transformation of information into knowledge.

Such a perception provides the context for the discussion aimed at by this article whose purpose is to introduce and reflect upon what I name *complex educational design*: A set of constructs that, grounded on complexity (Morin, 2005, 2008a, 2008b), attempts to guide the design of online language courses that may respond to the current needs of society with its features, practices, and educational goals. This original design orientation intends to be a way to provide online language courses with an innovative path to deal with virtual learning environments, by establishing a dialogue between educational practices and students' real lives, by emphasizing content and not only form, and by acknowledging needs and expectations as well as providing a genuine partnership among teachers and students so that they can together create a non-linear, non-fragmented course that offers unique opportunities to (re-) connect contents in various and unpredictable ways – this is, a complex course.

From a Fragmented to an Interwoven View of Knowledge

The learning environment described in the *Introduction* of this article is theoretically rooted on what is recognized as *the traditional educational paradigm* (Nonata, 2007; Behrens & Oliari, 2007). From this paradigmatic perspective, knowledge construction is perceived as linear, disciplinary, fragmented, reduced to an inextricable cause-effect relationship, and understood as the simple result of the sum of its parts. Grounded on a cartesian-newtonian worldview, the traditional paradigm conceives of knowledge construction as objective, measurable and susceptible to generalizations. Morin (2005, p.59-61) refers to this paradigm as disjunctive and simple-minded in the sense that it imposes *order*, avoiding *disorder*; contemplates the unique *or* the multiple; splits up what should be interconnected; and puts apart what is diverse, thus causing reduction.

Discussing the traditional view on knowledge, Morin (2005) claims an innovative paradigmatic framework which, according to him, results from the articulation of three epistemological principles: *complexity* (that denies reduction and stresses recursivity), *instability* (that refuses stability and emphasizes non-totality, non-completeness), and *intersubjectivity* (that rejects knowledge as a unilateral construct objectively perceived). The emerging paradigm – *the complex paradigm* – is focused on a more inclusive view on man: a non-divided being who takes part in knowledge construction by associating reason together with emotions, feelings and intuitions (Behrens & Oliari, 2007, p.61-63).

Etymologically, the word *complexus* — in opposition to its commonsensical meaning— regards *something that is interwoven together*, for “complex knowledge attempts to locate its object on the network where it is connected” (Morin, 2008b, p.190). Morin (2008b) explains that when we state something is complex, we in fact confess

... our incapacity to provide a simple, clear, and precise description or explanation. We feel that many diverse aspects, contradictory aspects are interconnected, but we are not able to perceive them. To us, everything is uncertainty and confusion and, the more we repeat “*this is complex*”, the less we are able to describe it and explain it – but we are not aware of this incapacity. In sum, the “*this is complex*” statement expresses our embarrassment, our inability to define it in a simple way, to clearly name something, to organize our ideas. The complex knowledge is an attempt to respond to this challenge. (p.189)

Furthermore, Morin (2008b, p.190) clarifies that *complex* is everything that cannot be reduced to a simple, clear explanation and much less to a simple law or principle. As he defines:

Complexity is effectively the texture of facts, actions, interactions, retroactions, resolutions, hazards, which constitute our phenomenological world. Then complexity displays itself in the disturbing traces of confusion, inextricability, disorder, ambiguity, uncertainty. (Morin, 2005, p.13)

The explanation provided so far reveals that complexity is more than an educational paradigm. It is a way of thinking, of being in the world, facing life, and dealing with daily situations. Complexity is a concept that should be understood not only rationally but also emotionally for, besides reason, it involves emotions, feelings, and intuition (as already mentioned); it refers to human beings in a physical, mental and spiritual sense; it involves the intricate systemic interconnection between the whole and its parts, disclosing that the whole is never completed, totality that is never achieved.

Morin (2005, p.72-77) presents three principles to clarify the complex thought. These principles are like *self-knowledge tools* that, according to Mariotti (2007), help us “think, reflect, account for the multiple aspects of the same reality” (p.139). The first one – the *dialogical principle* – establishes a confrontation between opposite concepts and emphasizes that if they are opponent, they are also simultaneously complementary. Morin (2005, p.64) affirms that complexity can be found where it is not possible to overcome a contradiction. As an illustration, the author mentions *order* and *disorder*, and states:

Order and disorder are two enemies: one suppresses the other but, at the same time, in certain occasions they cooperate and produce organization and complexity. The dialogical principle allows us to keep duality within unity. It associates together two terms which are complementary and opposite. (Morin, 2005, p.74)

The second principle – *recursivity* – emphasizes the circular, retroactive interconnection between cause and effect. This perception contradicts the linearity disseminated by the Cartesian-Newtonian paradigm, which defines a straightforward relationship through which a certain cause always generates the same effect. In opposition to this traditional idea, Morin (2005, p.77)

asserts that effect may go back to cause by *retroaction* and, due to that, the product may be also the producer. The author distinguishes cause and effect as two notions that are simultaneously correlated.

The third principle — *hologrammatical* — refers to the relationship between the whole and its parts, stressing that, just like in a hologram, each part reflects the whole as the whole reflects each part. Contradicting the Cartesian-Newtonian perspective, Morin (2005, 2008a) insists that the whole is more *and* less than the sum of its parts, at the same time, depending on its emerging *and* neglected qualities, respectively. This assumption leads us to *multidimensionality*, *non-completeness*, and *non-totality* as signs of a complex view on reality.

The complex paradigm echoes on education and brings this field fresh perspective. By following its features, a complex orientation demands an innovative view on knowledge construction that is non-linear, non-fragmented, and non-restricted to specific disciplinary areas. According to local circumstances, it may be interdisciplinary³ or transdisciplinary⁴ (Nicolescu, 1997), in the sense that fields of study may be juxtaposed or articulated to deepen or transcend knowledge boundaries and create new investigation spheres. By prioritizing non-disciplinary formats and, therefore, non-segmentation of knowledge, complexity-based courses create opportunities for (re-) connecting contents in various and unpredictable ways so that they may fulfill learners' needs and expectations as much as transcending specific boundaries to build knowledge that go beyond the limits of what is already known. Hence, a complex course demands a specific design direction in which knowledge construction acquires innovative textures, as discussed in the next section.

The Complex Educational Design – CED

Literature has exposed some orientation to course design and some guidelines to the creation of virtual learning environments. Currently, studies have dedicated special attention to *instructional design*, defined by Filatro (2008, p.25) as “the process of identifying a learning problem and designing, implementing, and evaluating a solution to that particular problem.” Among the suggestions presented, the most accepted pattern is known as the ADDIE model⁵, which, in didactic situations, comprises an initial stage called *conception* (including *analysis*, *design*, and *development*), followed by a stage named *execution* (subdivided into *implementation* and *evaluation*). By adapting the graphic representation provided by Filatro (2008, p.25), I present the following figure for such a model.

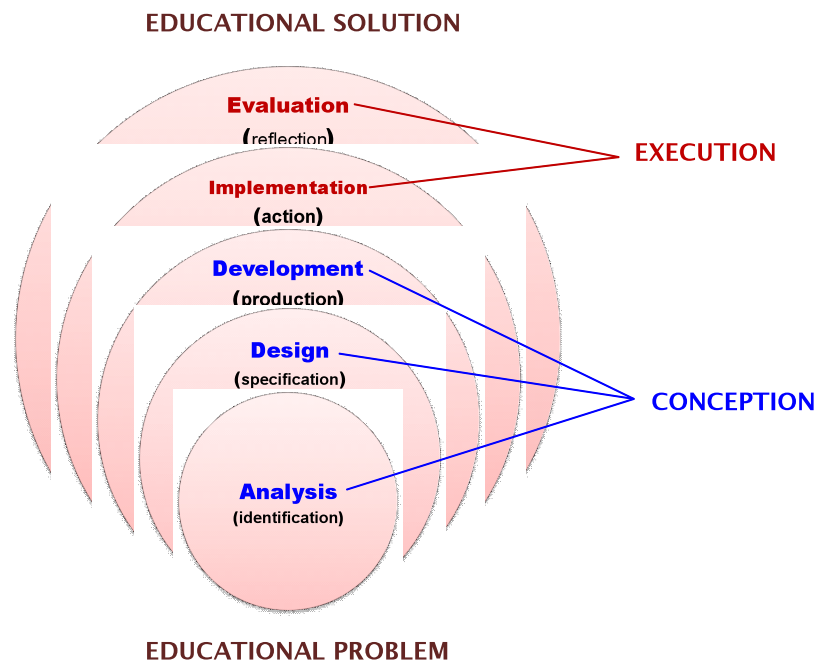


Figure 1. Phases of the classical ADDIE instructional design.

By commenting on the ADDIE pattern, the author not only remarks on its feature as a *fixed instructional design*, but also mentions its possibility to be modified to provide more or less strict orientations. According to her, an alternative suggestion is the *open instructional design* (Filatro, 2008, p.27) in which *design* and *development* are associated together in the *conception* stage, and *implementation* and *evaluation* are associated in the *execution* stage. This open design stresses the interaction among students and teacher, contemplates gradual contents presentation, and includes a faster and less detailed *conception* stage. Moreover, *evaluation* permeates the whole *execution* stage, and the students' production is perceived as contents. The *open instructional design*, however, excludes the *analysis* stage.

As an original contribution, Filatro (2007, 2008) proposes the *contextualized instructional design* in which the *conception* stage comprises *analysis*, *design*, and *development*, but the *execution* stage, although including *implementation* and *evaluation*, retrieves any feature of *conception*, if and when necessary, thus generating flexibility and contextualization to the design. The learning environment is structured according to specific learning units, independent activities are previously prepared, possible adaptations are predicted, and stages are built throughout the process.

In my opinion, the design alternatives suggested so far⁶ seem to be somehow unable to account for an open-ended syllabus, co-constructed according to students' interests, needs, and expectations. Furthermore, they do not seem to be flexible enough to promptly account for students' performance and reactions, as well as for moments of disagreement and disruption. These patterns do not to contemplate a certain level of unpredictability and uncertainty that naturally emerge from disorderly ordered – or orderly

disordered — contexts that are typical of complex environments, the ones usually found outside and beyond school walls.

These considerations lead me to reflect upon a set of guidelines that might interweave together educational purposes and complex thinking in such a rhizomatic way that could result in a purpose whose *educational* basis (and not *instructional*) could provide students with more enjoyable and concrete opportunities to construct transdisciplinary knowledge. In creating an innovative design model, instead of adapting a previous one, I would have a more tangible opportunity to shorten up the distance perceived between schools and society, as already mentioned. By deepening such reflections I came up with the *complex educational design* — CED — whose basis I start to detail.

The CED Components

The *complex educational design* is conceived of three staged intertwined components that attempt to primarily cope with the predictable steps of a language course design, keeping in mind that unpredictability remains in its surrounding area. The CED starting point is labeled *preparation* and covers from preliminary details and initial decisions of any sort to the very first draft of course contents. In this regard, the *preparation* stage of the CED comprises:

- identification of the students' needs, expectations, interests, preferences, profile, learning styles, previous experiences, and previous knowledge;
- identification of the teacher's⁸ needs, interests, expectations, preferences, profile, learning and teaching style, and previous experiences;
- accurate contextual information: the institution and its regulations, length of course, specific local/global characteristics, demands that may affect the teaching learning process, resources and technical support available;
- selection of the virtual learning environment to be adopted and of the technological tools to be used;
- identification of possible inter-/transdisciplinary associations;
- definition of general and specific objectives;
- selection of themes/topics (which provides the students with a learning situation) that may interest students and be adequate to introduce or develop specific linguistic contents and discourse genres;
- first draft of the general structure of the course, including the starting point, alternative intermediate paths, and ending points, as well as possible connections, reconnections, ruptures, and potential *order* and *disorder* situations;
- first draft of the linguistic content, tutorials, and materials to be used;
- first draft of complementary materials;

- first draft of possible development of the first theme/topic; and
- definition of an initial schedule that also contemplates strict and negotiable deadlines, possible interruptions and extensions.

The *preparation* stage constitutes, therefore, the initial step in which the teacher/designer⁷ establishes the basis and elaborates the backbone of the course to start negotiating it afterwards.

The second stage — *execution* — corresponds to the moment in which the course is inserted into the virtual environment selected and made available on the web; when it starts to be collaboratively developed by the teacher and students; and when it actually starts to be managed. Although this stage comes after *preparation*, both stages maintain a very close interconnection that induces the teacher/designer to go back and forth through these stages before making specific decisions or solving certain disruptions or unpredictable situations. The CED *execution* stage regards:

- implementation of the course on the courseware;
- introduction of the course to the students (including the virtual environment and its tools, objectives, class dynamics, and evaluation processes);
- negotiation of schedule, deadlines, work-related procedures;
- presentation of the first theme/topic (according to the *preparation* first draft), and beginning of an implicit/explicit negotiation of its development;
- reflection upon the students' reactions, comments, connections, inferences, clues on knowledge construction, as well as on their complaints, difficulties, absences, silence, and possible breakdowns revealed;
- continuous reflection on the themes/topics presented, considering their actual contribution to foreign language development; and
- persistent examination of the course, from both process and product point of view, in order to make decisions in terms of sequence of contents, theme/topic selection, and tasks/activities/materials/tutorials adequacy.

The last stage of the CED is labeled *reflection* and involves not only the assessment process that permeates the course but also the critical reflective thinking developed by the teacher/designer who wants to interpret this course, learn from this experience, and prepare him/herself for future complex courses. This stage is also connected to the preceding one for evaluation and reflection should be interwoven features, which are necessary to make decisions at the *execution* level. This stage then comprises:

- formative evaluation, undertaken by the teacher throughout the course;

- students' self-evaluation, undertaken throughout the course and, particularly, in the middle and at the end of it;
- teacher's critical reflection upon:
 - the starting point, development, and ending point of the course,
 - course nodes and interconnections,
 - *order* and *disorder* moments,
 - ways of connecting and reconnecting knowledge, and
 - knowledge effectively constructed;
- conspicuous transformations (in terms of learning, behavior, values, for instance); and
- aspects to be improved, developed, transformed.

Figure 2 synthesizes my conception of the *complex education design*, attempting to graphically represent its constructs, their meaning and interconnections:

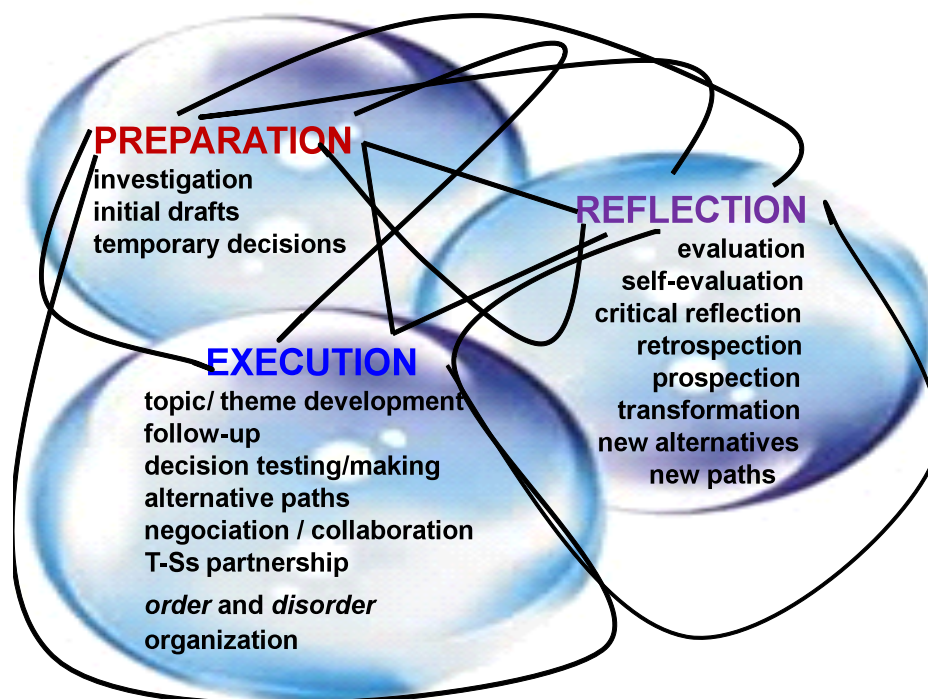


Figure 2. The complex educational design: constructs and meanings.

Although the CED comprises three constructs initially performed in a sequence, it is relevant to remind that they maintain an intense, recursive, circular, dialogic interconnection that is responsible for the creation of the course as a whole as well as of its subdivisions, its multiple parts. These parts, from the beginning to the end, are naturally orchestrated by the teacher/designer; however, as soon as the interaction starts, the command is shared and decisions are made collaboratively with the students who are also

important parts of the teaching learning process. A complex course is, therefore, a joint venture that associates teacher and students together in the construction of knowledge as summarized below:

Table 1

Some Features of a Complex Course

A Complex Course Based on the CED Pattern
<ul style="list-style-type: none"> • Goals and objectives are established according to the students’ needs, profiles, and expectations, but they also contemplate the teacher’s needs, profiles, and expectations. • Goals and objectives are reviewed throughout the course and some of them may be changed while others may be added. • Students’ previous knowledge is the starting point of the learning process. • Learning process is jointly controlled by teacher and students (they are <i>parts</i> of the same <i>whole</i>). • The digital learning environment is open and flexible, but deadlines, rules, and procedures are discussed and jointly defined in the beginning of the course. • Negotiation and self-expression are encouraged all the time. • Subject matter is organized in such a way that knowledge network may emerge from the sequence of themes/topics/learning situations: a <i>recursive</i> movement may always occur. • Themes/topics or real learning situations provide students with concrete reasons to interact and express opinions, to use the foreign language for genuine communicative purposes. • By providing students with various themes/topics/learning situations, it is possible to interweave information from various fields and generate opportunities to construct inter-/trans-disciplinary knowledge. • Knowledge (re-) connection (s) is (are) always encouraged for knowledge construction is non-linear and non-fragmented. • Assessment is undertaken continuously and according to different formats. • The sequence of contents is defined throughout the flow of action and interaction: each part is unique, although reflects the previous contents addressed (course as a <i>hologram</i>). • By having an open course design, ongoing adaptations on the model are allowed. • Conflicts, divergences, disruptions, and unpredictability are faced as normal parts of the course that naturally complement moments of calmness, order, and organization, establishing a <i>dialogue between opposite but complementary concepts</i>. • Foreign language is viewed as social practice and each participant of the course (students and teacher) as a citizen who perform a social role within the group.

CED: Some Reflections and Implications

This article made explicit that most part of Brazilian online English language courses seem to be attached to the traditional view of linear, fragmented knowledge construction and, due to that, they fulfill neither the students' nor the society's needs and expectations. In general, such courses are content-based and focused on non-contextualized linguistic structures. Grounded on the traditional paradigm, the course as a whole is perceived as the sum of their parts, this is, a set of units that addresses reading comprehension, grammar explanation and exercises to test the acquisition of specific language items. The technological apparatus (like animation, automatic responses, pop-up tutorials, sound effects, songs, and videos, among others) is used to reduce the structural appeal of the course and its focus on form.

As espoused in this article, the *complex educational design* is based on a complex view of reality and on a non-linear, non-fragmented perception of knowledge construction, which emerges from the texture of facts, actions, interactions, retroactions, resolutions, hazards, confusions, disorder, order, ambiguity, and uncertainty, as stated by Morin (2005, p.13). From such a complex perspective, an online language course design — although aiming at schematizing a series of learning situations and defining target teaching contents — needs to contemplate unpredictability and instability, which prevent it from having a pre-established fixed design. Instead, it should be based on an open syllabus, structured according to themes/topics which, selected by them, respond to students' interests, and through which linguistic items will be introduced and discussed. By taking advantage of technological resources (like animation, hypertexts, sound effects, songs, and videos, among others) to address real learning situations and provide students with concrete reasons to communicate and express their opinions, the course provides the students with opportunities to use the foreign language in spontaneous ways, perform social roles and develop themselves as citizens.

A contrast between a traditional and a complex online language course may be graphically represented by the following figures:

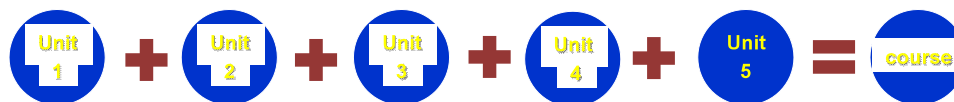


Figure 3. A traditional online course representation.

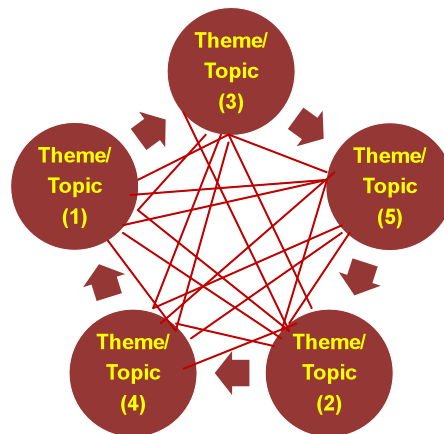


Figure 4. A complex online course representation.

The representation above suggests that a paradigmatic change requires much more than a diverse course organization. In fact, to adopt a complex view on knowledge building, it is essential to assume a complex way of living and facing life and, therefore, it is crucial to start thinking complexly in order to start teaching complexly. To some extent, it is necessary to be prepared to deal with moments of disorder and confusion and to admit that a response may not be clearly evident and ready to be provided at once as requested. It is essential to dare, to take risks, not to be afraid of working in partnership with students and recognize that interesting paths may be found in association because teachers and students are actually parts of the same whole. As far as language learning is concerned, it may be quite rewarding because it is possible to intertwine information from distinct areas and mediate thoughts and communication through a foreign language while teaching that particular language.

Nevertheless, a great challenge still remains to jeopardize a decision to dare introduce a complex course in Brazil (and in many other countries): how to implement a language course based on the CED pattern to be offered in an educational system still grounded on the traditional paradigm? The systemic incompatibilities would certainly make the implementation impracticable. For this reason, while the complex paradigm is emerging and gradually conquering more followers and complex thinkers, we have the continuing education segment to open up trial areas and spread out the paradigmatic novelty.

Considering the aspects discussed, I conclude this article by emphasizing that this innovative design orientation, demands teachers/designers to have consistent linguistic, pedagogic and technological background to deal with the challenges that complex environments present them, particularly if they want to elaborate creative complex online courses. The conceptual framework is presented and theoretically articulated; it is now open to be operationalized and interpreted in its potentiality.

Notes

1. I refer to a considerable part of the courses available on the web that, by not applying much personnel investment, are cheaper and more attractive to many uninformed students.
2. According to the commonsensical meaning, the term *complex* is more often associated to what is *difficult* and *intricate*.
3. An interdisciplinary approach regards the transfer of methods from one discipline to another (Nicolescu, 1997).
4. Transdisciplinarity indicates knowledge that is constructed *between* disciplines, *through* disciplines, and *beyond* all disciplines, at the same time. Its goal is the comprehension of the present world and one of the requirements for that is the reunion of knowledge (Nicolescu, 1997).
5. ADDIE stands for *analysis, design, development, implementation, and evaluation*.
6. My aim was not to thoroughly examine a series of different approaches to instructional design. In fact my intent here was to present the patterns that seem to be more frequently mentioned in the Brazilian context, and the ones that had somehow impacted on the conception of the CED model.
7. The use of the expression *teacher/designer* is intentional and indicates that in the contexts I am familiar with, the teacher is the one who performs both roles in online courses.
8. I would emphasize my deliberate purpose to also account for teacher's needs and expectations, as well as on his/her teaching style and preferences. From a complex point of view, I perceive teachers and students as parts of the same whole and, therefore, needs, expectations, preferences, styles, profiles and features of both of them should be involved and considered in the design of a course.

References

- Behrens, M. A., & Oliari, A. L. (2007). A evolução dos paradigmas na educação: do pensamento científico tradicional à complexidade (The evolution of paradigms in education: from the traditional scientific thought to complexity). *Diálogo Educacional*, 7(22), 53-66.
- Filatro, A. (2007). *Design instrucional contextualizado: Educação e tecnologia (Contextualized instructional design: Education and technology)*. São Paulo: Senac.
- Filatro, A. (2008). *Design Instrucional na prática (Instructional design in practice)*. São Paulo: Pearson Prentice Hall.
- Freire, M. M. (2009). Formação tecnológica de professores: problematizando, refletindo, buscando... (Teachers' technological educational: problematizing, reflecting, searching...) In U. Soto, & M. F. Mayrink (Eds.), *Linguagem, educação e virtualidade: Experiências e reflexões (Language, education, and virtuality: Experiences and reflections)* (pp. 13-28). São Paulo: Cultura Acadêmica.

- Keegan, D. (1996). *Foundations of distance education*. New York: Routledge Falmer.
- Mariotti, H. (2007). *Pensamento complexo: Suas aplicações à liderança, à aprendizagem e ao desenvolvimento sustentável (Complex thinking: Applications to leadership, to learning, and to sustainable development)*. São Paulo: Atlas S.A.
- Moore, M. (2007). *Handbook of distance education*. New York: Routledge.
- Moore, M., & Kearsley, G. (2005). *Distance education: A systems view of online learning*. California: Wadsworth CENGAGE Learning.
- Morin, E. (2008a). *Ciência com consciência (Science with consciousness)*. Rio de Janeiro: Bertrand do Brasil.
- Morin, E. (2005). *Introdução ao pensamento complexo (Introduction to complex thinking)*. Lisboa: Editora Sulina.
- Morin, E. (2008b). *Meu caminho (My way)*. Rio de Janeiro: Bertrand Brasil.
- Nicolescu, B. (1997). A evolução transdisciplinar a universidade: Condição para o desenvolvimento sustentável (The transdisciplinary evolution to university: Condition to the sustainable development). *Conferência no Congresso Internacional "A Responsabilidade da Universidade para com a Sociedade", International Association of University*. Bangkok: Chulalongkorn University. Retrieved from <http://basarab.nicolescu.perso.sfr.fr/ciret/bulletin/b12/b12c8por.htm>
- Nicolescu, B. (1999). *Manifesto da transdisciplinaridade (Manifesto of transdisciplinarity)*. São Paulo: Triom.
- Nonata, A. F. (2007). Paradigmas do conhecimento: Do moderno ao ecológico (Paradigms of knowledge: From modern to ecological). *Diálogo Educacional*, 7(22), 259-275.
- Silva, M. (2003). *Educação online: Teorias, práticas, legislação, formação corporativa (Online education: Theories, practices, laws, corporative education)*. São Paulo: Loyola.