

## Language Curriculum Development from a Complex Nonlinear System Perspective (Pembangunan Kurikulum Bahasa daripada Perspektif Sistem Nonlinear yang Kompleks)

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### ABSTRACT

*The present position paper aims to provide a renewed definition of curriculum development in general and English as a foreign language (EFL) curriculum development in particular. In so doing, it will not only re-conceptualize curriculum development as a multifaceted and dynamic process of interrelated components but also introduce a new direction for looking at curriculum renewal from the lens of complex system theory. To this end, the features of both curriculum development in the field of English language teaching and the features of complex nonlinear systems in physical sciences will be discussed in an attempt to apply the features of the latter to the development of a language curriculum. It has been argued that, as is the case with complex nonlinear systems, a language curriculum can also be considered a complex nonlinear system in which different components are at work and the interactions among them are unpredictable. Furthermore, it has been discussed that the success or failure of a language curriculum will depend not on each single component of the curriculum but is the product of the interrelationships and interactions among the various components. Therefore, the development of a language curriculum should not be considered a step-by-step linear process. Rather, it should be considered as the unpredictable product of the behavior of and interactions among a complex set of variables and factors functioning in a nonlinear complex way.*

*Keywords: Curriculum development; complex system theory; nonlinear; English language teaching curriculum*

### ABSTRAK

*Artikel ini bertujuan untuk memberi definisi secara umum tentang pembangunan kurikulum dan secara khusus bagi Bahasa Inggeris sebagai bahasa asing (EFL). Dengan berbuat demikian, ia bukan sahaja dapat mengkonseptualkan semula pembangunan kurikulum sebagai proses pelbagai bentuk dan dinamik yang saling berkaitan, tetapi juga memperkenalkan hala tuju bahasa dalam membuat pembaharuan kurikulum dari sudut teori sistem yang kompleks. Untuk tujuan ini, ciri pembangunan kurikulum dalam bidang pengajaran Bahasa Inggeris dan ciri sistem non-linear yang kompleks dalam sains fizikal akan dibincangkan dalam usaha untuk menggunakan kedua-dua ciri kurikulum tersebut kepada pembangunan kurikulum bahasa. Kedua-dua ciri kurikulum ini berpendapat bahawa seperti halnya dengan sistem non-linear yang kompleks, kurikulum bahasa juga boleh dianggap sebagai sistem non-linear yang kompleks di mana tempat kerja dan interaksi antara mereka mempunyai perbezaan yang tidak boleh dijangkakan. Selain itu, kejayaan atau kegagalan kurikulum bahasa tidak hanya bergantung kepada setiap komponen tunggal kurikulum, tetapi adalah hasil daripada saling hubungan dan interaksi antara pelbagai komponen. Oleh itu, pembangunan kurikulum bahasa tidak boleh dianggap satu proses linear langkah demi langkah. Sebaliknya, ia harus dianggap sebagai produk yang tidak dapat diramalkan daripada kelakuan dan interaksi antara satu set pemboleh ubah yang kompleks dan fungsi faktor-faktor non-linear dengan cara yang kompleks.*

*Kata kunci: Perkembangan kurikulum; teori kompleks sistem; non-linear; pengajaran kurikulum bahasa Inggeris*

### INTRODUCTION

Language teaching is a very complex and intriguing undertaking, and “replete with intricacies and complexities” as Ahmadian and Tavakoli (2011) put it. “A part of these complexities derives from the fact that this practice involves engaging in an ongoing process of *ad-hoc* decision-making” (ibid). A plethora of interrelated factors and variables are involved in the language teaching process. This has been reflected by Tudor (2003) where he comments:

Learners are not ‘simply’ learners any more than teachers are ‘simply’ teachers; teaching contexts,

too, differ from one another in a significant number of ways. We cannot therefore assume that the technology of language teaching will lead in a neat, deterministic manner to a predictable set of learning outcomes.

The long history of English language teaching bears witness to the fact that the question of how to teach language in the best way possible has attracted the attention of applied linguists and language teachers alike. The quest for best methods has been a preoccupation of teachers and other people engaged in second/foreign language teaching since the beginning of the twentieth century. Various techniques

and activities have been tried out and abandoned in the past one hundred years or so in pursuit of what Richards (2001) calls “the best method.” Richards continues to argue that “although methods are specifications for the processes of instruction in language teaching, that is, questions of *how*, they also make assumptions about *what* need to be taught, i.e. the content of instruction” [italics added] (ibid).

Therefore, the swinging pendulum of the methods tradition has aimed at finding the best answer to the question of ‘how can we teach language in the best and most successful and effective way?’ with reference to two key issues: the *how*, i.e. methodology and the *what*, i.e. content (i.e. teaching materials). The ‘*how*’ part of this two-layered distinction constitutes the concept of method in language teaching which is itself one of the components of a much broader and more comprehensive process which has come to known as ‘curriculum development’ which, as Richards (2001) proposes, began in the 1960s, while issues of syllabus design, he argues, emerged as a major factor in language teaching much earlier.

Thus, an accurate understanding of curriculum development as an inclusive concept and process in English as a second/foreign language (ESL/EFL) teaching and learning is essential. Also, an understanding of the premises of the complex system theory can broaden and add to our understanding of second language acquisition (SLA) research and practice. The need for looking at SLA from the lens of the complex system theory has been highlighted by Soleimani and Alavi (2013) where they point out:

It appears the time is ripe for SLA to follow the empirically based new trend in science and get divorced from absolutely Newtonian camp of causative reality and its reductionist positivistic linear tenets. Curriculum development is no exception.

This paper, therefore, has aimed at both redefining curriculum development as a multifaceted process and reorienting readers towards a new conceptualization of curriculum development from the perspective of the complex system theory. In other words, it is an attempt to foreground the emergent nature of curriculum development by highlighting the unpredictable interactions and interrelationships among its unpredictably varying components.

#### CURRICULUM DEVELOPMENT

But what exactly is meant by curriculum development? Richards and Schmidt (2002) define curriculum development as “the study and development of the goals, content, implementation, and evaluation of an educational system” (p.140). In language teaching curriculum design includes: “a) the study of the purposes for which a learner needs a language (needs analysis), b) the setting of objectives and the development of a syllabus, teaching methods and materials, and c) the evaluation of the effects

of these procedures on learners’ language ability” (ibid). According to Richards (2001),

curriculum development includes the processes that are used to determine the needs of a group of learners, to develop aims or objectives for a program to address those needs, to determine an appropriate syllabus, course structure, teaching methods and materials, and to carry out an evaluation of the language program that results from these processes.

Different authors have proposed models of curriculum development. A brief account of these models is needed for the purpose of our discussion.

#### MODELS AND APPROACHES TO CURRICULUM DEVELOPMENT AND THEIR COMMONALITIES

There is a considerable area of overlap and commonalities among different models of curriculum development in terms of the components they comprise. All models include needs analysis, goals and objectives, assessment and/or evaluation, methodology and/or format and presentation. However, there are also some areas of difference. For example, some models include principles while others don’t. The following are agreed-upon components included by almost all models of curriculum development: needs analysis, environment/context analysis, formulation of goals and objectives, content and methodology, and assessment and evaluation.

Nation and Macalister (2010) include eight components in their curriculum model as follows. First, there are the ‘principles’ by which they mean deciding on the most important principles which give the greatest support to learning. Second, they refer to environment analysis, which refers to a ranked list of environmental/contextual factors which affect curriculum development. The third component is needs analysis. By needs these authors mean a list of language needs of the learners as a result of considering their present level of proficiency as well as their future needs and wants. The fourth component is the specification of content and the sequencing of that content. The fifth component is the format and presentation. Sixth, there is monitoring and assessment. The seventh part is goals and the eighth component is evaluation. The three components of *content and sequencing, format and presentation, and monitoring and assessment* in this model represent the syllabus, while these three components together with all the others make up the curriculum. Content refers to “the language items, ideas, skills, and strategies that meet the goals of the course” (Nation & Macalister 2010). Presentation refers to “the use of suitable teaching techniques and procedures” (ibid: 9) through which the course is presented to learners. And format denotes the form in which the presentation takes place, i.e. whether all the lessons follow the same predictable sequence of presentation or not. Monitoring and assessment is that part of the curriculum which aims

at assessing how adequately the aims of the curriculum have been achieved. ‘Goals’ are placed at the center of the model, indicating the importance and centrality they are assumed to have in the process of language curriculum development and teaching. ‘Evaluation’ relates to the whole process of curriculum development, the major purpose of which is to assess the effectiveness of the curriculum and make the necessary changes in the curriculum for the sake of improvement and reaching the pre-specified goals and objectives.

As mentioned earlier, there exists a high degree of similarity and overlap among different models of curriculum development. Although different authors use differential terminology, they are, in essence, referring to the same or similar conceptual categories. For example, by the terms ‘beliefs’ and ‘principles,’ Graves (2000) and Nation and Macalister (2010) mean the same concept. The same relationship exists between other pairs of terminologies used in different models such as ‘*context and environment*,’ ‘*content and sequencing and organizing the course*,’ ‘*format and presentation and developing materials*,’ ‘*format and presentation and methodology*,’ ‘*needs analysis and learners’ present level of competence and reasons for studying English*,’ ‘*environment analysis and four components of Murdoch’s (1989) model such as resource limitations, socio-cultural factors, learner characteristics and aspects of target culture*.’

These commonalities have been discussed here to highlight the fact that there is considerable overlap among different models of curriculum development. Therefore, considering this degree of overlap, we are on safe ground to argue that the features of complex systems can be applied to all curriculum development models, even if not exactly to the same degree. The most noticeable area of commonality relates to the linear progression from one component to the next in the curriculum development process.

#### THE LINEARITY ASSUMPTION

Most approaches to curriculum development are premised on the assumption that all or most parts of the curriculum development model should be covered and accounted for in a step-by-step and linear fashion. That is, the needs analysis or environment analysis constitutes the starting point. Then, the curriculum developer goes on with the formulation of goals and objectives after which s/he proceeds to design a syllabus. And this process continues until all components of the curriculum design model have been taken into consideration. In general, there are three main approaches to the process of curriculum development (Nation & Macalister 2010).

They identify three approaches to ordering and sequencing the components of a model of curriculum design. First, considering that there is plenty of time, access to the intended learners, and information about the teaching-learning environment, and also that there are plenty of resources, Nation and Macalister (2010) refer to

what Tessmer and Wedman (1990) view as the “waterfall model.” In this approach, there is a linear progression from the first part of the curriculum model up to the last part. Each part will be thoroughly considered and planned for before the curriculum developer proceeds to deal with the next part. In other words, “the output of one stage becomes the input of the next” Nation and Macalister (2010). The assumption is that all parts should be planned and considered as completely as possible. Second, there is what Tessmer and Wedman (1990, cited in Nation & Macalister 2010) call “layers of necessity” model. Here again, the linearity assumption equally holds. That is, there is a step-by-step progression until all parts of the curriculum model have been taken into consideration. The only difference with the previous model is that the degree of thoroughness and detail is proportionate to the amount of time and resources available. That is, Tessmer and Wedman (1990) argue that in designing a curriculum we have to decide on “...a choice between various layers. Each layer is complete in terms of the parts covered, but it differs in the detail and thoroughness with which each of these parts of curriculum design are carried out” (ibid). The third approach is the ‘focused opportunistic’ approach. In this approach, as Nation and Macalister (2010) have argued, there is a “do-what-you-can-when-you-can” approach. That is, the choice of what component or components should be emphasized is determined by the requirements of the teaching situation. Instead of going through all parts of the curriculum model, “the format and presentation part of the curriculum design process is typically done first. Then, with each re-teaching of the course, one part of the curriculum design process is done thoroughly” (ibid).

It is clear from the above discussion that, at least in the first two approaches, the progression throughout the various components of the curriculum design model is step-by-step and linear. Now, it is time to evaluate current thinking about the curriculum development process from the perspective of the chaos-complexity theory and apply the principles of this theory to the process of developing and implementing a language curriculum in the ecosystem of English language teaching (ELT).

#### CHAOS-COMPLEXITY THEORY FEATURES OF COMPLEX NON-LINEAR SYSTEMS AND THEIR APPLICATION TO THE PROCESS OF DEVELOPING, IMPLEMENTING AND EVALUATING A LANGUAGE CURRICULUM

Unlike more traditional cause-effect scientific explanations of natural phenomena which took the form of deterministic accounts of the behavior of complex systems from a linear perspective, chaos-complexity science underscores the notions of unpredictability and non-linearity in the behavior of such systems (Larsen-Freeman 1997). In this part of the article, we will elaborate on the features of complex non-linear systems which will, then, be applied to the process of curriculum development in an attempt to propose a justification for the non-linearity and unpredictability

of the complex process of developing, implementing, and evaluating a language curriculum. Acknowledging the fact that human beings and human-related fields of endeavor and activities are complex and dynamic, and as Ahmadian and Tavakoli (2011) have argued, “human behavior constitutes a complex system,” we have adopted Larsen-Freeman’s (1997) characterization of the features of complex non-linear systems. She has characterized such systems by such features as “dynamic, complex, non-linear, chaotic, unpredictable, sensitive to initial conditions, open, self-organizing, feedback sensitive, adaptive, and having strange attractors which are fractal in shape.”

Following Larsen-Freeman, we discuss the features of complex systems in clusters below. Then, we apply them to the curriculum development process. But before that, Briggs & Peat’s (1989) general characterization of complex systems may prove effective in providing a general understanding at the outset:

Complex systems ... are ultimately unanalysable, irreducible into parts, because the parts are constantly being folded into each other by iterations and feedback. Therefore, it is an illusion to speak of isolating a single interaction between two particles and to claim that the interaction can go backward in time.

#### DYNAMIC, COMPLEX, NON-LINEAR

By ‘dynamic,’ Larsen-Freeman (1997) means that complex systems change with time. Gleick (1987) argues that ‘chaos is a science of process rather than state, of becoming rather than being.’ The reasons for calling such systems complex are twofold. First, they comprise a large number of components or agents (Davies 1988, cited in Larsen-Freeman 1997). Complex systems are often heterogeneous, being made up of both agents and elements (Larsen-Freeman & Cameron 2008). Second, the behavior of a complex system is more than the product of the behavior of its individual components. That is, the behavior of such systems emerges from the interaction of their different parts. It is not built into any one component (Cho 2009; Larsen-Freeman 1997; Larsen-Freeman & Cameron 2008a). To sum up, the fact that the interrelationships, interactions, and connections among the different components of a complex dynamic system behave in a nonlinear way accounts for the complexity of such systems (Larsen-Freeman & Cameron 2008b). Mason (2008), referring to the mutual interactions and interrelationships among the different parts of a complex system, maintains that “new properties and behaviors emerge that are not contained in the essence of the constituent elements, nor can be predicted from the knowledge of initial conditions” (p. 32). Complex systems are nonlinear in which the effect is disproportionate to the cause (Larsen-Freeman 1997). They are non-linear, in that “the relevant variables are not related one to another according to strict proportionality” (Keller 2008, cited in Gregg 2010)

So far, there seem to be a number of parallels between complex nonlinear systems and the curriculum development process in terms of such characteristics as dynamism, complexity, and non-linearity. Curriculum development is dynamic because every component of the curriculum development model is likely to be affected by and change with time. For example, the needs analysis should not be considered a fixed and predictable component in curriculum design because, throughout the implementation phase of the curriculum, completely new needs may emerge which had not been planned for a priori. Furthermore, the linearity assumption inherent in most curriculum models and approaches is not scientifically and logically grounded, especially with reference to the behavior of complex nonlinear systems. That is, no language curriculum developer and/or language teacher can exactly predict the real effects of the planning and deliberating of a particular component of the curriculum. For example, there is no proportionate correspondence between pre-specified objectives and learners’ learning gains. Each pre-specified objective or element of content will differentially influence the ultimate achievement of each individual learner as constrained by unpredictable mutual interactions among an unpredictable number of variables, e.g. learners’ background knowledge, motivation, teacher’s presentation and methodology, time allocation, etc.

Language curriculum development can be considered dynamic in still other respects. From the one hand, it is completely clear that learner inter-language development is a dynamic phenomenon. It is always subject to change and growth. From the other hand, language learners themselves as human beings are dynamic and continually change and develop both physically and more especially mentally and intellectually. Furthermore, the conditions of learning including learner-related, teacher-related and context-related conditions are always likely to change. As Ahmadian and Tavakoli (2011) argue,

One particular classroom at a particular point in time is not *qualitatively* identical to the ‘same’ classroom a week later, since, for example, learners’ cognitive status may change, teachers’ thoughts may alter, they are likely to learn something new, they might forget some information, and so forth” [italics in original].

Most importantly, however, all these variables interact in unpredictable ways further complicating the dynamism involved in language teaching and curriculum development.

Curriculum development is also a complex process because not only do several components comprise this process but also there are complex patterns of interaction among the various components of a curriculum model in a nonlinear and unpredictable way. For example, needs analysis influences goal setting which in turn affects formulation of objectives. The pre-specified objectives determine content which, by its very nature, influences

methodology. Content, methodology, and evaluation may render the initial needs analysis inadequate because new needs may incidentally arise and emerge during the implementation and evaluation of the curriculum or after the assessment of learner achievement. Therefore, the behavior of the complex process of curriculum development does not equal the product of the behavior of its individual components. Rather, it is equal to the interaction of all the components and their interrelationships and mutual effects.

The complexity of the curriculum development process is further strengthened and increased by other variables such as individual learner differences, learning itself, instability of inter-language, differential effects of instruction, etc. which themselves are complex variables.

The preceding characteristics render the process of curriculum development unpredictable and nonlinear. Each variable in the complex web of variables involved in curriculum development and its interaction with other variables is likely to add exponentially to the nonlinearity of the curriculum development configuration. One area where we can expect such nonlinearity to show up is in the mismatch between learning linguistic elements and the sequencing of those elements in the lessons. That is, we can never be certain that language learners learn phonological, lexical, morphological and grammatical features in exactly the same sequence that we have placed them in the syllabus. Learners are likely to intake and consequently internalize those features or elements in an order contrary to the sequence with which lessons have been ordered. This learner-determined order of acquisition may be accounted for with reference to developmental, psychological, methodological, and many other variables which might not have been controlled and likely to intervene in the implementation phase of the curriculum. This nonlinearity can also be applied to all other components of the curriculum development and implementation processes.

#### CHAOTIC, UNPREDICTABLE, SENSITIVE TO INITIAL CONDITIONS

The behavior of complex nonlinear systems is regular and orderly until a point which is the threshold of randomness is passed “that is the point of complete randomness that complex nonlinear systems enter into irregularly and unpredictably” (Larsen-Freeman 1997). According to Larsen-Freeman, “that randomness will occur is predictable, what is not is exactly when it will occur” (p. 144). She continues to elaborate on the unpredictability of the behavior of complex nonlinear systems, proposing that a major reason for such unpredictability is the sensitive dependence of complex systems on initial conditions: “Indeed the behavior of systems with different initial conditions, no matter how similar, diverges exponentially as time passes” (ibid). Or, as Gleick (1987) put it, “tiny

differences in input could quickly become overwhelming differences in output.” A phenomenon which best exemplifies this is known as ‘the butterfly effect,’ i.e. “the fluttering wing of a butterfly in the Amazonian forest can have a chain of reactions and inter-reactions that extend all the way to the path of a hurricane in Hawaii” (Brown 2007). Some researchers have attributed such unpredictability of complex systems to their openness (Ahmadian & Tavakoli 2011).

When applied to the domain of curriculum development, the unpredictable, irregular randomness into which complex systems enter can be recognized in the gap between what a curriculum developer or language teacher had planned prior to the implementation of the curriculum, i.e. planned syllabus, and what each learner came up with, i.e. what s/he perceived to be the goal of the course or what s/he actually learned which is his/her built-in syllabus (Corder 1967). The same argument can be applied to the needs analysis component of the curriculum development process. That is, the gap between what the curriculum developer perceives to be the learners’ needs for attending the course, i.e. perceived needs and what each learner herself or himself feels to be the needs, i.e. felt needs. That the needs will/may change throughout the implementation of the curriculum with new needs emerging is predictable. That is, one can predict that the curriculum implementation process will unpredictably enter a period of randomness because new needs will emerge, thus, necessitating new content and consequently new methodology and expectations of both teacher and learners. But, when such randomness will occur is not predictable because no one knows what initial conditions, e.g. learners’ consciousness being raised, their being motivated or even de-motivated, teacher’s behavior, etc. might influence the process of curriculum implementation and emergence of new needs.

The curriculum development and implementation are completely contingent rather than predictable processes because contrary to the commonplace assumption taken for granted by many authors and curriculum development models, it is extremely difficult, in reality, to proceed from one element of curriculum design to the next in a predictable linear way, as any moment in the curriculum implementation process, both from the beginning to end, and any decision thereof is unpredictably contingent upon an unpredictable number of variables and the interaction among those variables. Therefore, it would be naïve to think that curriculum development, implementation, and evaluation comprise a step-by-step linear process. Rather, there must always be room for flexibility and change in the face of unpredictability and novelty.

#### OPEN, SELF-ORGANIZING, FEEDBACK-SENSITIVE, ADAPTIVE

Complex nonlinear systems are believed to be open. That is, “they are open to new matter and energy infusion, and

increase in order and complexity by absorbing energy from the environment” (Larsen-Freeman 1997). This openness of complex nonlinear systems renders them self-organizing, a characteristic which “forces the system away from its initial chaos, and toward the many forms of order and complexity of which it is capable” (Churchland 1988). A very critical feature of complex systems is that they exhibit order after their initial chaos because they are feedback sensitive. This feedback sensitivity, Larsen-Freeman argues, can most readily be perceived in the field of biology. Briggs (1992, cited in Larsen-Freeman 1997) maintains that

Positive feedback kicks evolution forward. Meanwhile, negative feedback in evolution keeps mutation changes from spiraling out of control – the checking power of many negative feedback loops simply wipes out most mutations and keeps the design of the species stable for long periods of time.

It is due to this capacity to naturally select and self-organize that some scholars (e.g. Kauffman 1991) believe that complex systems in biology are adaptive. This co-adaptation is “the process in which a system adjusts itself in response to changes in its environment” (Larsen-Freeman & Cameron 2008b)

The features of openness, being self-organizing, feedback sensitivity, and adaptiveness or co-adaptation all connote the fact that complex nonlinear systems are flexible and subject to change rather than closed and predictable. In other words, the behavior and/or outcome of complex systems are not necessarily fixed and predictable from the configuration of initial conditions. It is true that complex systems are sensitive to initial conditions in the sense that differences in such initial conditions may result in exponentially different outcomes – and hence the unpredictability of complex systems. However, there are still other features of complex nonlinear systems such as dynamism, emergence, and interconnectedness of their co-adapting components which rule out the possibility for the effects and outcomes at different stages of operation to be much predictable. This is what Ahmadian and Tavakoli (2011) mean by “irreversibility” of complex systems (p. 124).

Upon reflection, these features, when applied to the components of curriculum development, should not only be evidently recognizable but also remind us of the important fact that because there are so many mutually interacting and co-adapting components in the development and implementation of a language curriculum, especially human factors, we should refrain from looking at the curriculum development process as the unalterably fixed product of a set of steps and components. In other words, we should always bear in mind that, as many scholars in the field of curriculum development have argued (Brown 1995; Graves 2000; Nation & Macalister 2010; Richards 2001; Weir & Roberts 1994), evaluation is an integral part of the whole curriculum development process since it is the nature of evaluation which suggests presupposing

the unpredictability, openness, and adaptiveness of the various parts of the curriculum. It consists of a series of feedback loops through which we trace the ongoing dynamic process of curriculum implementation not only to assess its effectiveness but also to feed back into each and every component and step for the sake of reaching the desired order, organization, and improvement. It is the means of providing the feedback to which the curriculum implementation process as a complex nonlinear system is highly sensitive. The curriculum development process is adaptive and can move from a state of disorder and unequilibrium toward a state of order and equilibrium, thanks to the feedback provided by evaluation procedures.

“Evaluation may be carried out as part of the process of program development in order to find out what is working well, and what is not, and what problems need to be addressed” (Richards 2001). Also, as Brown (1995) observes,

In the absence of evaluation, the elements [of the curriculum model] lack cohesion; if left in isolation, any one element may become pointless. In short, the heart of the systematic approach to language curriculum design is evaluation: the part of the model that includes, connects, and gives meaning to all the other elements.

Unless, as is the case with complex nonlinear systems, the curriculum design process is considered an ‘open adaptive’ system which will and should change for the better in response to the feedback provided through evaluation, the evaluation process itself will be pointless. It is this openness, feedback sensitivity, and adaptiveness of the curriculum development process that should deter us from looking at it from a deterministic, linear, step-by-step, and predictable perspective.

#### PEDAGOGICAL IMPLICATIONS

English language teachers as the practicing agents in the implementation phase of the curriculum can benefit from the insights provided by the application of chaos-complexity theory to the curriculum development process. This discussion can provide English language teachers with a peripheral vision to see a much wider range of contributing variables in their teaching practice than is usually the case. This can increase their sensitivity to the role of many previously-ignored factors and their interactions for the enhancement of their students’ learning and the effectiveness of their own teaching. It can also equip teachers with the understanding that no syllabus, method or methodology, and curriculum is exempt from ongoing critical analysis and evaluation. Then, they will develop the habit of always expecting unpredictability and being ready for solving emergent problems and dealing with new situations.

## CONCLUSION

The ELT ecosystem as encompassing an enormously various array of factors and variables which interrelate and interact with one another in a very sophisticated way can be considered an example of a complex nonlinear system. Therefore, ELT practitioners including curriculum developers, materials writers, teachers, and test developers all have to be cognizant of the fact that nothing in this profession is uni-directionally and uni-dimensionally predictable except the very fact that 'nothing is predictable.' That said, none of these agents is allowed to take a simplistic approach to his/her practice because, even under equal circumstances, a very trivial change in initial conditions is likely to trigger an unpredictable effect which, in and by itself, may change the whole direction which was initially specified, and thus necessitate completely new decisions to be made, for example, new decisions about needs, methodology, materials, objectives, testing, expectations, and many other elements of a language teaching program or curriculum. This is the gist of what we mean by the application of chaos-complexity theory to the field of ELT in general, and to curriculum development and implementation in particular.

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