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11th LUMEN International Scientific Conference Communicative Action & Transdisciplinarity in the Ethical Society | CATES 2018 | 23-24 November 2018 | Targoviste, Romania

Communicative Action & Transdisciplinarity in the Ethical Society

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https://doi.org/10.18662/lumproc.100

How to cite: Cristea, G., & Manole, I.-C. (2019). The Structure of Functioning of the Curricular Design Activity from the Perspective of Computer Science. In C. Ignătescu (ed.), *11th LUMEN International Scientific Conference Communicative Action & Transdisciplinarity in the Ethical Society | CATES 2018 | 23-24 November 2018 | Targoviste, Romania* (pp. 73-81). Iasi, Romania: LUMEN Proceedings. https://doi.org/10.18662/lumproc.100

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The Structure of Functioning of the Curricular Design Activity from the Perspective of Computer Science

Gabriela CRISTEA[1], Ionuţ-Constantin MANOLE[2]

Abstract

Our study analyzes an epistemological and practically interdisciplinary issue at the intersection line between curriculum theory and Computer Science. We will consider an ideal model of curricular design that can be computer-aided at system level and educational process. The general aim is to value the educational backgrounds of the curriculum, identified and developed at the level of education's endowments, by means of appropriate informational means: a) macrostructural, valid at the scale of the entire education system; b) microstructural, valid for the entire educational process. The specific objectives aim at the pedagogical and informatic analysis of the correlation between: a) the macrostructural finality of education and the curriculum project of the reform of education; b) microstructural finalities of instruction and curriculum projects promoted at all disciplines and levels of education. The fulfillment of these two specific objectives implies the capitalization of adequate informational means fixed normative and methodological at the level of fundamental concepts: data, information, database, algorithm, networks, external and internal feedback. At the level of the curriculum, the training must ensure: a) the deduction of the concrete objectives from the learning objectives of the unit, the chapter, etc. - validated by computer, by fixing the database; b) logical ordering of contents - computer-validated by the positive formative generated effects; c) permanent pedagogical correlation between objectives - basic contents - methods - evaluation, validated by using efficient algorithms under existing network conditions or created

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https://doi.org/10.18662/lumproc.100
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Selection and peer-review under responsibility of the Organizing Committee of the conference

especially by the teacher; d) continuous evaluation of the results achieved with the activity-regulating-self-regulation function - informatic validated in terms of external and internal feedback.

Keywords: *Curriculum theory; curriculum design; information; database; networks; feedback.*

1. Introduction

The pedagogical foundations of the curriculum are set at the level of the educational finality. They capitalize in the specific area of education sciences: a) historical (by referring to the concept of curriculum promoted in premodern, modern and postmodern/contemporary); b) philosophical (through the global, axiological, epistemological approach to the content of education / training); c) sociological (by reference to the concept of culture and general culture); d) psychological (by reference to the constructivist theories of learning) [6: 82-90].

On a computer-based basis, these foundations of the curriculum synthesize the general significance of the curriculum of a pedagogical project of a certain type, applicable at all levels of the system and of the educational process. They can be argued and validated by calling on a set of concepts and principles of informatics. Data (about certain topics) that turns into information through algorithms. Information is once of applicative value that can serve a purpose [14]. The concept of graph (especially oriented) leads to the emergence of networks. Networks create interaction structures. Within these structures appear oriented connections (see graphs) in streams. Flows carry information. From the informational point of view, we have the notion of variable. These variables carry the information in the system. Information is constantly changing, subject to "algorithms". The information can then be arranged in databases, another computer concept, emerging from the need to order the information and give it a purpose-oriented character [15]. Returning to the system, analyzing from the perspective of the cybernetics methodology this time, the variables entered into the positive or negative loops, the process of regulation / self-regulation creates the premises of transforming information into knowledge (which in the long run increases value utility).

2. Theoretical Background

The pedagogical foundations of the curriculum are identified and developed at the level of the education objectives that define the value

orientations established by the designers of education at all levels of the education system, at all levels and educational disciplines, related to all the general contents of education (moral, intellectual, professional, aesthetic , physical) and all general forms of education (formal, non-formal, informal).

The educational finality ensures the "pedagogical foundations of the curriculum, as a new model, superior, design, realization and development of activities aimed at forming the personality within the system and the educational process" [6: 91]. The curriculum as an ideal model of pedagogical design is built on two categories of pedagogical objectives: a) the macrostructural finesse (the ideal of education; the general aims of education) valid at the scale of the entire education system; b) the microstructural (general, specific, concrete) finalizations that are valid at the scale of the whole educational process, on steps and educational disciplines, operationalized at the level of the training activities (lessons, etc.) [4: 50-51]. In computer science, the pedagogical foundations of the curriculum synthesize the main directions of the designers of education and training activities, the long term (the ideal of education), the environment (general goals, general and specific objectives) and short (concrete/ operational objectives). They can be argued and validated by calling on a set of concepts and principles of informatics. They define the general regulatory requirements that are specifically involved at the level of ordering the Database Management System (DBMS). The database operates with data and data operations through algorithms. The conceptual model of Entity-Relationship [5: 5-11] works with the notion of entity and attributes (of which the entity is built).At this level they are defined as "principles of integrity" that include a set of rules to be observed in ordering the SGBD [1 p308]: 1) Domain Integrity Principle. This principle "sets domain constraints that specify restrictions on allowed attribute values." 2) The principle of integrity of domain entities (fixed by the basic concepts of data, algorithms, graphs). 3) The principle of referential integrity.1. Compliance with the three principles of integrity, provides the database management system, the total relational system quality [3].

3. Argument of the paper

Pedagogic and informatic analysis of praxiological impact of the macro-structural and micro-structural aims involves valorification of appropriate informatic means fixed epistemological in normative and methodological plan at level of fundamental concepts: data, information, databases, algorithms, graphs, networks, external and internal feedback.

At the level of the fundamental information technology concept, in the field of normative informatics we can emphasize the necessity of promoting and observing two principles: 1) The principle of ordering data according to the specifics of the data types (dictionary data, control data, filtered data etc.); 2) The principle of validation of any kind of data according to the specificity of the logic and epistemology of the informatics science. At the level of the fundamental information informatics concept, in the field of normative informatics, we can emphasize the necessity to promote and observe two principles: 1) The principle of the transformation of data into significant information / "significant data"; 2) The principle of information evolution in the context of its applications [10].

Reverse Connection Law [16]. This law normatively fixes the necessary interactions in any "feedback loop" existing in any cybernetic system." [16].

The Law of Negative Entropy [12]. This law regulates the necessary connection between the degree of organization of the information system - the accumulated information - the level of information entropy (which expresses the uncertainty in the system that must be known, evaluated and valorised in the positive sense) [12]. The macrostructural pedagogical finalizations are employed at the conceptual, normative and methodological level in the elaboration of the curricular curricular reform of the education system.At the level of macrostructural pedagogical finality we consider: a) the ideal of education "which defines the type or model of the human personality projected at the scale of the entire society, at a historical time determined on a cultural, economic, political, religious level, etc."; b) the general goals of education which "define the strategic development of the education system in accordance with the requirements of most general concentrated in the ideal education" that "determines the design of the general and specific objectives that will guide the development of school curriculum, the curriculum, the curricula and the textbooks" [6: 93-95].

4. Arguments to support the thesis

The reform of the education system can only be achieved at the level of a curriculum project that is based on the reconstruction of the macrostructural pedagogical objectives (the ideal of education and the general aims of education that value the elaboration of the new structure of the educational system and the elaboration of the new educational plan according to the objectives "curricular reform is implicitly a reform of the education system" achieved at the level of value orientation (through the

macrostructural and microstructural pedagogical objectives), structure (organization by levels and stages of education) and content (curriculum, school curricula, school textbooks) [6: 127-129].

In computer science, the correlation between the macrostructural pedagogical objectives and the reform of the education system (conceived at curricular level) can be argued and validated by the appeal to: a) the concept of information algorithms for search; b) 1) Axiom of data processing to transform them into meaningful information in an open context. 2) Axiom of fixing information at the basic data level. 3) The axiom of integrating network-level database information. c) principles of informatics: the principle of external complementarity. It expresses a normative imperative that must be fulfilled at the level of the interaction of a higher rank system (which includes the complete relationship loop) - a subsystem that includes an important component of the relationship loop. On a pedagogical plan this informatic principle can be capitalized at a lesson level, conceived as an integrated system of actions (organization, initial evaluation, teaching-learning-continuous evaluation, final evaluation) which also includes an important component, the continuous external evaluation, with the potential to to become a continuous self-evaluation, with a self-regulating self-regulation function of perfection / self-perfection as a complete relationship loop [9].

The principle of binarity. It expresses a normative imperative that must be fulfilled when a computer system can act at a closed system level, necessary within certain determined value limits and an open system, necessary for initiating some changes required by the logic for the activity. computer science can be exploited in the space and time of the binary design of the curriculum project as a "closed system" determined by the stability of the objectives and of the basic contents and as an "open system", conditioned by the flexibility of the didactic methods, the evaluation techniques, organizing training, adaptable to existing, created situations, etc. [15].

In the curriculum design of the training, informatic argumentation [11] and validation can be done at the level of the construction of the curriculum [8], the curricula and the textbooks and lessons, as a main form of organizing the educational process. In all four situations it is necessary to pedagogically process the data that make up primary informational pedagogical resources (primary data, pedagogically unprocessed) at the disposal of the designers ("curriculum designers"), realizable on the following computer circuit: Selection of the essential data from the perspective of their pedagogical value potential (optimal training and development of pupils' personality, in relation to the psychological and

school age and the particularities of the educational discipline). In the process of selection, the concepts of information (data, information, algorithms, databases, networks, feedback) are used: 1) Axiom of data processing to transform them into meaningful information in an open context. 2) Axiom of fixing information at the basic data level. 3) The axiom of integrating network-level database information. [1]. Transforming the selected data into information with the value of essential informational pedagogical resources, set at the level of: a) educational discipline (in the curriculum); b) knowledge and skills (included in the compulsory curriculum for teachers, translated into the school manual designed as an effective learning / self-learning tool); c) curriculum design of the lesson, etc. (which includes: concrete objectives-content-methods-evaluation, context of realization: organizational forms, human and didactic-material resources, managerial styles). This informatic transformation involves the capitalization of some computer-validated design algorithms. Planning algorithm - used in an operating system to give process and data streams access to system resources (processor / processing time, bandwidth for communications) "to" balance the system and reach a level high quality of service offered "; a) The sorting algorithm - "used in mathematics and computer science, responsible for placing the elements of a list in a specified order (usually numerical or lexicographic)" done by "sorting by comparison, by quick selection, by insertion, by interclassing" etc.; b) lossless compression algorithm - used to reduce the information / data representation space with implications at the archive level (in computer sense) [1: 24-26].

In the normative framework, we can capitalize on the following laws and principles of informatics: 2) Curriculum planning of the training activity (lesson, etc.) involves: a) "representing an algorithm" of the activity planning that always includes the general purpose - the concrete (operational) objectives - the basic contents / knowledge (the "database") - the didactic methods - the evaluation techniques [10]; b) permanent reporting of the "database" to "a source code" [1]. General purpose of activity, expressed in "programming language" [13] (Didactic message) accessible to students to obtain "a final product" [6]. Confirming that the concrete objectives have been met; c) providing a permanent inverse connection between the "planning algorithm" [13] and the "programming language" (didactic message) curriculum of planning, (centered on the general purpose) and hardware (the material support of planning by means of increasingly technically improved teaching methods).

Integration of essential information (the educational subject, the curriculum, the knowledge, skills and skills of the curriculum, translated from the pupil's perspective in the school manual, the concrete objectives-

the contents-the methods-the evaluation, the organizational forms, the managerial styles- of the lesson) in the database: a) curricular areas (at the level of education); b) Objectives / competencies - stable, achievable content through assessment methods and organizational and managerial styles - flexible, adaptable in an open context (at the curriculum and school curriculum and lesson project, etc.). This computer integration requires the capitalization of some graphs that confirm in a computer plan the nodes and the edges existing between the essential information with a positive formative pedagogical value fixed at the database level, usable in the short, medium and long term: oriented graphs whose component nodes enter positive feedback structures alongside the edges (connections between them) [1]. Normally, we can capitalize on the following laws and principles of computer science. At the level of the fundamental concept of Graphics, in the field of normative informatics, we can emphasize the necessity of promoting and observing two principles: 1) The principle of representing a problem at the level of its theoretical and practical peaks; 2) The principle of using special charts for validating the "data structure" at the database level [14]; 3) The expert system - "contains a basis of facts containing the set of knowledge available in the considered domain (in which we refer, applications, etc.), a basis of rules that recalculates logical relations and general deduction rules and an inference engine, respectively of the computer science that selects and links the rules and facts. The user is in touch with the expert system due to a dialogue module [2]. Within the framework of pedagogy, "at work level" the computer system is usable, largely at the level of the training methodology involving the selection of didactic materials and educational software, integrable in didactic activity, formally organized (lesson, etc.) and nonformal (specialized circles, individual and group consultations, etc.). The exploitation system extends the scope of applications to more specific activities - educational, didactic, formal, non-formal, operational research, school and professional guidance, career counselling, etc. in the perspective of their permanent improvement in an open context, in the school environment, but also in the local, territorial, national, global.

5. Conclusions

At the level of the curriculum project of the lesson [6 p178-180], the database is distributed and rationalized on a computer circuit that sets in terms of algorithms and graphs: 1) Deduction of concrete objectives from the learning objectives of the unit, the chapter, etc. - Informatically validated

by setting up the database required in any lesson under previous lesson assessment conditions - Continuous teaching-learning-evaluation of new content, understood, sense-final assessment, in reflection / self-reflection in the spirit of pedagogy constructivist [7]. 2) Logical content ordering - Informatically validated through positive formative effects generated in relation to the competencies concerned defined by the objectives specific to the chapter or unit of learning, in the medium term 3) Permanent pedagogical correlation between objectives - basic contents - methods - evaluation, computer validated by using efficient algorithms under existing network conditions or created especially by the teacher; 4) Continuous evaluation of the results obtained with a function of regulation-self-regulation of the activity - computer-validated in terms of external and internal feedback, treated and capitalized on the basic concept of informatics and the basic principle of informatics valid in any socio-human activity , expressed pedagogically by the principle of continuous evaluation (imposed in the normative plan by the curriculum design paradigm).

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