Educational Efficiency by Gradual Performances

Vasile Postolica 1 | Costica Lupu

1 Romanian Academy of Scientists, “Vasile Alecsandri” University of Bacău, Faculty of Sciences, Department of Mathematics, Informatics and Educational Sciences, Bacău, Romania.
2 “Vasile Alecsandri” University of Bacău, Faculty of Science, Department of Mathematics, Informatics and Educational Sciences, Romania.

ABSTRACT

The general education systems, in particular, the education technologies cannot be described without a penetrative study of its research, economic, political and social context. A universe of components like objects, persons, events, dynamical phenomena and many other strong relations between them has to be taken into account to carry out such a study as this. These form a complex system usually referred to as the Education System (ES). It is important to examine the details concerning the education system now. But, it is more important to know it, having in view, especially, its future projections, for which the mathematical modelling is essential. Therefore, the research on ES modelling methodology can provide clues to foresight and planning of future development of the corresponding information technologies in ES (ITE) and their applications areas as follows in the next two causal graphs.

2. Premises and their immediate consequences

Following [1] – [4], we specify the main objectives of our investigations.

2.1. Developing a mathematical model concerning the learning interdependencies performance defined as:

A. Learning is the operational capacity of a person to:
- consciously assimilate concepts, information, knowledge;
- create skills and abilities (both cognitive and motric);
- develop skills and competencies;
- adapt his/her attitude and behaviour to the environment, or social context.

B. Competency is characterized by the ability of the person to solve issues / theoretical and practical situations or tasks/requirements related to a field (scientific, social, technical, medical, educational, etc. – efficient acting); keeping it brief, “knowing to do”.

C. Performance is characterized by the average and high levels of professional achievement, thus by the actual results marked at highest levels, above the average of the subject group. Hence, a psycho-social model of the performance essentially trains/engages.

D. Determining / identifying the internal and external factors of the learning process and, respectively, of education (be it formal, informal or non-formal);
- the optimal creation of learning circumstances that will involve the psycho – physical resources of the person and that will favour, stimulate and develop abilities.

KEYWORDS: Science education, Efficiency, Gradual performance, Risk.

1. Introduction

The general education systems, in particular, the education technologies cannot be described without an in-depth study of its research, economic, political and social context. A universe of components like objects, persons, events, dynamical phenomena and strong relations between them has to be taken into account to carry out such a study as this. These form a complex system, usually referred to as the Education System (ES). It is important to examine the details concerning the education system now. But, it is more important to know it, having in view, especially, its future projections, for which the mathematical modelling is essential. Therefore, the research on ES modelling methodology can provide clues to foresight and planning of future development of the corresponding information technologies in ES (ITE) and their applications areas as follows in the next two causal graphs.

2.2. Concrete validation of the model to show its efficiency through logical reasoning and psycho-pedagogical experimentation.

3. The basis of the mathematical model

Each component (quality) marked by \( c_i \), and, respectively, incompetence / inability (defect) marked by \( d \) (quantifications that can be made by various sortings, attachments of numerical values following psycho-pedagogical criteria, etc.) receives a “index” (“ratio”) of “importance” \( a_i \) and, respectively, \( b \), \( n, m \in \mathbb{N}^* \) obtained from the performance assessment and including the risks [6]. Let \( E \rightarrow F(t) \) be the competences set, and let \( F \rightarrow E(t) \) be the incompetences set at \( t \in T \). \( F \rightarrow E \rightarrow R \) moment, defined by \( F(t) = \sum_{n \in \mathbb{N}} a_i F_i; E \rightarrow R \) resulting following \( F_1 = \sum_{n \in \mathbb{N}} b_i d_i \). From our mathematical point of view, the gradual performances in means solving the elements of the system at moment \( t \):

\[
\max_{n \in \mathbb{N}} F_i(t)
\]

Equivalent to each of the next optimization problems:

\[
(P_1) \max \{ F_i(t) : t \in T, F_i(t) \geq F_i(t^*) \}
\]

and, respectively,

\[
(P_2) \min \{ F_i(t) : t \in T, F_i(t) \leq F_i(t^*) \}
\]

where \( t, t^* \in T \) are minimum and maximum performance moments, respectively, with a proper synchronization between the solutions of the above mentioned problems. The model’s complete and, obviously, more complex version is obtained for \( \alpha = a_i(t), c_i = c_i(t), \beta = \beta(t), d_i = d_i(t), \gamma = \gamma \). In terms of the general efficiency in the ordered vector spaces [5] this means that

\[
Eff(A, R) \rightarrow Max(A, R), \gamma \leq \gamma
\]

where for maximum performance or, equivalently, \( A = (F(t) - F(t)) \) looking for maximum performance or, equivalently, \( A = (F(t) - F(t)) \) for minimum, respectively, with \( \alpha = Max(A, R), \gamma \leq \gamma \).

Following our opinion, the hierarchical, strategical and geometrical relations
description for the performance in the education are as follows [4]:

4. Some conclusions and future projects

Our proposal represents a new mathematical way to tackle the gradual performance in the education systems, that is, following the educational efficiency step by step, in order to construct and obtain the educational efficiency on the whole. The general applications of the model in determining the competencies of the science education and its immediate implementations will be presented and developed later on.