FERENC MEZŐ

LEARNING DIAGNOSTIC AND DEVELOPMENTAL ASPECTS OF THE IPOO-MODEL

In our days, we can observe an increasing interest in development and diagnostics in Hungary. The manifestations of this interest are:

a) the numerous requests of the schools, education institutions and organizations, teachers, parents and students for the learning researchers that they show and teach effective learning methods to teachers and pupils/students. In Hungary we organise trainings for learners (from elementary school to university) and for teachers and parents.
b) the increasing number of books on learning development may be significant, because the law of supply and demand shapes bookselling.
c) learning development is a compulsory or elective course in several Hungarian universities and colleges of teachers education.

An important and necessary component of learning development is learning diagnostic. It helps to identify and measure learning problems, the goals of development and the effectiveness of development.

In the past few years, we have worked out a new and useable learning model for effective diagnostic and developmental work. Let us call it briefly the IPOO-model.

The aim of the present study is to demonstrate how we can work with the IPOO-model in learning diagnostic and development. This study consists of three parts. First, we have to define some basic concepts. In the second part, we present the IPOO-model of learning. Finally, we give some examples of using the IPOO-model.

Basic concepts

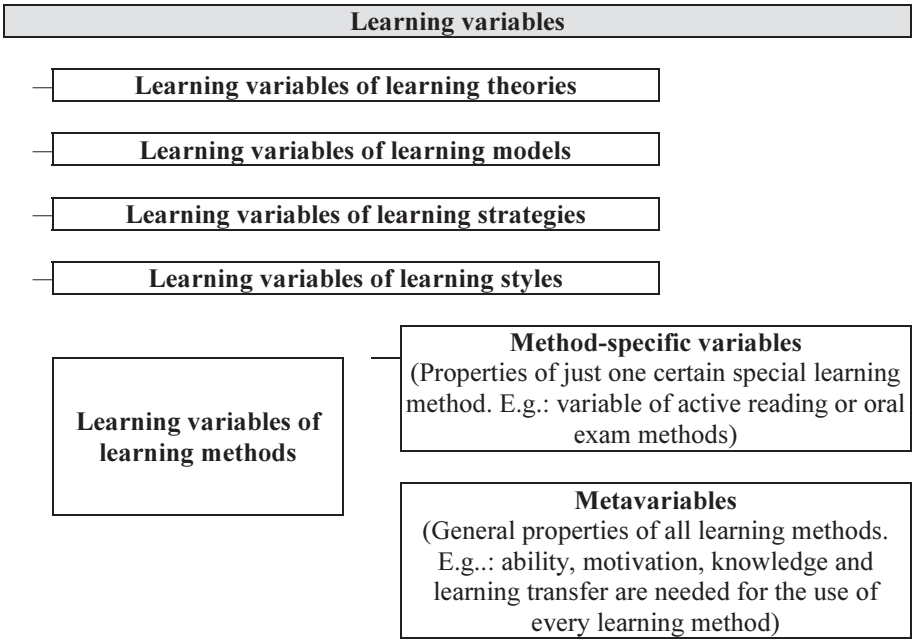
Below we will describe the concepts of the learning variable, learning diagnostic, learning development and learning ideal.

Learning variable: It is a sort of property of learning. It is a simple statistical (nominal, ordinal or quantitative) variable with two or more different values. For example, the ’Time of Learning’ ordinal variable has three different values: ’too much’, ’enough’ or ’not enough’. If this variable

is a quantitative variable, we can measure the seconds, minutes or hours of the learning. Learning developers have to choose and determine the applied learning variable and its type of statistical scale and values for learning diagnostic and development.

A great many multitudinous learning variables have been described. Figure 1 shows a simple grouping of these. The first group of Figure 1 shows the variables of learning theories. These theories – e.g., the theory of classical conditioning (Pavlov, 1927) and operant conditioning (Skinner, 1974), etc. – try to describe the general process and acts of learning. Their learning variables, among others, are the following: stimulus, response, duration of conditioning, reinforcement, schedules of reinforcement, etc.

Figure 1: Principal groups of learning variables (Mező and Mező, 2005: 11)



Another group is the variables of the learning models. These try to describe and predict school learning. For example, Carroll's model uses the following learning variables: learning efficacy = duration of learning / necessary learning-time (Carroll, 1963).

Learning strategies are patterns of information processing activities (Das, 1988). A learning strategy is the battery of some special learning actions. (The term 'strategy' was originally a military term that referred to procedures for implementing the plan of a large-scale military operation –

Schmeck, 1988: 5.) For example, Claire Weinstein (1988) describes five different strategies. These are: rehearsal, elaboration, organizational, comprehension monitoring, affective strategies.

According to Schmeck, "if ever we observe that an individual has an inclination to use the same strategy in varied situations, we can suspect the presence of a style" (Schmeck, 1988: 7-8). Learning styles try to describe the bio-psychological, cognitive and motivational properties of learning and/or the learners. As Katona and Oakland (1999) write, we can find three groups of theories of learning styles: 1) the basis of some theory is the biological differences (e.g., dominance of the left or right brain hemisphere – Torrance and Rockstein, 1988); 2) the basis of other theories is the differences of the cognitive styles (e.g., Witkin's 'field-dependent' and 'field-independent' styles or Pask's 'holist' and 'serialist' styles or Marton's 'holistic' versus 'atomistic' styles, etc. – see Schmeck, 1988); 3) some theories build on the motivational differences (e.g., 'Hope for Succes' or 'Fear of Failure').

The last group of the learning variables concentrated on learning methods. We can distinguish two types of these variables (Mező and mező, 2005): method specific variables and metavariables. Method specific variables can be used in just one special learning method (e.g., variable of the active reading or the oral exam methods). Metavariables are useable with all learning methods. For example, every learning method needs a sort of ability, motivation, knowledge and learning transfer.

Direct learning development and diagnostic aim at the development of the variables of the learning methods, the last group of the learning variables (the 'indirect' learning development objectives are the learning abilities – Balogh et al., 2001).

Learning diagnostic: measurement of the value of a learning variable with psychological and/or pedagogical methods (for example: observation, experiment, interview, content analysis, questionnaire, test).

Learning development: adjustment of the ideal value (the 'learning ideal') of a learning variable. Figure 2 shows the relationship between learning diagnostic and development. The objective of the 'pre test' is to determine the kind of learning problems. The objective of learning development is to put an end to the learning problem. The objective of the 'post test' is to control the effect of the learning development.

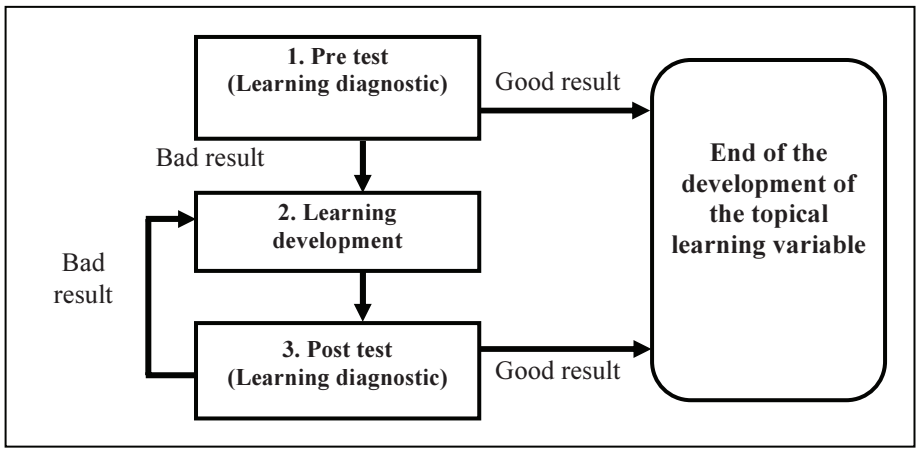


Figure 2: The relationship of learning diagnostic and development (Mező and Mező, 2005: 8)

Learning ideal: a special value of a learning variable, which is the goal of the learning development. The developers determine the ideal value of a learning variable. We can see that determining the ideal value of a learning variable is considerably subjective.

The IPOO-model of learning

According to the IPOO-model (Mező, 2002, 2004), school learning is an information processing procedure, and it has four components:

- Input (I): from selecting the theme to effective reading techniques.
- Process (P): from mnemotechniques to the holist system of knowledge.
- Output (O): from oral or written presentation to everyday skills.
- Organising (O): organising of learning (time, place, money, systematically, legalisation of knowledge, etc.)

Every phase is built on the basis of special abilities, motivations, methods. These phases are in a special connection with each other:

LEARNING = (INPUT + PROCESS + OUTPUT) * ORGANISING

In this formula, the plus sign (+) adverts that the value of the input, process or output component (as learning variable) may be zero. For example: if somebody learns some foreign words (so input is given), but she

or he never uses those (has no output; in other words: the value of the 'output' variable is zero), we will talk about learning (without output).

The symbol of multiplication (*) adverts that if any of the values of the factors of the multiplication is zero, then the result (of the learning) will be zero. For example, learning without organising is impossible. Somebody (e.g.: a teacher, the school or the autodidact learner) has to organise the learning. Therefore, we have to develop the organising competences, skills and knowledge to develop the autodidact learners. At the same time, schools will waste their labour on learning (organising) development, if they do not develop the input, process and output competences of the learners.

According to the IPOO-model, we can differentiate three information processing possibilities: the learning may be deficitive, reproductive and productive as determined by the aspects of the relationship of the inputs and outputs.

Deficitive learning: input > output. If the input is more than the output, the learning will be ineffective. For example: a poem has four verses (as input), but the learner can reproduce (as output) less than four verses. The most important characteristic of learning of this kind is information deficit.

Reproductive learning: input = output. If the input is equal to the output, learning will be reproductive without adequate processing. It is often very much. For example: a poem has four verses (as input), and the learner can recite (as output) all of the four verses, but she/he does not understand the words, the verses, the poem, the metaphors of the poem, etc. The learner tries to memorise the lesson word for word, but the learner does not dope the lesson out.

Productive learning: input < output! If the input is less than the output, learning will be meaningful, holistic and creative. For example: a poem has four verses (as input), and the learner (at the moments of output) can recite all of the four verses and she/he understands the poem, and she/he searches the nexus between the new lesson and his/her earlier knowledge. The result is productive, creative learning. This learning is the most important developmental goal together with the learning ideal by the IPOO-model.

The differential diagnostic of reproductive and productive learning can be realized by a confused text (as input). If the oral or written output is exactly the same as the input text, the learning will be reproductive. If the output is not confused, the learning will be productive. The text for the diagnostic of the deficitive learning may be any factual (confused or non-confused) text.

Learning problems can be seen from the aspect of the IPOO-model:

LEARNING = (INPUT + PROCESS + OUTPUT) * ORGANISING
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Some typical problems of the input phase are: 1) 'What will be the topic of the learning?' 2) 'Where can I find information about my learning topic?'; 3) 'How can I use the authorities effectively?' Some process-problems are: 1) 'I don't understand the text, the lesson!'; 2) 'I have to learn too much. I can't memorize everything…'; Output problems are, for example: 1) I hate oral exams; 2) How can I write my dissertation? Finally, let us consider three classical problems of the organising phase: the time, the place and the cost of learning. All of these problems can be revealed by observation, experiment, interview, content analysis, questionnaire and/or test. The general goal of learning development is to improve these phases, and to give effective problem solving methods to the learners.

Working with the IPOO-model

How can we use the IPOO-model in learning diagnostic and development? Figure 3 shows an example. It shows a possible algorithm of the learning of textual information. Above all, we have to teach this algorithm to the learners (Step 0). Steps 1-9 show different actions and competences for productive learning. We can analyse all of the steps of Figure 3 by learning diagnostic.

What can we think about the holistic system of knowledge? On one occasion a student had to take an exam in the 'Fish'-theme in biology and the 'Upthrust'-theme in physics. Both oral exams were successful. The student's knowledge was high-class, wasn't it? Later a teacher asked this student: 'What is the relationship between the functioning of a swim-bladder of a fish and upthrust?' The student's answer was: 'I don't know. Neither biology nor physics book wrote about it.' Is this student's knowledge high-class? Or: what kind of processing level does the student have? If we have a look at the grouping of holistic information processing levels below (Figure 4), we will see that this student did not have 'Level 5'-processing.

Figure 3: The learning strategy of textual information according to the phases of the IPOO-model (Mező and Mező, 2005: 68)

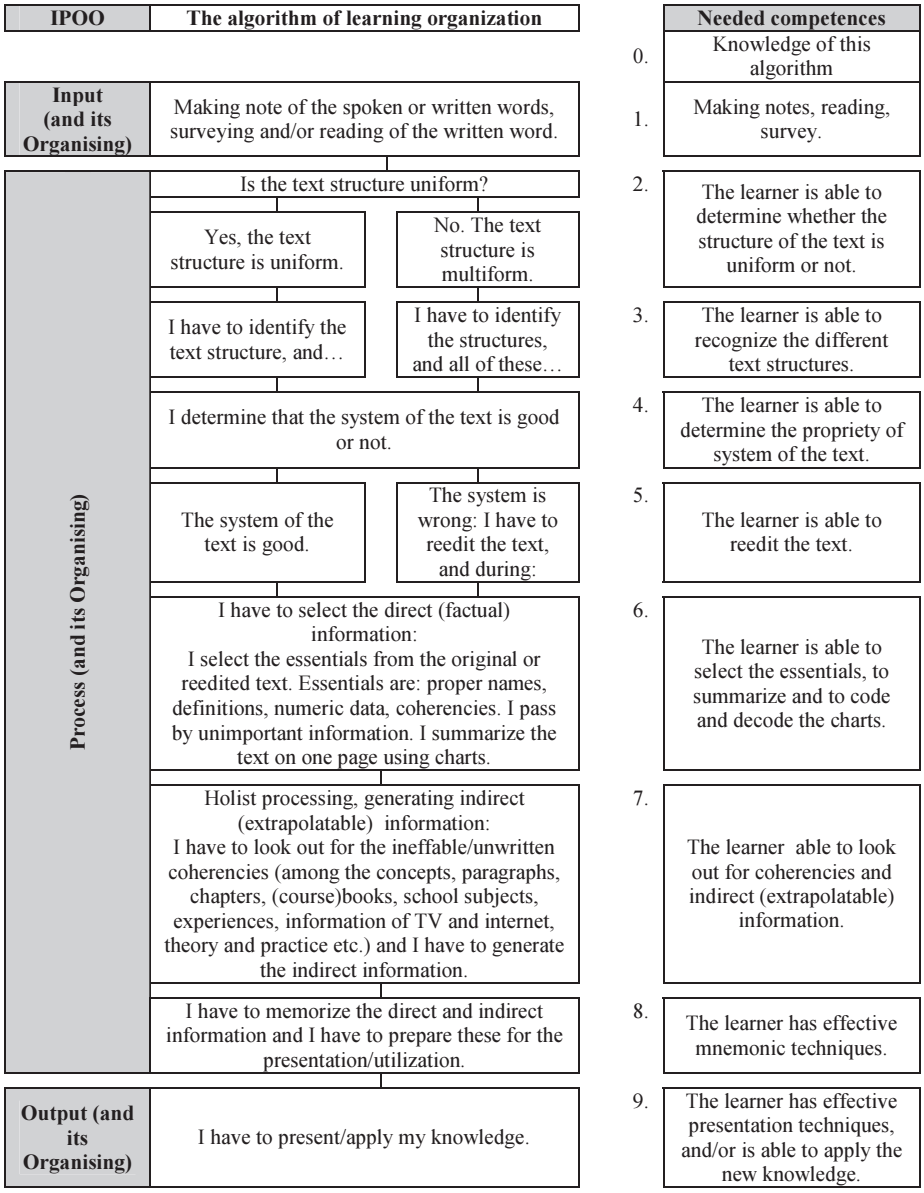
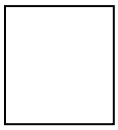
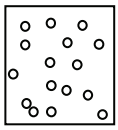


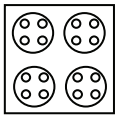
Figure 4: Organising the information from the 'no knowledge' level, across the 'atomic'-level to intersubject holistic information processing (Mező and Mező, 2005: 95)



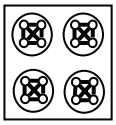
Level 0: no knowledge.
For example: a pupil knows nothing about the 'Fish'.
(The square represents a subject, e.g.: biology)



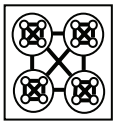
Level 1: *some atomistic information.*
The pupil has segregated information about some theme (e.g. 'Fish'), but s/he can't group the information.
(The little circles represent some information)



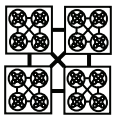
Level 2: simple grouping of information.
At level two the pupil doesn't understand the nexus among the concepts (as little circles) of a chapter (big circles) of a biology coursebook (the square), but s/he has already grouped the information.



Level 3: *holistical processing of two or more different items of information of a chapter of a subject.*
For example: the pupil can find the relationships (represented as lines) between the words of a chapter of a biology coursebook.



Level 4: holistic processing of two or more chapters of a subject.
At this level the pupil can find the relationship between two or more chapters of the biology coursebook (e.g.: chapter on the 'swim-bladder of a fish' and chapter on the 'life of fish).



Level 5: holistic processing of two or more subjects.
For example: at this level the pupil can find the relationship between biology ('swim-bladder of a fish') and physics ('upthrust') and other subjects (the squares represent different subjects).

The role of some metavariables is very serious for successful development. These are: ability of using a particular method, motivation for using the method, knowledge of the method and transfer of using the

method. Possible values and investigations of these metavariables (using a simple three-grade ordinal scale):

Values of the ’Ablitiy of method usage metavariable are:

2 = the learner’s intellectual abilities are sufficient for using the method (it is the learning ideal)

1 = the learner’s intellectual abilities may be sufficient for using the method

0 = the intellectual abilities are insufficient

Investigation: intelligence test, estimation of intelligence, or: if method usage is successful, the learner will have sufficient abilities. In general, only one testing or estimating is enough for all methods.

Values of the ’Motivation for using the method’ metavariable are:

2 = the learner has intrinsic motivation for using the method (it is the learning ideal, because if somebody knows a method, but she/he doesn’t use it automatically, the development will be unsuccessful. The goal is that method usage will be habitual.)

1 = the learner has extrinsic motivation for using the method (the motivation is triggerable)

0 = the learner doesn’t have motivation for using the method (untriggered motivation)

Investigation: if the learner has intrinsic motivation, he/she will use the method without the teacher’s warning (2 point). If the teacher has to warn learners, that he/she use the method, the learner’s motivation will be extrinsic, triggerable (1 point). Otherwise the motivation is zero. We have to measure this metavariable with every method.

Values of the ’Knowledge of the method’ metavariable are:

2 = the learner has practical knowledge of the method (it is the learning ideal)

1 = the learner has only lexical knowledge about the method

0 = the learner doesn’t know the method

Investigation: if the learner uses the method successfully, he/she will have practical knowledge of the method (2 point). If the learner does not use the method, but he/she can speak about the method, he/she will have lexical knowledge about the method (1 point). Otherwise the knowledge is zero. We have to measure this metavariable with every method.

Values of the ’Transfer of using the method’ metavariable:

2 = the learner uses the methods in identical tasks in different subjects in every possible situation

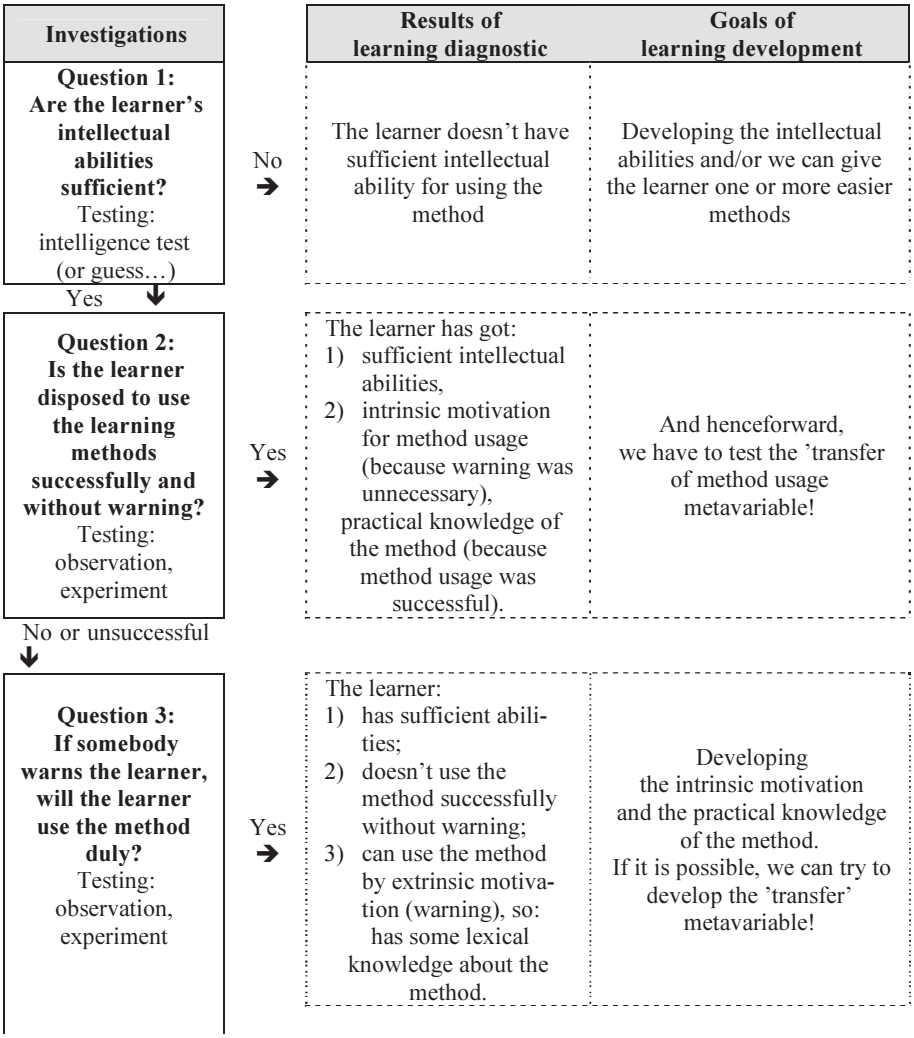
1 = the learner does not use the methods in every possible learning situation

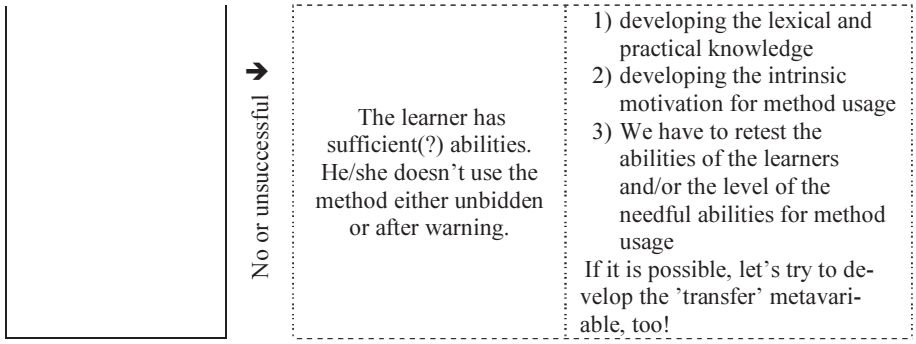
0 = no transfer

Investigation: the diagnostic of the 'transfer of method' can be realized by observation. For example, we can observe using the method in different subjects (mathematics, physics, literature etc.). Or we can analyse the written products of the different subjects of the learners. We have to measure this metavariable with every method.

The Figure 5 shows a practical algorithm of diagnostic of these metavariables.

Figure 5: Investigational questions, possible results, developing goals and simple algorithm of diagnostic of metavariables (Mező and Mező, 2005:)





Plan of the research in the near future

In our days, learning diagnostic is compelled to use questionnaires (principally). Regrettably, the information of the questionnaires could be false, desinformative. Sometimes the validity and reliability and objectivity of these utensils are not very good. It has negative effect to the effectiveness of learning development.

Our possible alternative method would be an objective learning achievement test instead of questionnaires. Though achievement tests are beloved methods in the area of studies of abilities (see: intelligence test), but these are not in use for the research of learning strategies and methods. The application of learning methods and strategies can be measured by tests. The problem is: we do not know any learning achievement test which can measure the variables of the IPOO-model.

In the near future, we will make a new learning test and its handbook. These will be useable in the following areas:

- Learning diagnostic: we will have an objective test, which can identify the problems of learning and show the efficiency of developmental work.
- Learning development: the handbook of the test will suggest developmental possibilities and methods, and it will contain tasks and examples.
- Research: the translated forms of the new test will be useable in national and international comparative research on learning by educational and psychological specialists.
- Education of teachers: diagnostical and developmental application of the test and the knowledge of its variables can be a part of the higher and academic (post)graduated education of teachers. We have already used the IPOO-based learning development for teacher

education at the University of Debrecen, (Debrecen, Hungary) and at Eszterházy Károly College (Eger, Hungary) for a few years.
- School psychology: the test would be a practical utensil of school psychologists.
- Talent identification: this test will be useable for the identification of gifted and talented persons in the learning area.

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