VISIBLE TEACHING AND INQUIRY-BASED LEARNING

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Rezumat. Sunt examinate metode de predare, care conțin o componentă esențială de feedback. Este arătat că în conformitate cu teoria *Visible Teaching and Learning* comunicarea bidirecțională profesor – elev ar trebui să fie prezentă în orice metodă modernă de predare. Este descris conceptul de *Inquiry Based Education* și este demonstrată corelarea lui puternică cu teoria *Visible Teaching and Learning*. Sunt prezentați factorii de impact asupra învățării a diferitor metode constructiviste de predare. Este evidențiat rolul comunicării și a efortului personal de învățare în formarea cunoștințelor sustenabile.

Abstract. Teaching approaches with strong feedback component are examined. Is shown that according to the theory of Visible Teaching and Learning bidirectional teacher – student communication should be presented within any modern teaching approach. The concept of Inquiry Based Education is described and its strong correlation with Visible Teaching and Learning is demonstrated. The impact factors on learning of some constructivist teaching methods are presented. The role of communication and student's personal learning effort in the formation of sustainable knowledge is highlighted.

I.   Introduction. Feedback within Visible Teaching Strategies

The problem of the impact of teaching strategies used in classroom on students' academic achievement and measurement of this impact is a permanent constant in the field of interest of educational researchers. The most known work in this sense is Hattie's concept of visible teaching and learning [1]. A short description of most powerful teaching strategies according to Hattie's concept is given in [2]. From those six main areas which essentially contribute to learning:

1. the home,
2. the school,
3. the curricula,
4. the teacher,
5. teaching modality,
6. learning approach,

we will examine in this section of the article only series of teaching modalities which contain a strong feedback component. Because the essence of Visible Teaching and Learning (VTL) theory could be stated in one and short sentence: from one side the teacher teaches without knowing what namely each student has assimilated, and from other side the student learns only by guessing the learning objectives. Thus, the basic actors of teaching – learning process do not act as a harmonic oscillator. In this way, the higher is correlation degree between teacher and student the higher are learning outcomes. Teacher – student bidirectional interaction in classroom provides this correlation. In other words, when teacher is seeking feedback, but in his/her turn, gives feedback to students, and is able immediately adapt teaching according to the feedback from the students. Live streaming of two strongly correlated channels.

According to the concept of VTL the most powerful teaching approaches should have at least three following components:

Firstly, it is about the quality of teaching when students are inspired to study the proposed subject in an inquiry – based way, to highly value and deeply understand the

school subject. As we shall see in the next section, the definition of quality teaching is congruent with inquiry – based education.

Secondly, positive student – teacher relationship, or larger, lucrative classroom climate based on multilateral empathy which ensures class engagement toward high achievements [3].

Thirdly, high expectations of teacher for his/her students. Lower expectations determine lower results. Learning effort should be permanently encouraged. It suits with an important didactical principle of the pedagogy of collaboration: the true learning must be hard. Here we have to underline that learning has two sides: surface learning and deep learning, both mandatory. However, deep learning is that part of the learning, which ensures sustainability of the learning and life-long learning potential of personality.

Thus, the most powerful teaching strategy is a priori assumption of the teacher regarding the skills and abilities of a student or group of students when the teacher has adequate expectations for the achievements of his/her students. The impact factor of this approach is 1,62, which is four times higher than in the case when an experienced teacher applies for two years the same conventional method [4].

Also the knowledge of students' response to teacher's intervention has an impact factor equal to 1,29. The strategies containing classroom discussions, mandatory component of inquiry-based education, may have an impact factor up to 0,82. In addition, in order to reach high results, the students must be aware of success criteria of their learning, i. e. in which way their success will be measured. The digitalisation of evaluation is the appropriate solution as it eliminates all subjective factors. Thus, knowledge of success criteria has 0,7.

Another strategy related to healthy bidirectional student – teacher interaction is not labelling students or a priori accreditation of students – 0,61. As inappropriate assumption distorts feedback, the communication in classroom should be a coherent one.

II.   Inquiry-Based Learning Strategies

There are many researches describing the principles of inquiry – based education and a relatively comprehensive work in this sense is an article of the author [5]. Now we will reveal the main features of inquiry – based science education (IBSE) from VTL point of view.

We have to state that IBSE is a constructivist didactic approach, which recognizes the active role of student in the formation of his/her conception and scientific ideas about nature and world. This lead to the fact that IBSE, applied permanently in classroom, forms lifelong learning (LLL) skills, which is much more important than surface knowledge. In this way, two important features of IBSE should be underlined: from one side – deep knowledge acquired as a result of the own learning effort of student, and from other side – learning or even research skills formed within research projects in the frame of group work. Three types of communication ensure positive class engagement:

A. Among students – members of the same group which work on a joint project (problem discussion, identification of the goal, distribution of tasks, debating of obtained results).

B. Among different groups of students at class level, when the results of group work are presented and analysed by the entire class;

C. Teacher – student communication during whole project length from the initial analysis of the situation to the results discussion.

Proper communication is responsible for the formation of active and reach scientific vocabulary of students, while performing of research tasks is the basis for sustainable LLL skills. Thus, structuring teaching – learning process into a series of research projects is the distinctive feature of IBSE [6]. Usually these projects are organized around *big scientific ideas*. It means that before adopting IBSE approach a teacher should structure subject curricula into a chain of relatively major scientific terms. Further, for each term or notion the teacher identifies a set of scaffolding questions. The adequacy of these *pushing* questions along with further monitoring and guidance of students group work determines the success.

IBSE is about the involvement of students into the process of collective debates and reflections. The humanities teachers are familiar with this process, but the question is to introduce the debate into the frame of science and math lessons, where teacher usually delivers the knowledge in the form of undeniable truths. The transition from the linear paradigm of memorisation of an amount of knowledge to the one of understanding through involvement requires from teachers those qualities already stated in the previous section. Namely, inspiring students, ability to create in class an atmosphere of empathy, and challenging students. The value of knowledge obtained through the personal effort of students is much higher than the one transmitted by teacher. For example, in VTL the impact factor of learning strategies based on students' personal effort is equal to 0,77. In comparison, ludic education has 0,35, and one on one laptop programs – 0,16. Remember that numbers lower than 0,4 (reference level) should be interpreted as negative impact factors. In this way, VTL gives a clear response to the adepts of mechanistic gamification or digitalisation of education. In this way, the shifting should be from *learning by doing* to *learning by understanding* or even *learning by being*.

III.   Correlation between VTL and IBSE

In this section, we will analyse various components of IBSE from VTL point of view and will demonstrate that to a certain extent IBSE and VTL are similar concepts.

Firstly, by its nature, IBSE is a project based and problem based learning. Even more than that, any IBSE project starts with a discussion about what will be researched by groups of students and in which way it will be done. We could state that each successful IBSE project needs a Research Road Map. Detailed planning by of students' research activities developed both in classroom and outside ensures the success. Any impromptu needs a good preparation. In this sense, according to VTL *Cognitive Task Analysis* is ranked at the level

of 1,29. A well-known thing by all teachers, the class has to start with highlighting and informing the students about learning objectives. Understanding and ownership of learning outcomes is the basis of success.

Secondly, the structure of IBSE projects, namely by group working on research projects, is quite similar with "jigsaw method" [7], which has in VTL an impact factor equal to 1,2, i.e. it increases the academic achievements of students with 120%. This is possible due to the overlapping of series of strong factors, such as: differentiate learning, mandatory personal learning effort, and sequential learning (when new subject is assimilated in small portions).

Thirdly, when the teacher designs an IBSE project he/she starts from prior knowledge of students. The recurrent use of previously acquired knowledge is actually the Latin phrase *Repetitio est mater studiorum*. Valorisation or capitalisation of the knowledge bring sense to learning, anchor the knowledge into student's value system. Permanent use of this methods contributes with an impact factor equal to 0,93. Also, IBSE supposes a certain freedom degree for students in their learning activities. According to VTL the independence of students in their *learning by research* is highly paid off with an impact factor equal to 0,83. Note it is about an independence, which requires strong interaction and communication in the frame of the group. Thus, in healthy classroom climate students learn from each other. As the teacher is the one who is in charge with whole project guidance and monitoring (leading classroom discussions), a real feedback brings other 0,92 points to the impact factor. In this way, the permanent integrated implementation of following approaches:

- integration of prior knowledge
- self-regulated learning
- classroom discussions

will increase academic achievement of students and enhance the sustainability of their deep knowledge.

IV.   Conclusions

1.   Six main areas influence the learning (in order of relevance): home, school, curricula, teacher personality, teaching approach, learning approach.

2.   The higher is correlation degree between teacher and student the higher are learning outcomes and feedback should be seen as live streaming of two strongly correlated channels.

3.   According to the concept of VTL the most powerful teaching approaches should have at least three following features: inspiring teaching, empathy – based teaching and encouraging teaching.

4.   Communication in classroom determines the formation of LLL skills within IBSE. Three types of communication are presented in an IBSE class: student – student among the same group, student – student between groups, teacher – student.

5.   Proper communication is responsible for the formation of reach and active scientific vocabulary of students, while research activity of students – for the formation of sustainable scientific knowledge.

6.   An IBSE project starts with adequately selected set of pushing or scaffolding questions.

7.   Personal learning effort of students is crucial both in IBSE and in VTL and is reflected by *learning by being* paradigm.

8.   Cognitive task analysis at very beginning of the lesson/project ensures students' understanding and ownership of learning outcomes.

9.   Overlapping of differentiate learning, mandatory personal learning effort, and sequential learning increases the impact factor (in terms of students' achievement) of an IBSE project.

10.   Recurrent use of previously acquired knowledge, self – regulated learning and teacher guided classroom discussions increase cumulatively the impact factor on student learning.

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