

The Potential of Learning Programming

Razumowsky A.I.

*Trapeznikov Institute of Control Sciences of RAS, 65 Profsoyuznaya street, Moscow 117997, Russia
Email: razumowsky@yandex.ru*

ABSTRACT

Today the need to understand the mechanism of transferring and acquiring knowledge in education is still relevant. This article discusses the possibility of activating various interests among IT students on the basis of creating a special artificial environment for teacher-student interaction. Thus, some limit properties of knowledge transfer and acquisition have been studied, namely, minimizing the term base, maximizing the certainty, context specificity and repeatability of a term. The research methodology included a three-stage semester survey, as well as a final survey of students. The conclusions drawn are about the clear opportunity of transferring knowledge to those IT students who either have already developed some skills and have a corresponding cognitive interest in the subject, or when it is possible to ignite interest by creating special artificial environments. This is achieved by reducing the number of important terms, as well as through their well-informed and practical use. It was also found out that there is a direct dependence of the training quality on the degree of personal interaction between the teacher and student.

Keywords: *programming, interest, minimization of the terminological base, specificity of the term, rehearsal term*

1. INTRODUCTION

Many studies note that today, in higher education, when teaching disciplines related to the study of methods and practices of information technology, in particular programming, there are difficulties of an objective order. Firstly, the dominance of smart devices - smartphones, tablets, e-books - negatively transformed the traditional practice of taking notes and record keeping by students during a lecture or in a laboratory. Now records are almost never or not kept at all. As such, the information provided by the teacher is practically not comprehended [1]. Secondly, a decrease in the socialization of students again due to “communication” with smart devices led to a strong atomization of the student community. It has been proved [2-4] that atomization of the community entails a decrease in the responsibility of an individual, which is closely related in turn to the stimulus environment of the learning process and, accordingly, reduces interest. And, interest is that cornerstone, the presence of which determines the very potential and dynamics of gaining experience and knowledge. If there is no interest, there is no learning! [5] Using the term “potential” in the title hereof, we focus not only on overcoming obstacles to the transfer and acquisition of knowledge in modern conditions, but also attempt to decompose the process of transferring knowledge into elementary connected steps. The setting in which such elementary actions are immersed, presumably, will expand the range of methods for teachers interacting with students, and also make them more appropriate and focused, orientated on the student individuality.

In the study, we make the following set of assumptions.

The acquisition of knowledge is influenced by several limit properties of the form of its transfer. These may include:

- minimizing the term base
- maximizing the clearness (understandability) of a term
- maximizing the specificity (practical applicability) of a term
- increasing the repeatability of a term, including through discussion and informal communication.

We aim to exclude from consideration the content-related side of knowledge transfer, focusing only on the forms of its transfer. The focus of our attention is at studying ways, iterations, traces, feedbacks, errors and their correction during knowledge transfer. Each of the above forms together with the others should be considered as the possibility of initializing diverse interest among students.

2. METHODOLOGY

When using the term “interest”, it is important to explore the whole range of phenomena, goals and opportunities defined by this term. This is necessary to reduce misunderstandings, as well as because of the frequent simplification of the nature of interest (or interests) in the literature.

Indeed, in relation to educational methods, the term “interest” basically means cognitive interest. However, the meaning that defines this concept narrows the horizon of the problem essence and prevents its comprehensive

discussion and search for solutions. It should also be noted that we refuse to consider interest only in psychological context, for example, as emotion or motivation. Although it is precisely the study of the nature and forces of motivation of students in a loose sense, apparently, that will allow for the control of knowledge transfer.

Along with cognitive interest, the life of today's student is full of many other interconnected interests. In this study, we will focus on three types of interests: the interest in acquiring knowledge; interest in financial security; as well as interest in the future application of knowledge gained today.

The focus on the potential of acquiring knowledge is at the whole tangle of interests that students have. The methodological context of the study will be formed on the basis of the interconnected interests of students within situationally created media and learning environments. And the learning media themselves will rely on the above conditions for the transfer of knowledge.

There are several popular instructional areas used in education to stimulate the acquisition of knowledge. Firstly, gaming techniques. Secondly, discussion platforms. Thirdly, interdisciplinary methods, synthetically combining playing time with concentrated group contacts. The paper [6] shows how different approaches can form the skills of completely different types of activities. The paper [7] reports on the importance of high motivation of teachers, allowing strengthening the process of knowledge transfer. The conclusions of this paper are well connected with the need to maximize the clearness (understandability) and context specificity of the term. The paper [8] confirms the important role of the context specificity of term base and examples. In addition, there is an interesting fact that the quality of education directly depends on the level of practical knowledge of the teacher. Unfortunately, there are almost no studies related to the possibility of a student avoiding liability. In this case, interest is expressed not by the desire to study less, but to get a higher final grade. Nevertheless, in the paper [9] there are experimentally confirmed results on the best indicators in the training of those students who count on cheating in the final tests.

In terms of increasing the repeatability of terms, one can consider the studies of learning through images and animations, for example [10-12].

Thus, methodologically summarizing, we observe the absence of papers directly exploring the conditions and forms of knowledge transfer combined with the maximum characteristics we have offered.

This paper is the second one in the author's study of knowledge transfer in the educational process. The previous paper [13] showed the relationship of interest and creative activity of all parties involved in the transfer of knowledge. In addition, it indicated the necessity of testing the transferred knowledge for solving real practical problems.

Obviously, the teacher acts as a driving force and initiator of student activities. This role should lead the student to some kind of interest. As a result, the internal learning

processes will be mobilized. Considering each hypothetical limit property of the educational process in the context of various interests, it is important to trace which of them will lead to the initiation of a certain interest. In conclusion, it is necessary to approve preliminary assessments by questioning on the topic of identifying those interests or interest groups that really guide the student in the pursuit of his/her own goals.

3. RESEARCH RESULTS

The studies were conducted as part of a lecture and seminar interaction with students studying object-oriented programming at MSTU "STANKIN".

The minimization of the term base, as an attempt to reduce the load on the student's short-term memory was indicated as the first limit property. Minimization of the term base used addressed the name of the main program elements. The term "function" was chosen for active elements, and "data" - for the content ones. Thus, two classes of program elements were formed. Moreover, the term base of programming was reduced to two meaningful actions: to do and store (or contain). It is appropriate for each of these verbs to substitute a purposeful word "why" in order to bring the student's thought to a clear space of decisions or assessments. By means of a sample interview, different students showed opposite reactions. One group of students with substantial, in the teacher's opinion, skills and experience, demonstrated a distinct increase in cognitive interest (at the expense of others). Other students, on the contrary. In the first case, we can assume a kind of "linking" of interest to understanding the subject, which gives a boost to accelerate the insight into the subject. Otherwise, most likely, there is a suppression of cognitive interest by the lack of readiness for the meaningful use of program elements.

Terminological clearness has two sides:

- general or objective clearness, correlated with the natural expressiveness of the word. For example, mapping is a function; save - function; storage - data.
- subjective clearness of the term is associated with personality traits, experience, goals, desires.

Practically speaking, we emphasized the conceptual moment. It should be noted that, in contrast to objective terminological clearness, the reverse pairs of terms can serve as examples of clearness focused on a personality: function - action; data - saturation, group, and cluster.

It can also be noted that when defining something based on individual preferences, we should specify the concept and its essential subjective clearness: something specific becomes clear. Moreover, the blurring of context specificity, respectively, entails the costs of understanding. In abstract disciplines, to which programming is largely related, many essential elements are not properly understood, leaving gaps in the consciousness. Such gaps are very difficult to fill in later [14], since the learning process itself contains a set of concrete abstract associative pairs [15]. Indeed, during the sample interview of students

during the term (a three-stage interview was used), it turns out that the correct application of any abstract construction in the program hides a misunderstanding of the real nature of the performed action. Such misunderstanding is a direct way to systematic errors and inability to correct them.

Lack of understanding and inability to express a specific action in your own words indicates the absence of either the most cognitive interest in the subject or the need for thorough insight into the material. Thus, there is one more technique that is suitable for monitoring the depth of understanding in combination with the presence of certain interests of the student.

We see the direct connection between clearness, understanding, concretization of term base and the possibility of control over stimulating the educational interests.

In an attempt to achieve the best clearness, understandability and context specificity of the terms, there is an increasing trend to use the significant terms in various contexts more often. The repetition of the term "function" in combination with the terms "data", "storage", and "set" revealed an important effect on the formation of stable pairs of phrases. Phrases such as integral compound terms can also be subjected to numerous repetitions. It was found that at first, such an effect gives a little conscious understanding of the subject, and it becomes ever-increasing over times.

The three-stage survey confirmed not only the memorization of the combinations used, but also showed an increase in the quality of answers to questions about the essence and significance of the terms used.

In addition, it turned out that for an individual understanding the choice of the correct term or phrase is extremely important. The care about the selection of the correct terms primarily is the responsibility of the teacher, who, accordingly, must possess an extensive term base and developed intuition. The choice and repeatability of the correct term is, apparently, the basic mechanism of conceptual processes. There are numerous studies of the effect of repeatability or rehearsals in educational procedures, for example [16-18]. It is noted that the repeatability of the term increases addiction to it. This leads to the freedom of its use in thinking and associative binding to other terms, creating a target conceptual outline of the subject material.

4. DISCUSSION

At the end of the semester training, 2nd year undergraduate students (18-19 years old) were asked, as part of the final questionnaire, to choose the appropriate answers from several formulated ones in the questionnaire. The questionnaire under the general title - "I need programming for ..." - contained the following items:

- Financial security;
- Creation of important programs (in science, technology, society, medicine);
- Writing interesting programs (games);

- Other;
- I need;
- I am not interested in programming.

It was allowed to select several answers at once, as well as indicate your own, more specific variant.

Thus, 72 students for the course "Object-oriented Programming" were interviewed. The voting was as follows. The item "writing interesting programs" was chosen by 46 students (63.9%). 39 people (54.2%) expressed their interest in material incentive. The item "creating interesting and important programs" was checked by 30 students (41.7%). In addition, 21 listeners (29.2%) chose the item "other" and wrote their preferences in the questionnaire, among which were the following interests: self-development, creativity, the subject itself is interesting. The astonishing fact was that 3 students (4.2%) chose the item "I am not interested in programming". Apparently, that was the case of erroneous career guidance, or it was difficult for a student to comprehend the abstract concepts of the subject, and he could not find a single stimulating interest. The item "I need" assumed the student's response to the lack of something in the learning process. Three listeners indicated in this questionnaire item that they did not have enough time. This suggests that the course itself requires a temporary extension.

To complete the picture, it should also be noted that the teacher taught separately seven students, offering them to solve additional problems, and then he checked the solutions and individually oriented students to study and apply some mechanisms and techniques.

5. CONCLUSION

The tangle of existing or unformed interests still contained in the student's personality can be analyzed and managed only with careful and scrupulous teaching of programming. We should state that there is an obvious possibility of transferring knowledge to future IT students who either have already developed some skills and have a corresponding cognitive interest in the subject or this interest can be developed by creating artificial environments where the number of significant terms is minimized, and their use is connected with understandability and targeted practice, including multiple repeatability. It is important to emphasize: the higher the teacher's participation in the direct learning of a particular student, the better the student is able to open up, exposing greater acquisition.

REFERENCES

- [1] A. I. Razumovsky, Dictation introduced at lectures as a practical method to increase the effectiveness of teaching software engineering in a digital era. International Scientific and Practical Conference on Digital Economy (ISCDE 2019). Atlantis Press, 2019.

- [2] E., Zamani, A., Kheradmand, M., Cheshmi, A., Abedi, & N., Hedayati, Comparing the social skills of students addicted to computer games with normal students. *Addiction & health*, 2(3-4), 59, 2010.
- [3] M., Deniz, & E., Ersoy, Examining the Relationship of Social Skills, Problem Solving and Bullying in Adolescents. *International Online Journal of Educational Sciences*, 8(1), 2016.
- [4] S., Dangkrueng, T., WannaUeumol, P., Yodming, & S., Sirithongthaworn, Relationships between internet addiction and loneliness, and internet addiction and teenage social skills: A case study of Mathayom Suksa students in the Northern region. *International Journal of Child Development and Mental Health*, 1(2), 2013, pp. 26-30.
- [5] G. Mingyuan, Where Is the Way Out for Education in China - A Random Talk on Education. *Curriculum, Teaching Material and Method*, (3), 2, 2015.
- [6] C. M., Hinkle, & M. D., Koretsky, Toward professional practice: student learning opportunities through participation in engineering clubs. *European Journal of Engineering Education*, 44(6), 2019, pp. 906-922.
- [7] D., Richter, M., Kleinknecht, & A., Gröschner, What motivates teachers to participate in professional development? An empirical investigation of motivational orientations and the uptake of formal learning opportunities. *Teaching and Teacher Education*, 86, 102929, 2019.
- [8] Y., Copur-Gencturk, D., Plowman, & H., Bai, Mathematics teachers' learning: Identifying key learning opportunities linked to teachers' knowledge growth. *American Educational Research Journal*, 56(5), 2019, pp. 1590-1628.
- [9] J. P., Houston, Learning, opportunity to cheat, and amount of reward. *The Journal of Experimental Education*, 45(3), 1977, pp. 30-35.
- [10] A., Ubreva Amor, Image as a daily learning opportunity. *COMUNICAR*, (31), 2008, pp.555-561.
- [11] J., Samuel, S., Patil, S., Solanki, & R., Karani, Baby mentor: Learning through images. In 2017 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS) IEEE, 2017, March, pp. 1-6.
- [12] Y., Postigo, & A., López-Manjón, Images in biology: are instructional criteria used in textbook image design?. *International Journal of Science Education*, 41(2), 2019, pp. 210-229.
- [13] A. I., Razumowsky, & M. A., Loktev, Information and technological support for knowledge management in the educational process. In 1st International Scientific Conference "Modern Management Trends and the Digital Economy: from Regional Development to Global Economic Growth"(MTDE 2019), Atlantis Press, vol. 81, 2019, pp. 680-683.
- [14] A. B., Rendas, M., Fonseca, & P. R. Pinto, Toward meaningful learning in undergraduate medical education using concept maps in a PBL pathophysiology course. *Advances in Physiology Education*, 30(1), 2006, pp. 23-29.
- [15] A. A. Ferreira, Sociocultural development in the spectrum of concrete and abstract ideation. *Mind, Culture, and Activity*, 2019, pp. 1-20.
- [16] S., Petersen-Brown, & M. K. Burns, Enhancing maintenance and generalization of sight words taught with incremental rehearsal: Applying the depth of processing and generalization frameworks. *School Psychology*, 34(3), 307, 2019.
- [17] S. S., Kavanagh, C., Monte-Sano, A., Reisman, B., Fogo, S., McGrew, & P. Cipparone, Teaching content in practice: Investigating rehearsals of social studies discussions. *Teaching and Teacher Education*, 86, 102863, 2019.
- [18] N. A., Utami, & A. Mustadi, The Application of Practice Rehearsal Pairs (PRP) Method to Develop Inquisitiveness of Learning in Students. *KnE Social Sciences*, 2019, pp. 269-279.