

# MODELING STUDENTS' INDEPENDENT STUDIES ON THE BASIS OF INFORMATION TECHNOLOGIES

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The paper is devoted to an important problem of supporting the use of an elaborated model of the hypertext during the independent study process in order the students would know, how to actively acquire knowledge and apply them in practice.

Hypertext has been elaborated on the basis of theoretical research and the principles of hypertext modeling, based on the structuring of a linear text information, it comprises the students' potential professional knowledge, necessary for students, and includes the structure and functional peculiarities of the essence of objects to be studied.

The paper also includes the research results based on the data which were elicited from self-evaluation questionnaires and test results of the learners. To answer the research question if the elaborated model of the hypertext has any impact on the perfection of self-dependent studies for students the statistical analysis was conducted. Research **results** indicate that when elaborated model of the hypertext is integrated in a properly organized study process, development of new knowledge as well as student independent development has been promoted

**Keywords:** information technologies (IT), hypertext, didactic modelling, structuring of professional knowledge

## 1. Introduction

The intellectual climate of the developed educational systems stresses the value and interest in individual experience (*Gremmo, M.J. and Riley, P. 1995*), therefore issues of independent studies and self-access language learning have attracted many educationists' attention. The development of independent learning skills largely depends on the facilities offered to the student. The *aim* of the present article is to view the potentialities of a hypertext as a means of material structuring for the perfecting students' self-dependent studies. In order to achieve this let's turn to the layout of the **concept "hypertext"**.

## 2. The Concept of the Hypertext

There are several definitions of a hypertext. In the present article hypertext is considered from the pedagogical point of view and interpreted according to the very essence of this science.

**"Hypertext is a stock of information, characterized by the entirety of the layout of thematic information, the links between the separate parts of a text or texts and limited number of sections"** (*В. Морозов, В. Тихомиров, Е. Хрусталеv, 1997*).

Hypertext as a technology of material structuring may serve as a means, helping a student to acquire and perfect professional knowledge independently, paying particular attention to the logical-semantic relations of texts. Since logical structuring of the material means maintenance of consistent logic group of relations among separate elements of the material, where acquiring one element is based on and depends on knowledge regarding the other ones, hypertext enables material structuring and acquiring, taking into consideration several interconnections existing both within the text and beyond the text. The structuring of the hypertext study content in the paper means the discovery of the highlighted parts of the study material and the development of links by applying the hypertext technology. It facilitates the selection of useful study material, enables to formulate the objectives for each theme, protects from the duplication of material and from the unnecessary parallelism. The developed social logical structures of the hypertext allow studying separate problems, providing the university lecturer with a good methodological material in order to improve the methodology for the acquisition of separate study issues, establishing the interdisciplinary links, as well as providing an opportunity to design or to model the process of students' studies, however the students are able to guide actively their cognitive processes. Thus, hypertext, providing hierarchy suppression and possibility to choose freely the route of reading, affects process of studying fundamentally, since the individual needs of gnostic activities of students are met. It facilitates the transition from formal or disciplinary education to problematically active one (*Jonassen, D. H., & Wang S. 1993. Jansen, W., Jagers, H. P. M., van den Hooven, H. M., Steenbakkens, G. C. A., 2002*).

### 3. The Essence of Independent Studies and the Analysis of the Developmental Levels of Its Structural Components

It has been discovered that the concept of independent studies has no unambiguous definition in pedagogy, but in different definitions there is an idea emphasized that independent studies are based on independence – personality’s inner readiness for the activities and their active manifestation. Independence is closely related to the personality’s activities and it facilitates the students’ independence within the cognitive process.

On the basis of the research performed by scientists (*I. Žogla 2001, B. Ясвин 2001*), the independence qualities of cognitive process were analysed:

- critical approach to the material to be acquired and opinions of other people,
- ability to justify one’s opinion,
- skill to think and conclude independently, acquire new knowledge, apply them for self-development and practical activities.

Independence of cognitive process is an important precondition for the students’ independent studies, because it ensures one of the most significant pedagogical principles of a higher educational establishment – the principle of conscientious attitude towards one’s studies. It is developed gradually – alongside with the components of a student’s personality: intellectual, motivating and emotional components, which are a part of the structural components of a student’s independent studies: *motivating and aim component, content and activity component, emotional and volition component, evaluating-corrective component*. The interconnectedness between the structural components of independent studies, which develop and are being improved within the students’ cognitive activities, indicates the procedural aspect of the development of these interconnections.

*Motivating and aim component* facilitates the acquisition of knowledge and activities, and at the same time facilitates the students’ volition to overcome difficulties within the study process.

*Emotional and volition component* ensures the logical completeness of study process.

*Evaluating-corrective component* controls the study process through the comparison of result and generally accepted norms, and, if it is necessary to correct the results, the plan for the correction of mistakes is being developed.

*Content and activity component* is a system of fundamental knowledge, on the basis of which the operational aspects of independent studies – learning techniques – are formed.

Within the framework of research, the essence of independent studies is disclosed through the analysis of the developmental levels of its components: low, average and high, and the criteria, the indices of which reflect the dynamics of independent studies. *High* level of independent studies proves the student’s ability to formulate the problem, forecast and choose efficient techniques for its solution, to control and to perform the self-assessment of work.

Students with *average* level of independent studies quite often require for assistance, for example, in order finding out, which technique should be applied for the problem solution, or when they need the control over the individual activities during the study process. *Low* level of independent studies shows that the student’s cognitive activities should be facilitated, the student should be supervised on an ongoing basis they need an example for the solution of problems (*И. Кондаурова 1999*).

*The aim of elaborated experimental model* of a hypertext for the students, studying at the Faculty of Economics, is to achieve the development of the structural components of independent studies, while working with a hypertext, consisting of professional authentic texts in English, and to encourage the students to choose a strategy, which would help them to fulfil the tasks independently within a particular period of time (a term, a study course, some months, weeks, etc.) This decision was taken after having evaluated the possibilities of a hypertext to be used for the acquisition of independent study content and professional terminology, as well as after having analysed the criteria of independent studies and having found out the students’ independence during the study process.

### 4. Approbation Results of the Elaborated Hypertext Model as a Means of Perfecting Students’ Self-Depended Studies

At the beginning of *the establishing experiment*, the developmental level of the structural components of students’ independent studies was analysed. For this purpose the questionnaires developed by other researchers were used, as well as those developed by the author of the paper. The questionnaires were based on the students’ self-assessment on the development of students’ independent study components (i.e., Test 1).

On the basis of the test results, the students were grouped into 3 levels: low, average and high and by selecting students according to the random choice from all three levels an experimental group and a control group was formed. Within the next stage of establishing experiment, there was a test carried out to find out the students’ English knowledge and the skill of independent studies (i.e., Test 2). This test was performed

in order the research results would be objective and would not be based on the results of students' self-assessment. The results of the Test 2 enable to evaluate the level of students' knowledge in both groups at the beginning of the experiment. The following is necessary for the comparability of the final results of the experiment: the results of both tests would be identical and there would be correlation between the levels of students' knowledge of language and the components of independent studies, it would confirm the substantiation of the questionnaires, developed for the determination of the level of students' independent study components and the credibility of the experiment itself. Thus, both tests are considered to be the two factors, aligning the initial conditions for the experimental group and the control group, in order, with the conditions being identical, to evaluate the efficiency of the developed methodology.

Within *the developing experiment*, the students from the experimental group were acquainted with the developed methodology of independent studies. At this stage of the experiment it was important to identify the changes in the developmental level of the structural components of students' independent studies. The students from both groups were offered to acquire independently one theme "From History of Economic Thought" within the framework of the acquisition of English for professional purposes, but to apply different methodologies. The students from the control group acquired the theme, continuing to work with the linear texts. The students from the experimental group worked with the developed hypertext.

At the final stage of developing experiment the establishing measurements of the structural components of students' independent studies were taken, using the diagnostic means for the second stage, i.e., inquiry forms, questionnaires, tests. The efficiency of methodology on the hypertext basis was confirmed, using the comparative analysis of *structure deviation*, which developed in each group of students at the end of the experiment in comparison to its beginning. Besides, *the structural differences* between both groups at the beginning and at the end of the experiment were evaluated. !!!

Table 1 shows that the significances of all calculated coefficients indicate the *structure deviations* in the developmental levels of the structural components of students' independent studies at the end of the experiment in comparison to its beginning in both groups. However, the indices of experimental group three times exceed the corresponding coefficients of structure deviation of the control group. This fact enables to establish significant differences between the methodologies of control group and experimental group.

**Table 1.** Coefficients of the Structure Deviations in the Developmental Levels of the Structural Components of Students' Independent Studies at the End of the Experiment

Coefficient	Borders of changes	Control group	Experimental group	Both groups
1. K. Gatev's integral coefficient of structural deviations	$0 < K_g < 1$	0.10	0.28	0.19
2. Quadratic coefficient of absolute structural changes	$0 < K_{kv}$	5.50	15.48	10.6
3. Difference index	$0 < I_r < 1$	0.07	0.22	0.15

But the results of the coefficient calculation of *structural differences* (see Table 2) confirmed the assumption on the absence of significant difference in the developmental level of the structural components of students' independent studies at the initial stage of experiment. At the end of experiment, the differences in the structure of the two groups of students became more significant, which was confirmed by the increase of all calculated coefficients for almost three times.

**Table 2.** Coefficients of Structural Differences between Groups according to the Developmental Levels of the Structural Components of Students' Independent Studies

Coefficient	Borders of changes	Beginning of the experiment	End of the experiment
1. K. Gatev's integrated coefficient of structural differences	$0 < K_g < 1$	0.05	0.14
2. Quadratic coefficient of absolute structural differences	$0 < K_{kv}$	2.51	7.61
3. Difference index	$0 < I_r < 1$	0.04	0.11

The analysis of the calculation of results obtained concerning the structural changes and difference indices, which was performed according to the results of **Test 2**, confirms all conclusions, drawn earlier on the results of Test 1. It should be pointed out that the structural changes in the results of Test 2 are more significant than in the results of Test 1. Thus, the coefficients of the structure deviation of experimental group four times exceed the corresponding indices of the control group. Thus the results of the analysis of the structural changes of both indications, obtained as a result of Tests 1 and 2, show the link, existing between them.

The results of the calculation of determination coefficient and the results of the calculation of empirical correlative relations according to the results of establishing and developing experiment results are shown in Table 3.

**Table 3.** Correlation Parameters and Coefficients of Indications

Totality Parameters	Control group		Experimental group		Both groups	
	Beginning	End	Beginning	End	Beginning	End
Coefficient of determination	0.52	0.50	0.61	0.78	0.56	0.63
Empirical correlative relations (ECR)	0.72	0.71	0.78	0.88	0.75	0.79

The value of determination coefficient shows that at the beginning of the experiment the control group is characterized by 52% of the results of Test 2 variation theoretically concerning the differences between the developmental levels of the structural components of students' independent studies. At the end of the experiment this index for the control group, in fact, did not change, but at the same time for the experimental group this index increased up to 78%.

According to the empirical correlative relations (ECR), varying within a range from 0 to 1, it is possible to draw a conclusion regarding the close relation between the indications (И. Елусеева, А Изомов, Е. Канралова 2006). However, the experimental group is characterized by more significant increase of the closeness of relations at the end of the experiment. It, in fact, reaches its highest (sufficiently high) level of the closeness of relations. In order to evaluate the statistical significance of this relation, we used Spearman's rank correlation coefficient and drew a conclusion that it is possible to state (with the probability of at least 0.99) that there is a statistically high direct relation between Test 2 and the developmental level of the structural components of students' independent studies.

In order to confirm the statistical significance of the results obtained in Test 2, as well as in order to identify the nature of difference between the groups, we applied *Wilcoxon-Mann-Whitney test* of the sample difference criterion. As the null hypothesis we chose  $H_0$ : the distribution rule of both samples is identical; as the first alternative hypothesis we chose: 1.  $H_a$  – “the rules of sample distribution do not correspond”; as the second alternative hypothesis we chose 2.  $H_a$  – “the first sample (control group) is shifted to the left in relation to the second sample, this deviation is equal to the deviation of the second sample (the experimental group) to the right in relation to the first sample”.

**Table 4.** Results of the Calculation of Wilcoxon's Actual Criterion

Parameters		Calculation results	
Name	Designation	Beginning	End
Actual significance of the criterion	$Z_i$	1.0291	-3.1118
Laplace functions from the actual significance of the criterion	$\Phi(Z_i)$	0.3485	-0.4994
Significance level, corresponding to the actual significance of the criterion ( $H_a : 1$ )	p-value-1	0.303	0.0012
Significance level, corresponding to the actual significance of the criterion ( $H_a : 2$ )	p-value-2	0.8485	0.0006

The analysis of the calculation results (see Table 4) shows that, according to the data of Test 2, the actual significance of the criterion of two alternative hypotheses under the research is characterized by the decrease in the area of permissible significances ( $Z < 2, 33$ ) at the beginning of the experiment. Therefore there is no reason to reject the correspondence regarding the rule of sample distribution of the null hypothesis. In the case of the rejection of the correct null hypothesis in favour of the alternative one, the probability error of raw 1 corresponds to the parameters p-value-1 (30.3%) and p-value-2 (84.85%). At the end of the experiment, the situation changed completely: the criterion takes place in the area of critical significances, enabling to reject the null hypothesis in favour for the alternative ones. It is possible to state that at the determined significance level (the distribution rules of two samples do not correspond, moreover – the second sample is diverted to the right) the probability of the 1<sup>st</sup>-type error in this case may constitute only 0.12% for the double-sided and 0.06% for the critical area of the left side.

In order to compare the results of each group before and after the experiment, we applied *the sign criterion* (Б. Л. Ван дер Варден 1960). The comparative analysis of the results of each group performed before and after the pedagogical experiment, applying the sign criteria, showed that there is no reason to reject the null hypothesis

for the control group on the correspondence of the rule at the beginning and the end of the experiment. At the same time, the experimental group has the significant reason to confirm (with the probability of at least 0.99) the significant changes of the results of statistical significances of Test 2 at the end of the experiment, moreover – for the changes for the better.

The conclusions confirm that the experimental methodology on the hypertext base is more efficient than the traditional methodology.

The results of the statistical analysis proved the results obtained during the empirical research. Besides, the conclusion drawn on the differential influence of experimental methodology on students with different developmental levels of the structural components of students' independent studies, determines the possibility of further improvement of experimental methodology. First of all, it is related to the study of combined teaching technologies, as well as to the adaptive teaching technology by means of a hypertext with the possibility to develop the automatic regulation of contribution level for different categories of students.

## 5. Conclusions

1. In the article the hypertext is considered from the pedagogical point of view and interpreted as “a stock of information, characterized by the entirety of the layout of thematic information, the links between the separate parts of a text or texts and limited number of sections” (В. Морозов, В. Тихомиров, Е. Хрусталеv, 1997).
2. Hypertext may serve as a means of helping a student to acquire and develop professional knowledge independently, in case it is implemented as a technology of material structuring.
3. The discussed problem of independent studies enables to establish that independent studies are based on independence – personality's inner readiness for the activities and their active manifestation, which is characterized by the subject's knowledge, skills and abilities as well as by the subject's attitude towards the process of performance and its results. Independence is closely related to the personality's activities and it facilitates the students' independence within the cognitive process.
4. The essence and structure of independent studies determine the structural components of independent studies, i.e. *motivating and aim component* – encourages to act, *content and activity component* – created conditions for the implementation of activities, *emotional and volition component* – facilitates the completion of activities, *evaluating-corrective component* – implements the function of control and evaluation, the indicators of which and their description reflect the dynamics of the above mentioned structural components.
5. Independent studies are characterized by the developmental levels of their structural components: low, average and high (И. Кондаурова, 1999). They were taken into account, while developing the complex of tasks for the professionally oriented texts, which was introduced into the study process according to the principle of sequence, as well as while developing the hypertext model, the aim of which envisaged the improvement of the structural components of independent studies, developing the skills to work with a structured content of studies.
6. In the experimental part of the research the developmental level of the structural components of students' independent studies at the beginning of studies was found out and the efficiency of the developed hypertext was tested, which had to facilitate the improvement of the structural components of students' independent studies and the development of their intellectual, motivating, emotional and corrective sphere. Although a conclusion was drawn that the hypertext technology ensured better results, while working with the students, whose developmental level of the structural components of independent studies had reached average and high stage, however, on the whole the results of experimental research proved the efficiency of the developed instrument and the real possibility to apply these means during the practical classes of professional English. By integrating the elaborated model of hypertext into the methodologically correctly organized one, i.e., correspondingly, study process, there was facilitated the development of students' new knowledge and the development of their cognitive independence; i.e., *motivating and aim component*, *content and activity component*, *emotional and volition component*, *evaluating-corrective component*. In its turn, the development of students' skills for the work with the study content, increases the quality of study process and prepares the students for the acquisition of techniques, how to independently structure the information on the basis of a hypertext. The students are provided an opportunity to expand the types of their study strategies. It will enable them to achieve the considerable improvement of the quality of studies.

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### **Gode, I. ISTUDENTU PATSTĀVĪGĀS MĀCĪŠANĀS MODELĒŠANA, PAMATOJOTIES UZ INFORMĀCIJAS TEHNOLOĢIJU IZMANTOŠANAS IESPĒJĀM**

Raksts ir veltīts izstrādātā hiperteksta modeļa izmantošanas iespējām studentu patstāvīgās mācīšanās prasmju pilnveidei, lai studenti varētu aktīvi apgūt jaunas zināšanas un lietot tās praksē.

Hiperteksta modelis izveidots, pamatojoties uz teorētiskiem pētījumiem un hiperteksta modelēšanas principiem, kam pamatā ir lineāra teksta informācijas strukturēšana. Tas aptver studentu potenciālās profesionālās zināšanas, kas studentiem nepieciešamas, un izzināmo objektu būtības struktūru un funkcionālās īpatnības, kas tiek atklātas ar valodas semantiskajām un gramatiskajām hipersaitēm.

Rakstā ir iekļauti empīriskā pētījuma rezultāti, kas balstās uz studentu patstāvīgās mācīšanās komponentu attīstības pašnovērtējumu un testu rezultātiem. Ir veikta arī rezultātu statistiskā analīze. Pētījuma **rezultāti** apstiprināja izstrādātā hiperteksta modeļa efektivitāti. Integrējot to pareizi organizētā, t.i., mērķim atbilstošā studiju procesā, sekmēta studentu jaunu zināšanu veidošanās un izzinošās patstāvības attīstība.

**Atslēgvārdi:** informācijas tehnoloģijas, hiperteksts, didaktiskā modelēšana, profesionālo zināšanu strukturēšana

### **Годе, И. МОДЕЛИРОВАНИЕ САМОСТОЯТЕЛЬНОЙ РАБОТЫ СТУДЕНТОВ ПОСРЕДСТВОМ ПРИМЕНЕНИЯ ВОЗМОЖНОСТЕЙ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ**

В статье рассмотрена проблема повышения эффективности самостоятельной работы студентов на основе использования модели гипертекста, разработанной автором с целью расширения возможностей самостоятельного освоения студентами знаний и применения их в последующей профессиональной деятельности.

Модель гипертекста создана на основе теоретических исследований и принципов гипертекстового структурирования информации, охватывающей профессионально ориентированные тексты на английском языке и раскрывающие их суть, структуру и функциональные особенности посредством формирования семантических и грамматических гиперссылок и узлов.

В статье представлены **результаты** опроса и тестирования студентов, проведенного в рамках исследования уровня развития навыков в самостоятельной познавательной деятельности студентов, а также приведены результаты статистического анализа. Был сделан вывод о том, что применение гипертекста наряду с другими методами и формами обучения способствует формированию новых знаний и совершенствованию познавательной активности студентов.

**Ключевые слова:** информационные технологии, гипертекст, дидактическое моделирование, структурирование профессиональных знаний