

УНИВЕРЗИТЕТ „ГОЦЕ ДЕЛЧЕВ“ – ШТИП  
ФАКУЛТЕТ ЗА ОБРАЗОВНИ НАУКИ  
UNIVERSITY “GOCE DELCEV” SH TIP  
FACULTY OF EDUCATIONAL SCIENCES



**ОБРАЗОВАНИЕТО ВО XXI ВЕК  
– СОСТОЈБИ И ПЕРСПЕКТИВИ –**

**МЕЃУНАРОДНА  
НАУЧНА КОНФЕРЕНЦИЈА  
– ЗБОРНИК НА ТРУДОВИ –**

**EDUCATION IN XXI CENTURY  
– CONDITIONS AND PERSPECTIVES –**

**INTERNATIONAL SCIENTIFIC  
CONFERENCE  
– PROCEEDING BOOK –**

Штип, 24 – 25 Септември, 2015  
Shtip, September, 24-25, 2015

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## LADIES AND GENTLEMEN, DEAR GUESTS!

With great honor and pleasure I welcome You on behalf of all teachers, associates, employees and students of the Faculty of Educational Sciences at the University "Gotse Delchev" in Shtip and I wish You pleasant moments during this solemn event organized to mark 20 years of university education of teachers.

But in fact, the Faculty of Educational Sciences basis its twenty years of existence on 146 year continuous development of formal education of teachers and preschool teachers in the region. The achievements of the Pedagogical-Seminary school founded in 1869, the existence of which is linked to the name of the creator of the first primer and the first textbook for teachers - School Pedagogy - Josif Kovachev, and to the name of the great teacher Gotse Delchev, followed by the School for Teachers established in 1946, Higher Pedagogical School founded in 1959, and the Pedagogical Academy (1961) are woven into the tradition and development of our Faculty.



In 1995 the two-year formal education of teachers and preschool teachers developed into four-year university studies.

In 2007 the Pedagogical Faculty became part of the State University "Goce Delchev" in Shtip, said to be the fastest growing university in Macedonia.

Following the global trends in teacher education, modern trends in education policymaking in Europe and in the world, respecting the knowledge of the history of civilizations as an important intellectual resource for social development, as well as scientifically and experientially diagnosed educational challenges that have emerged as a result of deep changes of values in our society and globalization trends (scientific, educational, technological, and economic) the Faculty of Educational Sciences has designed study programs for I, II and III cycle of studies in accordance with the organizational - pedagogical quality standards in compliance with the principles of the Bologna Declaration and European credit-transfer system with a high level of recognition in the area of European Higher Education.

If 20 years ago our Faculty started to implement teaching with 5 PhDs and 3 masters as regular employees, today we can proudly say that our academic community is comprised of 20 PhDs and one master.

Today our students have the opportunity to educate themselves at the faculty which sees its future as a continuous development aimed at:

- Strengthening and expanding international partnerships
- Popularization of mobility of students and staff,
- Internationalization and improvement of scientific research work,
- Improvement of pedagogical approaches to teaching and links with practice, putting students at the center of the educational process.

**Ladies and Gentlemen,**

I take this opportunity to thank you for coming today to celebrate with us the teaching profession and our contribution to it.

We are quite aware that the road to success is long and winding and it is easier to travel with joint forces. That is why we wanted to mark this celebration by organizing a scientific conference dedicated to education in the 21st century. Let us share our knowledge, understanding and experiences regarding the situation and perspectives and suggest possible ways of modernization. 89 papers have been submitted and there are authors from 8 countries. This is really promising!

Once again, I wish you all a warm welcome and successful work.

Dean,  
Prof. d-r Sonja Petrovska  
24. 09. 2015., Stip

**ПОЧИТУВАНИ ...**

Со голема чест и задоволство, Ве поздравам во името на сите наставници, соработници, вработени и студенти на Факултетот за образовни науки при Универзитетот Гоце Делчев во Штип и Ви посакувам пријатни моменти во текот на оваа свечена манифестација организирана по повод 20 годишно факултетско образование на наставници и воспитувачи.

Факултетот за образовни науки своето постоење го темели на 146 годишниот континуиран развој на формалното образование на наставници и воспитувачи на овие простори. Во традицијата и развојот на нашиот факултет се вткаени достигнувањата на Педагошко-богословското училиште основано во 1869 год. Со чие постоење се врзува името на творецот на првиот буквар и првиот учебник за наставници – Школска педагогија – Јосиф Ковачев, и името на големиот учител Гоце Делчев, па Учителската школа основана во 1946 год, Вишата педагошка школа формирана во 1959 год, Педагошката академија (1961 год.).

Во 1995 година формалното двегодишно образование на наставници и воспитувачи прераснува во четиригодишно факултетско образование.

Во 2007 година Педагошкиот факултет стана дел на државниот Универзитет „Гоце Делчев“ во Штип, кој го носи епитетот најбрзорастечки Универзитет во Р Македонија.

Следејќи ги глобалните тенденции во образованието на наставници, современите тенденции во креирањето на образовните политики во Европа и во Светот, респектирајќи ги знаењата за историјата на цивилизациите како значаен интелектуален ресурс за општествениот развој, како и научно и искусствено дијагностицираните воспитни предизвици кои се појавија како резултат на длабоките вредносни промени во нашето општество и глобализациските тенденции (научни, образовни, техничко-технолошки, економски) ФОН дизајнираше студиски програми за I, II и III циклус на студии согласно организациско –

педагошки стандарди за квалитет, согласно принципите на Болоњската декларација и Европскиот кредит-трансфер систем, со високо ниво на препознатливост во Европскиот високообразовен простор.

Ако пред 20 години нашиот факултет започна да ја реализира наставата и вежбите со 5 доктори на науки и 3 магистри, како редовно вработени, денес со гордост можеме да кажеме дека оваа академска заедница ја сочинуваат 20 доктори на науки и 1 магистер.

Денес нашите студенти имаат можност да се образуваат на факултет кој својата иднина ја гледа како континуиран развој во насока на:

- зајакнување и проширување на меѓународните партнерства,
- омасовување на мобилноста на студентите и на вработените,
- интернационализација и подобрување на научно-истражувачката работа,
- унапредување на педагошките пристапи во наставата и врските со практиката, поставувајќи ги студентите во центарот на образовниот процес.

#### **Почитувани присутни,**

Ја користам оваа прилика, да ви се заблагодарам што дојдовте денес заеднички да го чествуваме учителското дело и нашиот придонес во него.

Ние сме сосема свесни дека патот до успехот е долг и кривулест но и дека полесно се патува со заеднички сили. Затоа ова наше празнување сакавме да го одбележиме со Научна конференција посветена на образованието во 21 век, да ги споделиме нашите знаења, разбирања и искуства во врска со состојбите и перспективите како и да предложиме можни начини за негово осовременување.

Уште еднаш, На сите Ви посакувам топло добредојде и успешна работа!

Декан,

Проф. д-р Соња Петровска

24. 09. 2015. година Штип



## TABLE OF CONTENTS

1. СО КВАЛИТЕТНИ ПРОМЕНИ ДО ПОКВАЛИТЕТНО УЧИЛИШТЕ <b>Блаже КИТАНОВ</b> .....	5
2. LANGUAGE CULTURE – A SEGMENT OF LANGUAGE EDUCATION <b>Violeta NIKOLOVSKA</b> .....	9
3. RESEARCH TRENDS IN EDUCATION IN MULTICULTURAL ENVIRONMENTS IN THE REPUBLIC OF MACEDONIA <b>Elizabeta TOMEVSKA-ILIEVSKA, Emilija SIMONOVSKA JANACKOVSKA, Sadudin SADIKI</b> .....	15
4. USING AUTOMATIC TEXT CATEGORIZATION TECHNOLOGIES IN THE MODERN EDUCATIONAL PROCESS <b>Anna GLAZKOVA</b> .....	23
5. THE ROLE OF BUSINESS SCHOOL IN THE POST-GRADUATE EDUCATIONAL SYSTEM <b>Nikita RAVOCHKIN</b> .....	27
6. FORMATION OF ETHICAL RULES (CODE) IN PRESCHOOLERS THROUGH THE BULGARIAN CHILDREN'S FOLKLORE GAMES <b>Julia DONCHEVA</b> .....	32
7. FORMATION OF HUMAN POTENTIAL: INSTITUTIONAL MECHANISMS AND POLICIES <b>Stanka RINKOVA</b> .....	36
8. THEORETICAL FORMULATION AND SCIENTIFIC JUSTIFICATION OF THE PROBLEM OF TRAINING TEACHERS IN TECHNICS, TECHNOLOGY AND ENTREPRENEURSHIP <b>Tsvetana KOSTADINOVA ANTIPESHEVA</b> .....	41
9. INTERACTIVITY IN TEACHING STUDENTS MODERATORS <b>Kosta KOSTOV, Silvia KYUCHUKOVA, Hristina MILCHEVA</b> .....	45
10. EVALUATION OF STUDENTS' LEARNING UNDER THE PRISM OF EXPECTED OUTCOMES <b>Teuta SHABANI, Suzana NIKODINOVSKA BANCOTOVSKA</b> .....	49
11. COMMUNICATION IN THE TEACHING PROCESS. INTERACTIVE NATURE OF COMMUNICATION <b>Valentina VASILEVA</b> .....	57
12. PHYSICAL ACTIVITY OF 3-4 YEARS OLD CHILDREN IN KINDERGARTEN <b>Filip SHABANSKI</b> .....	60
13. MACEDONIAN LANGUAGE IN SECONDARY EDUCATION <b>Liljana MAKARIJOVSKA, Zhaklina GJORGIJOSKA</b> .....	64
14. STUDENTS' ATTITUDES TOWARDS TEACHING GRAMMAR IN THE FOREIGN LANGUAGE CLASSROOM <b>Vesna KOCEVA, Marija TODOROVA</b> .....	69
15. FOREIGN LANGUAGE CLASSROOM ANXIETY <b>Marija TODOROVA, Vesna KOCEVA</b> .....	75
16. TEACHERS AS A FACTOR FOR THE DEVELOPMENT OF KEY COMPETENCE CULTURAL EXPRESSION AMONG STUDENTS <b>Svetlana PANDILOSKA GRNCHAROVSKA, Fadbi OSMANI, Gordana STANKOVSKA</b> .....	82
17. INTRODUCTION OF THE DUAL SYSTEM IN THE BULGARIAN VOCATIONAL EDUCATION – REALITY AND CHALLENGES <b>Svetlana NIKOLAEVA</b> .....	86

18. THE VALUES OF EDUCATIVE FUNCTION IN RELATION PARENT-SCHOOL <b>Ardita CEKA, Rabije MURATI</b> .....	89
19. ELECTRONIC VERSUS TRADITIONAL TEST FOR MATHEMATICS IN PRIMARY SCHOOLS <b>Katerina PANEVA</b> .....	93
20. THE SIGNIFICANCE OF LOCALLY DEVELOPED EDUCATIONAL SOFTWARE IN THE PROCESS OF SCHOOLS' COMPUTERIZATION <b>Olga SAMARDJIKJ JANKOVA</b> .....	99
21. THE ACTIVITY OF MUSICAL GAMES FOR CHILDREN <b>Mujeser ILJAZI</b> .....	105
22. THE PATIENT IN THE PROCESS OF LEARNING IN HIGHER MEDICAL SCHOOL <b>Silvia KYUCHUKOVA</b> .....	110
23. INFORMATION AND COMMUNICATION TECHNOLOGIES IN TEACHING MUSIC EDUCATION <b>Lence NASEV</b> .....	113
24. LEISURE TIME AND SPORT ACTIVITIES OF STUDENTS FROM THE FACULTY FOR PRESCHOOL AND PRIMARY SCHOOL EDUCATION AT SOFIA UNIVERSITY "ST. KLIMENT OHRIDSKI" – BULGARIA <b>Georgi IGNATOV</b> .....	116
25. PLACE OF LIVING AS A FACTOR IN ORGANIZING STUDENTS' LEISURE TIME <b>Despina SIVEVSKA, Biljana POPESKA</b> .....	122
26. METHODOICAL APPROACH TO LEARNING ABOUT THE HOLOCAUST BY THE MODEL OF YAD VASHEM SCHOOL <b>Zhivorad MILENKOVIC</b> .....	129
27. A HERMENEUTIC READING OF A POETIC LITERARY WORK DURING IMPLEMENTATION OF A LESSON <b>Milena RISTOVA-MIHAJLOVSKA</b> .....	136
28. SOME GUIDELINES FOR INTELLECTUAL PREPARATION DURING PHYSICAL CONTACT BETWEEN THE INSTRUMENT AND THE PIANIST <b>Angele MIHAJLOVSKI</b> .....	142
29. IMPLICATION OF EFFECTIVE SCHOOL MANAGEMENT FOR THE CONTINUING PROFESSIONAL DEVELOPMENT OF TEACHERS <b>Kristinka OVESNI, Emina HEBIB, Vera RADOVIĆ</b> .....	148
30. THEORIES, SOCIAL EXPERIENCES AND PRACTICE IN INTERCULTURAL PEDAGODY <b>Alina SZCZUREK-BORUTA</b> .....	157
31. TEACHERS' ASSESSMENTS OF CERTAIN CURRICULAR DETERMINANTS IN PRIMARY SCHOOL <b>Milan MATIJEVIĆ, Siniša OPIĆ, Goran LAPAT</b> .....	162
32. THE SOCIO-POLITICAL IMPACT OF THE NEW SCIENTIFIC AND EDUCATIONAL TRENDS IN ARCHAEOLOGY, HISTORY AND RELATED FIELDS <b>Ljuben TEVDOVSKI</b> .....	172
33. THE PRACTICE OF TAEKWONDO AS A PREDICTOR OF MOTOR ABILITIES <b>Ivan PRSKALO, Anamaria RADIĆ</b> .....	178
34. THE RELATION MOTIVE - TEACHING CONTENT IN STIMULATING COGNITIVE ABILITIES THROUGH ARTISTIC ACTIVITIES AT PRESCHOOL AGE <b>Maja RAUNIK KIRKOV</b> .....	182
35. CONTEMPORARY ADULT LITERACY MODELS <b>Elena RIZOVA, Zoran VELKOVSKI</b> .....	188

36. COMPARATIVE ANALYSIS OF PROGRAMS FOR PRE-SCHOOL EDUCATORS IN EUROPE <b>Kiril BARBAREEV, Alma TASEVSKA</b> .....	196
37. INCLUSIVE EDUCATION - ROLE OF THE TEACHER AND BENEFITS <b>Sonja PETROVSKA</b> .....	203
38. THEORETICAL APPROACHES TO MODERN INTERPRETATION OF PEDAGOGY OF PHYSICAL EDUCATION AND SPORTS <b>Eleonora MILEVA</b> .....	210
39. POSTMODERN CONCEPTS OF FOUCAULT'S EDUCATION AND ITS RELATIONSHIP WITH DISCIPLINE <b>Kushtrim AHMETI</b> .....	215
40. ECOLOGY – A NECESSARY FACTOR IN TEACHING METHODS FOR NATURE AND SOCIETY STUDIES FOR FORMING A RESPONSIBLE PERSON <b>Oliver CACKOV, Tatjana GREGOVA</b> .....	219
41. THE ISSUE OF RESPECTING THE DEVELOPMENTAL POSSIBILITIES AND ACTIVITY-PLANNING IN EARLY CHILDHOOD DEVELOPMENT <b>Alma TASEVSKA, Kiril BARBAREEV</b> .....	223
42. INTEGRATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES INTO PRESCHOOL EDUCATION <b>Tatyana V. NIKULINA</b> .....	228
43. WHAT SHOULD MODERN SCHOOL LEARN <b>Snezana KIROVA, Dragana KUZMANOVSKA, Biljana IVANOVA</b> .....	233
44. EDUCATIONAL FUNCTION OF THE SCHOOL IN CONTEMPORARY SOCIETY <b>Emilija PETROVA GORGEVA, Mitko KOCEV</b> .....	238
45. SOME METHODS IN TEACHING PHYSICAL AND HEALTH EDUCATION <b>Marjan MALCEV</b> .....	243
46. REVIEW OF ADOLESCENT LITERATURE THROUGH COMPARATIVE ANALYSIS OF THE NOVELS "THE BLUE PATH OF LOVE" BY METODI MANEV AND "VOICE OF LOVE" FROM GROZDANA OLUJIC <b>Jovanka DENKOVA</b> .....	247
47. INTERPRETATION OF A LYRIC POEM IN IV AND V GRADE <b>Blaze KITANOV, Irena KITANOVA</b> .....	253
48. TRAINING EFFICIENCY OF CYCLISTS SPECIALIZED IN ROAD CYCLING <b>Ivan KOLEV</b> .....	258
49. PHYSICAL EDUCATION AND DIAGNOSTIC PROCEDURES <b>Veselina IVANOVA, Galena TERZIEVA</b> .....	262
50. PROTECTION OF IMMOVABLE CULTURAL HERITAGE THROUGH EDUCATING STUDENTS OF PRIMARY AND SECONDARY EDUCATION <b>Trajce NACEV, Dragan VESELINOV</b> .....	265
51. FORMATION OF TOLERANCE IN ADOLESCENTS <b>Valentina VASILEVA</b> .....	271
52. NEW EDUCATIONAL POLICIES AND THEIR REFLECTIONS ON SOCIAL DEVELOPMENTS <b>Daniela KOCEVA, Snezana MIRASCIEVA</b> .....	275
53. PRESENCE OF ENTREPRENEURSHIP IN PRIMARY EDUCATION IN MACEDONIA <b>Lulzim MEHMETI</b> .....	280
54. CONSONANT /J/ IN COLLOQUIAL SPEECH AND ITS IMPACT ON WRITING <b>Blaga PANEVA</b> .....	284
55. METHODOLOGICAL STRUCTURE OF A LESSON FOR INTERPRETATION OF A FAIRY TALE <b>Irena KITANOVA</b> .....	289

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56. THE INFLUENCE AND THE EFFECTIVENESS OF FORMATIVE ASSESSMENT AND THE FEEDBACK IN STUDENTS' SUCCESS AND ACHIEVEMENTS <b>Valdeta ZENUNI-IDRIZI</b> .....	294
57. AESTHETIC EDUCATION OF EDUCATORS AS A FUTURE CHALLENGE <b>Valentina PAJAZITI, Vlora MARKU-TUQI</b> .....	299
58. SOCIAL AND COMMUNICATIONAL-INTERACTIVE COMPETENCES OF TEACHERS AND STUDENTS IN EDUCATION <b>Florina SHEHU</b> .....	302
59. INFLUENCE OF MEDICINES ON THE COGNITIVE SKILLS OF CHILDREN WITH CHRONIC DISEASES <b>Elena IVANOVA BUYUKLIEVA</b> .....	308
60. THE SPIRITUAL ASPECT OF HUMAN DEVELOPMENT AND THE EDUCATION IN XXI CENTURY <b>Eleonora PENCHEVA</b> .....	312
61. RESEARCH IN TEACHING PRACTICE <b>Snezana JOVANOVA-MITKOVSKA</b> .....	316
62. HOW ARE PEACE AND TOLERANCE REPRESENTED IN HISTORY TEXTBOOKS FOR PRIMARY AND SECONDARY EDUCATION <b>Todor CEPREGANOV, Sonja NIKOLOVA</b> .....	324
63. ETHICS AS TEACHING <b>Trajce STOJANOV</b> .....	330
64. RISK ASSESSMENT OF HYGIENIC AIR QUALITY UPON PRESCHOOL CHILDREN'S HEALTH IN KINDERGARTEN "VERA CIRIVIRI TRENA" IN SHTIP <b>Snezana STAVREVA VESELINOVSKA</b> .....	335
65. ABOUT SOME EDUCATIONAL GOALS IN TEACHING-SOCIO-CULTURAL PROBLEM OR A CHALLENGE MODERN EDUCATION <b>Snezana MIRASCHIEVA, Emilija Petrova GJORGJEVA, Daniela KOCEVA</b> .....	339
66. ESCAPE FROM THE WAR –TIME IN THE UNCERTAINTIES OF LIFE TO REFUGEE IN BULGARIA. FUNDAMENTAL RIGHTS OF PERSONS SEEKING INTERNATIONAL PROTEKTION IN TERMS OF THE BUREAUCRATIC SYSTEM IN BULGARIA <b>Pavlin PETROV</b> .....	344
67. HIGHER EDUCATION IN THE PERIOD OF TRANSITION <b>Verica JOSIMOVSKA</b> .....	353
68. RESEARCH OF THE CONFLICT ZONES IN THE SYSTEM OF INTERPERSONAL RELATIONSHIPS OF THE CHILD BY THE METHODOLOGY OF RENE GILLE <b>Julia DONCHEVA</b> .....	356
69. CLASSROOM SOCIAL CLIMATE <b>Despina SIVEVSKA</b> .....	360
70. COMPATIBILITY OF PRESCHOOL AND PRIMARY SCHOOLA IN R. MACEDONIA <b>Snezana JOVANOVA-MITKOVSKA, Biljana POPESKA</b> .....	366
71. THE IMPORTANCE OF THE CAREER CONSELING PROCESS <b>Tanja ATANASOSKA, Biljana CVETKOVA DIMOV, Ana GJORGJEVA</b> .....	376
72. ROLE OF MANAGEMENT IN IMPLEMENTING EDUCATION INCLUSIVE POLICIES <b>Sadete TERNAVA-OSMANI, Voglushe KURTESHI</b> .....	380
73. WHICH FACTORS ACCORDING TO THE PARENTS AFFECT THE EDUCATION OF CHILDREN <b>Voglushe KURTESHI</b> .....	385

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74. THE PHILOSOPHICAL PARADIGM OF SIGMUND FREUD <b>Slobodan MARKOVIC</b> .....	370
75. EDUCATIONAL NEEDS AND ACHIEVEMENTS OF ROMA CHILDREN AND OTHER CHILDREN FROM MARGINAL ETHNIC GROUP IN RM <b>Stevan ALEKSOVSKI</b> .....	377
76. COMMUNICATIVE-PEDAGOGICAL FEATURES OF COMMUNICATION IN THE EDUCATIONAL PROCESS-COMMUNICATIVE COMPETENCE <b>Biljana GRAMATKOVSKI, Jasminka KOCHOSKA</b> .....	387

## USING AUTOMATIC TEXT CATEGORIZATION TECHNOLOGIES IN THE MODERN EDUCATIONAL PROCESS

Anna GLAZKOVA<sup>1</sup>

### Abstract

*The active improvement of natural text processing gives a lot of opportunities for the development of educational technologies. It is well-known that the participants in the modern educational process are faced with the need to quickly view and classify large volumes of text documents. This problem arises everywhere: while searching the Internet for information in digital libraries, working with text databases and other elements of the educational process. The improvement of text categorization technologies can make information retrieval more efficient and therefore help the learner to more quickly and efficiently find the necessary information.*

*The research deals with the problem of text categorization by the example of its assignment to a particular age audience. In the first place, the solution to this problem gives the ability to improve the relevance of information retrieval and also allows improvement of the mechanisms of excluding unwanted requests from the search results (such as websites whose content is designed for another age category).*

*The authors of the research are developing approaches to mathematical modeling of the text categorization task. These approaches are implemented within a prototype software system for automatic text categorization based on the age of the text audience. In developing this system the authors are using texts in Russian, but the proposed methods are universal and can be applied to other related tasks.*

**Keywords:** *information retrieval; natural language processing; text mining;*

### 1. Introduction

Text repositories in the field of education are constantly growing. Large text repositories need advanced information management and natural language processing to be efficiently accessed, therefore the development of methods and software for the automated processing of information has become an important task.

The need to improve the search tools in electronic documentary space is not in doubt. In this case, information retrieval, as a rule, is a comparison of the specified text fragments of natural language texts. Recent developments of search engines are primarily aimed at enhancing capabilities of text processing, which leads to a relevance requests increase. System of text categorization and text clustering, which main task is to carry text in a particular class or cluster, can help the learner reduce the number of documents viewed to find the actual information.

### 2. Text Categorization Based on the Age Audience

This research deals with the problem of text categorization by the example of their assignment to a particular age audience. This problem relates to the number of poorly formalized tasks that are extremely complex and contain a plenty of parameters due to the complexity of natural language and its variety of forms of communication. The search for ways to solve it requires the construction of adequate mathematical models of the process of classification.

### 3. Related Work

There are many areas of automatic text processing, the development of which may potentially contribute to the ease or difficulty of understanding complex text. Based on the specifics of the problem, the particular interest to this study are the works whose authors extracted from the text data about its author or addressee.

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<sup>1</sup> Institute of Mathematics and Computer Science (Tyumen State University), Tyumen, Russia, anya\_kr@aol.com,

A number of articles are devoted to the text author characterization, such as age, gender, personality type and ethnicity (Grechnikov, et al., 2009; Nguyen, et al., 2011; Santosh, et al., 2013). Choi and others (2013) offer approach to the use of methods of recognition of the sender of the text to find entries of terrorist subjects in the Internet. Some articles (Akker, et al., 2009; Baba, et al., 2012; Lee, et al., 2013) consider the task of creating a dialogue systems, which are analyzed the features that characterize the text in terms of its orientation to the various audiences. Sheehan and others (2013) suggest their own approach for estimation the text complexity.

The use of natural language processing in education is discussed by Zakharova (2003), Burstein (2009), and Zechner (2012).

#### 4. An Approach: Description and Testing

If we estimate the educational text in terms of its information content for different age groups, it is clear that the text addressed to students of elementary school will usually more informative for high school students than for adults. Similarly, a text addressed to adults would be more understandable for high school students than for children. However, one can argue that the text is equally interesting and informative for members of these age audiences, i.e. that it corresponds the levels of communicative development of these age groups. In this case, it makes sense to talk about a certain distance between the age categories.

##### 4.1. An Approach to Mathematical Modeling of the Text Categorization Task

Suppose given a text  $T$  and a set of categories  $K=\{K_1, K_2, \dots, K_n\}$ . Need to find a subset of  $K_i$  – a category, which may be associated with the text:  $T \sim K_i$ ,  $K_i = \{K_i: T \sim K_j\}$ , where  $i=j_1, j_2, \dots, j_m$  and  $1 \leq i \leq n$ . So the category  $K_i$  can be presented as  $K_i = \{q^{K_j}, w^{K_j}\}$ , where  $q^{K_j}$  – categorization feature,  $w^{K_j}$  – weight coefficient of categorization feature,  $L$  – total count of categorization features.

Measure of proximity of categories was defined as the Mahalanobis distance as the features of objects are statistically dependent and their relevance is determined by weight coefficient.

##### 4.2. Features

Three types of categorization features were developed: morphological, quantitative and lexical.

Morphological features include:

- Number of verbs

- Number of special verbs forms (transgressives, participles)

- Number of adjectives, etc.

Quantitative features are:

- Average count of words in a sentence

- Average length of words in a text

- Number of polysyllable words in a text (more than three), etc.

For estimation of lexical features of the text suggested creating bag-of-words model for both children and adults texts. Then by the subtraction sets of words the author offer to make a list of words that are present in the same category and absent in the other. This type of features was not considered in this experiment.

##### 4.3. Corpora

Two text collections are considered in this research. Our training corpus includes 532 texts of children's fiction and non-fiction literature and 510 texts addressed to adults. We added the third category separated from children literature that contains texts addressed to high school students. In the testing we used the part of the Russian National Corpus (RNC). Till the moment, the RNC contains the most diverse and grammatically correct texts of various genres in Russian. Every text in the RNC is supplied with the extralinguistic sociological information, which characterizes a text as a whole. The main items of this information concern the author's characteristics (name, age) and the text-as-a-whole characteristics (title, date of creation, genre, and so on) (Grishina, 2009).

##### 4.4. Results

Table 1 provides the numeric values of some categorization features for different categories. The category A includes texts addressed to adults, the category B consists of texts for high school students and the category C is the texts of children's fiction and non-fiction literature (primary school and preschool).

**Table 1. The values of the categorization features.**

Feature	Category A	Category B	Category C
Number of verbs (%)	0,2	0,2	0,21
Number of special verbs forms (%)	0,03	0,027	0,025
Number of adjectives (%)	0,11	0,1	0,1
Average count of words in a sentence	11,3	6,5	6,1
Average length of words in a text	7,4	6,7	6,2
Number of polysyllable words in a text (%)	22,95	16,9	13,9

Thus, the categories were represented as vectors, i.e. sets of feature values. The distances between these categories were calculated as the Mahalanobis distance. The distance values rounded to the nearest hundredth presented in Table 2.

**Table 2. The distance values.**

Categories	Value
Category A & Category B	1,75
Category A & Category C	2,12
Category B & Category C	0,37

The values presented in the Table 2 show that the distance between the categories B and C is minimal and, on the contrary, the distance between the texts addressed to adults and texts from the category C is the biggest.

## 5. Summary and Decision

This study demonstrated an example of using of automatic text categorization technologies for processing of texts addressed to different age groups of readers. These values allow quantifying the differences between these groups of texts. On the basis of these differences any text can be assigned to one of the declared category.

The results can be used by:

- E-learning systems (for selecting digital textbooks and other course materials)
- Electronics libraries (searching learning materials)
- Search engines (selecting relevant content)
- Automatic abstracting and reviewing systems (digital materials categorization), etc.

The using of modern technologies of text processing helps to develop open access to education. Learning materials can be more accessible for their target audience by improving the mechanisms for information retrieval.

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