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TABLE OF CONTENTS:

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Comparison Between Offline and Online Teaching in a Turkish Language

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Abstract

In the wake of the global pandemic, the need for having an alternative method for education grew considerably. Globally, institutions had to embrace distance learning and begin online classes to ensure their students' education was not interrupted by the pandemic. This study was done to observe the differences in students' achievement in online and offline groups to help Turkish language educators determine which method brings more positive results to students. The study was done in Nurorda school in Nur-Sultan, Kazakhstan with 60 participants from the 7th-grade class in a Turkish Language class. The students were in two groups, 50 students in the offline format while 10 students were in the online format. The students were taught for 5 weeks and in the 6th week, a final exam was conducted to test students' understanding. The scores of the students were obtained and an Independent Sample t-test was conducted to determine if there is any statistically significant difference between the two methods. The study found that there is no statistically significant difference between online and offline modes of instruction because our t-test was 0.083>0.05 after the analysis was done. Both methods were found to express the same results when it comes to students' achievement and were both equally effective in enhancing understanding and comprehension of the topic in Turkish language education.

Keywords: Online education, offline education, Turkish language class, student achievement

INTRODUCTION

In this modern era, Turkish language education is evolving gradually to suit the needs of both educators and learners. Rachman (2020) states that face-to-face learning is the most direct way to learn although, with the increasing reliance on technology, online learning has provided instructors with an opportunity to widen access to quality education at affordable costs.

Tallent-Runnels et al. (2006) describe synchronous online classes as students logging in to an online platform at the same time and are communicating. Mehtap (2018) states that digital literacy is very important in the current era, as everyone can access the internet and adds that prospective teachers in Turkish language education will become capable of exploiting communication technologies and knowledge effectively by becoming digitally literate.

Technology makes access to information easier and widens this access compared to traditional teaching, however, Turkish language teaching requires constant practice of a language through speaking which is more effective in a face-to-face setting. Learners need to practice speaking with the instructor and be able to make mistakes freely and be corrected. This creates a special bond of relationship between the instructors and learners that builds a positive attitude in students to keep learning.

Colpaert (2006) argues that activities in online pedagogy aren't necessarily new but just an improvement of pre-existing activities that were already being done offline by the teachers. Technology has made these activities easier and more interesting but has in turn reduced teacher-student interactions. In understanding learning models, knowing what students do is just as important as teaching (Rienties, Bart, et al. 2018).

In the wake of the global pandemic, teachers and instructors around the world have been forced to find alternative methods of teaching because the offline method was put off for a while. This study was done to address this concern by educators if the online method would be as effective as the offline method or even more.

LITERATURE REVIEW

Hart, Cassandra MD, et al. (2019), in their article on online and offline outcomes state that online course-taking is rapidly increasing in popularity. After observing a wide range of students and online courses, they concluded that online course taking improves the chances of students to progress through school because it opens access to education for different groups of students breaking even the geographical barrier.

Rahimi, Mehrak, and Yadollahi (2017), in their article on EFL learners to develop their language literacy, noted that online digital language learning was more effective because it increased the digital literacy of students. They argued that this online platform made learning languages more interesting and motivational to the students. The students developed a positive attitude towards language learning and were more interested in the lessons.

Ushida (2005), argues that online studying is effective when students can wisely direct their studies and be self-motivated to learn. He adds that not all students utilize the resources offered by technology causing a dynamic tension in the learning process of students. Motivated students perform better in online studies because of the flexibility online platforms offer. Teachers need to develop a culture of self-motivation in their classrooms for online studies to be effective. Blake (2011), states that the current enthusiasm of young learners towards online social networks makes it possible for them to be more successful in digital learning environments increasing student achievement.

Chenoweth, Ann, Ushida, and Murday (2006) in their article on language learning, used 354 students and 11 teachers for five semesters to investigate online and offline language learning. They found that despite hybrid online courses gaining popularity and being averagely successful, offline courses still outperformed online courses. They argue that this is because students still require guidance from instructors and both learners and instructors need training and technical support to successfully implement online instruction.

Chenoweth, Ann, and Murday (2003) investigated student achievement and satisfaction between online and offline instruction in a French course. They realized that there was no statistically significant difference between the two modes of instruction even though students from online classes expressed a bit of frustration and reported to have spent fewer hours of self-study compared to their counterparts in the offline group. Cha and Kim (2011) also emphasized that students who are self-directed learners were more likely to benefit from online classes because of the culture of procrastination among students.

PURPOSE OF THE STUDY

The purpose of this study was to compare the differences between online education and offline education in a Turkish language class by looking at students' achievement scores among 7th-grade students in Nur-Sultan, Kazakhstan.

RESEARCH QUESTION

1. Is there a significant difference in students' achievement between online and offline learning in a Turkish Language class?

METHODOLOGY

The students were asked to choose their preferred mode of instruction by the teacher. All the students were taught by the same teacher for a period of 6 weeks before sitting for a final exam. Initially, the teacher explained to the students in both groups about the objectives of the study, and the students were allowed to select their groups. The total number of students was 60 in both groups. 50 students selected the offline method and were used as the control group while 10 students selected the online method and were used as the experimental group. Their academic achievement was then used as the source of data.

INSTRUMENT

Final test: The instrument used was a final exam that was administered at the 6th week on both groups. The exam was standardized and covered all the content taught to both groups in the 6-week period. The students from both groups did the same exam and the teacher minimized cheating in both groups by making strict supervision during the exam. The exam contained 50 multiple-choice questions selecting from A to E.

DATA COLLECTION AND ANALYSIS

Data was taken from the scores of the students after the final exam. The scores were recorded and the mean of both groups was calculated before an Independent t-test was conducted to determine any statistical difference between the two groups. After the t-test, the results were analyzed by the researchers using the values retrieved.

PROCEDURE

The students selected their preferred mode of instruction and were put into two groups, one in the offline format while the other in an online format, and were being taught by the same instructor. The students in the offline format attended classes from the school in Nurorda and were being taught in a face-to-face format while the students in the online group were studying from online platforms like zoom.

The teacher taught using zoom and gave assignments and projects for the students to do online. The instructor tried to ensure that both groups covered the topics at the same pace and undertook the same projects and quizzes to enhance similar topic coverage. At the end of the 5-week period, the instructors and the researchers prepared a final test that covered the whole topic and tested the students' speaking, grammar, and writing skills from the topics taught in the coursebook.

The offline group did the test in school while the online group did the test through an online format. The system of the questions and the number of questions were similar for both groups to ensure uniformity in data collection. The test was conducted during one of the mathematics periods in the last week of the study and lasted 40 minutes. The students were taught the topics 'Ev konusu' and 'Okul konusu' using the 'Lale Turkçe' coursebook for a period of 5 weeks in periods lasting 40 minutes per lesson.

There are 3 periods for every group in a week totaling two hours of lesson per week for both groups. In the 6th week, the students were given a final exam from the topics taught covering all the content. The exam lasted 1 hour for both groups and contained 50 questions. The teacher then recorded the scores of each student in both groups. The mean of the students in each group was found and an Independent t-test was conducted by the researchers to determine and statistically significant differences.

RESULTS

Table 1: Group Statistics

groups		N	Mean	Std. Deviation	Std. Error Mean
scores	Offline teaching	50	71.80	11.551	1.634
	Online teaching	10	64.50	13.834	4.375

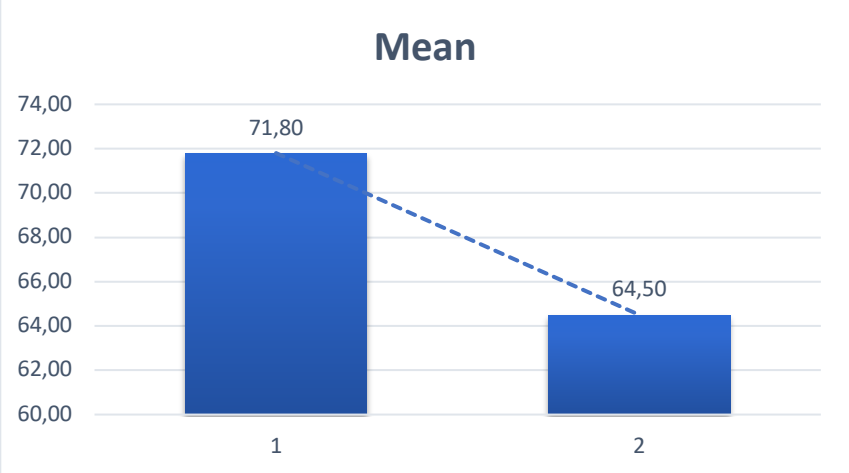

Table 1 represents the mean scores of both groups.

Group 1 represents offline group while group 2 represents online group.

Table 2: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
scores	Equal variances assumed	.945	.335	1.766	58	.083	7.300	4.134	-.975	15.575
	Equal variances not assumed			1.563	11.643	.145	7.300	4.670	-2.909	17.509

Table 2 represents the t-test analysis
Group 1 represents the control group with a mean score of 71.80.
Group 2 represents the experimental group with a mean score of 64.50.
The T-test conducted was 0.083>0.05.

DISCUSSION

This study aimed to primarily determine the differences in student achievement between online and offline modes of instruction. Following the global pandemic, many high schools and higher education institutions were forced to resort to distance learning and students attended classes online. After weeks of studying and guiding students in Turkish language lessons, the students were given a final examination to assess their understanding of the language.

The examination covered the topics taught to students in both offline and online groups. The control group from the offline instruction method recorded a mean of 71.80 and the experimental group from the online instruction method recorded a mean score of 64.50. From these abstract statistical scores, we can see that students in the offline group recorded a higher mean, however, this can be misleading, therefore, an Inferential statistic was necessary to determine if there is any statistically significant difference between the two modes of learning.

An independent sample T-test was conducted to determine any statistically significant difference between the two groups. The T-test had a significant value of 0.05. The t-test from the analysis conducted was found to be 0.083. Therefore we can assume that there is no statistically significant difference between offline and online modes of instruction since the t-test found was 0.083>0.05. The study reveals that the students in the online group learned just as effectively as students in the offline group. They were all equally involved, motivated, and satisfied with the learning methods. This study is in line with the study conducted by (Yen, Shu-Chen, et al., 2018).

CONCLUSION

The main objective of education is to provide a learning environment that is suitable for both instructors and learners. The pandemic revealed just how unprepared institutions around the world were for transitioning to online education.

Learning institutions should be flexible and always prepared for changes in education methods to be able to provide quality education to their students anywhere, anytime at affordable costs. Studies like (Kasmahidayat, Yuliawan, Budiman, and Sabaria, 2021) revealed that both methods were equally effective and competitive depending on the implementation.

Technology has eliminated geographical constraints and made it possible for people to access quality education despite their locations. Educators and Ed-techs keep exploring alternative methods and platforms that will maximize student-student and student-teacher interactions and communication to normalize the education experience for all learners and instructors.

This study aims to open instructors to the possibility of promoting both online and offline classes or blended classrooms to their students because each of these modes of instruction offers a unique experience for learners that is both beneficial and interactive.

The offline method allows instructors to bond easily with their students and be able to instill knowledge and values to their students. Students find moral and academic guidance from their teachers when they attend lessons in an offline format and they are able to develop social skills through one-on-one interactions with their fellow classmates.

In this digital age, online lessons provide students with an opportunity towards digital literacy, expanding their sources of information and offering a more flexible alternative for learning. Instructors should keep exploring various online teaching methods that are more beneficial for students because we have new technologically advanced platforms being developed rapidly.

More research should however be conducted to clearly determine which mode of instruction is more effective. This research should encourage instructors to keep exploring educational methods to ensure students get the most out of learning.

LIMITATIONS

The period and the sample of the study were very small hence may not express an exact picture in global standards therefore we encourage a larger study to be conducted to confirm our findings. The instrument used might have not been very comprehensive to determine the understanding of the students. The students' satisfaction was also not measured to show students' preferred mode of instruction after the study.

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Anglicisms as a consequence of vocabulary change – reasons for use and their stylistic function

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Abstract

The Language is a subject to constant change, which primarily affects the lexical level of any language, since lexis must always adapt to new communicative and cognitive tasks. The product of this change undoubtedly includes the very frequently discussed anglicisms. The intention of this paper is to explain the reasons why it is precisely the lexical level that is most affected by the change, and also to point out the problematic nature of the use of anglicisms in the German language. In this paper, a definition of the term anglicism is provided, and the reader is introduced to various types of anglicisms. These include conventionalized anglicisms, anglicisms in the process of conventionalization, and citation words, proper names, and cognates that are used only occasionally. Then, the reasons that lead to the use of anglicisms in the German language are analyzed. In the last part of this article, the stylistic functions of anglicisms are listed, which include, above all, the novelty effect and learning effect, the coloration and also the pragmatic and communicative value of what is said or written.

Keywords: Vocabulary change, anglicism, types of anglicisms, stylistic functions of anglicisms

1. Introduction

Every language is a wonderful and living phenomenon, and like any other language, German is subject to constant change. As a cultural language, German has absorbed various words from all parts of the world, for example from Latin, English or Italian. In many texts you can find words whose origin has nothing to do with German and yet these words can be heard in everyday life. Especially among young people, English words are very popular and are used in everyday language. We are talking about Anglicisms, which have become an integral part of German.

As a result of extensive social and societal influences, the basis of communication is rapidly being shaped. The human form of expression, namely language, is thus subject to constant development. It is known that language is divided into two main areas. Both, verbal and non-verbal language, are exposed to the turbulent development of society (Helmová, 2019). This can be seen in the form of language and linguistic trends that challenge the current German language. Here arises a scientific space where the contemporary German language can be traced more closely and because of this it becomes the object of research of many experts.

Linguists often base their research on the borrowings from English into other languages. Recently, these efforts have intensified and the issue has become much more topical. Whether it is the leading role of the U.S. in business, science, and politics, or global social transformations, the English language seems unavoidable. The rapid technological progress together with globalization as such have an impact on the linguistic development of European countries and the whole world. If you read a newspaper or watch an advertisement on television, you notice the use of Anglicisms at every step. However, the process already mentioned - globalization - causes not only communication. Of course, the creation of a unified cultural community has also led to a significant convergence of the vocabularies of European languages. But apart from linguistic means, behavioral patterns are also changing. For the German language this topic is very topical and often considered a bit sensitive. For this reason, this paper deals precisely with the influence of the English language on the German one. Its main task is to identify and explain in more detail the causes and consequences of this influence.

The linguistic management of man's constantly changing environment demands an intermittent expansion of vocabulary. New things and phenomena of daily life must be designated; new thoughts must be given their linguistic version. New terms become necessary with the progress of science. In this regard, of course, transformations have a special effect.

New words are created for already existing phenomena. The new version should be more powerful, more impressive to the reader and listener. It is one of the universal basic features of all natural languages that they are adapted again and again to the changing communicative needs of people. The existing sign meanings can be constantly transformed (expanded, differentiated, combined).

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Thus, language remains a universal means of communication. This unlimited production of new language signs does not lead to an interruption of communication, because the language bearers are connected not only by the common sign stock and the rules of sign production, but also by the common extra-linguistic activity and experience (Fleischer, 1976).

Over 100 million people in the world speak German. The German language is one of the most important world languages, but the international importance as a language of business, commerce and communication is now held by English. This also explains the fact that most foreign words that are newly introduced into the German language today are Anglicisms. The English language is a Germanic language. For about 340 million people English is the native language and a total of 510 million people speak English. The Anglo-American influence has been noticeable since World War II and is particularly evident in vocabulary, idioms, and the valence of some verbs. Already in the 18th century, several English words and word formations had entered German, especially through translations of English literature (humor, blank verse, pudding) and through the influence of English politics (opposition, parliament) and economics (budget, banknote). In the 19th century, this influence increased. The reasons for this are the political supremacy of the United States after the Second World War, internationalization in the economic, cultural and scientific fields, translations of specialized texts from English and communications of news agencies, the teaching of English in schools, etc. The mass media, advertising (after shave lotion, cleanser, filter tipped) and technical languages are also important. English words also appear in the field of music (breakdance, sound, standing ovation), fashion and social life (leggings, piercing, tuxedo, club, toast, roast beef), politics and science (strike, locomotive, partner). The 19th century also saw the development of the new technical language of sports (sport, match, coach, field hockey, green, advantage). Some English expressions were Germanized (soccer - soccer, penalty kick - penalty kick). Technological progression always brings new words. In the business world Anglicization is connected with the compulsion to globalization. Anglicisms particularly mark fashionable, technical or social trends (e.g. Internet, job sharing, surfing, last-minute travel, etc.). These words often fall out of use after a shorter period of time (Bohušová, 2000).

Anglicisms are now used at all levels of language. Many areas of life, e.g. radio and television or even newspapers follow this development and now use many English borrowings. In the meantime, Anglicisms belong to the general linguistic usage of Germans and are especially popular among young people.

2. Vocabulary Change

Many linguists have investigated whether vocabulary is a mere collection of words or whether it is a systematic and structured arrangement. Here are two well-known definitions: "Vocabulary as a dynamic open system is the product of many generations of people working together, communicating with each other" (Schippan, 1984, p. 243). "Vocabulary is that part of a language which changes most and most rapidly" (König, 1978, p. 113).

The vocabulary of the German language can hardly be surveyed in its entirety. It must be taken into consideration that the German common language contains about 500,000 words. The average speaker needs about 6000-10 000 words. In everyday language, one uses an average of 600 words.

Through the change of the objects surrounding us, through changed estimation of structures and contexts, through the expansion of human knowledge or through stylistic demands on texts, there also arises a need for new linguistic signs. Like stratification and structure of vocabulary, its changes and developments are ultimately determined by linguistic-communicative action and theoretical activity of people. According to Thea Shippan (2012), reduction and development, changes in structure and meaning result from people's communicative relations in "practical life" from the way they produce and the social relations they enter into in the process.

Schippan argues that vocabulary must always adapt to new communicative and cognitive tasks. More than other levels of language, vocabulary is subject to the processes of transformation and change because:

- the word meanings are generalized images of the changing reality,
- with the lexical meanings social generalizations are stored and fixed,
- through the word, through the choice of words, valuations and feelings are expressed and generated,
- it is in the vocabulary that relationships with other languages and other peoples are most clearly reflected,
- the potentials to move, activate and influence people with language are also stored as connotations with the vocabulary elements,
- vocabulary responds quickly and directly to social communicative and cognitive needs through the functions of nomination, generalization, and valuation; as a means of communication, it is not only an expression of social relations, but also a means of shaping those relations. Words can express class positions, ideologies, with them social consciousness is transferred, social and individual consciousness is developed (ibid).

The development and changes in vocabulary result from the communicative relationships among people. However, one does not speak of changes in vocabulary in general, because people in different groupings have a different share in the changes. These are occupation, class, social position, political attitude, age, education, and leisure activities.

Schippan addresses the issue of developments in vocabulary and as the most important changes in vocabulary she cites:

- Interrelations with other languages and the adoption of foreign vocabulary into the vocabulary of our language and its incorporation into the lexical system,
- Changes in relational systems and changes in meaning,
- Formation of neologisms and the obsolescence and extinction of vocabulary units, archaization and changes in the meaning structures of entire vocabulary areas (ibid).

3. Anglicisms

For many years, Anglicisms have been one of the major irritants of public language discourse. For the first time, as documented by the German Dictionary of Foreign Words, the term Anglicism was used in 1744 by Gottsched, who at that time spoke about "Anglicismi" (DFWB, p. 538). The German Dictionary of Foreign Words itself defines Anglicism as: "Characteristic peculiarity of the English language" or, more precisely, "linguistic peculiarity in the lexical or syntactic field borrowed from English into another language or formed after the English pattern in another language (which appears foreign in this language)" (Zindler, 1959, p. 2).

Zindler himself has expanded the definition of Anglicisms even further; for him, an Anglicism is not only "a word from British or American English in German or a non-standard word composition", but also "any kind of modification of a German word meaning or word usage (loan meaning, loan translation, loan transfer, loan creation, frequency increase, revival) according to the British or American model" (DFWB, p. 359) .Anglicisms are words that originate in English and have been borrowed into German. The term Anglicism is understood to mean: "transfer of a linguistic phenomenon characteristic of (British) English to a non-English language" (https://www.duden.de/rechtschreibung/Anglizismus).

"'Anglicism' is the generic term of borrowings from American English, British English, and the other English language areas such as Canada, Australia, South Africa, etc." (Yang, 1990, p. 7).

Eisenberg defines Anglicisms as follows: "Foreign words are words of German, even if they are taken over in whole or in part from other languages. A foreign word from English is called an Anglicism and expresses the fact that it is not an expresses the fact that it is not an English word, but one that is English, but rather one that originates wholly or in part from English. The Anglicism computer for example, is a German word in that, unlike in English it is capitalized, unlike in English, and has a genitive on s (of computer)." (Eisenberg, 2012, p. 3) From the above definitions, it follows that Anglicism is a language unit from English. In summary, it can be claimed that an anglicism is a linguistic borrowing from English that is adapted to the recipient language phonologically, orthographically or morphologically to varying degrees and is integrated into the language use.

English is often referred to as the lingua franca. The English language has assumed this communicative function worldwide because it is considered the leading language of technology, commerce, and research, and is also used everywhere thanks to its dissemination through the media. It is worth mentioning, however, that in the past this term had a different meaning, namely a mixed language of Arabic elements and elements of other languages.

Thus, the English language represents the function of a so-called international lingua franca. Moreover, also to keep up with technological and economic developments in the world market. In some countries, complete bilingualism is emerging, that is, the use of both the mother tongue and English. English is taught as the first foreign language in European schools and today it serves as a lingua franca within the European Union and on the world market.

4. Types of Anglicisms

In the German language, the term Anglicism represents a generic term. Yang differentiates three types under the term anglicism:

Conventionalized Anglicisms - these Anglicisms are assumed to be common and well-known, although they usually behave differently in the manner of articulation and/or orthography than a native word property. As an example, one can cite manager, computer, jeans, and rock 'n' roll.

Anglicisms in the process of conventionalization - in contrast to the already conventionalized anglicisms, this group of anglicisms seems foreign to many Germans. Nevertheless, they are used by mass media. It is reasonable to hypothesize that these anglicisms will become conventionalized or disappear from German usage after some time. These are, for example, words like factory or gay.

Quotation words, proper names and cognates - Anglicisms that are in this group are used only in a specific situation or in connection with America, Canada, England or other English-speaking countries, e.g. High School, US Army, Western, Boat People, etc. (Yang, 1990).

5. Reasons for adopting Anglicisms into German

The fact that anglicisms are used in the German language has been known for a long time, but in order to decide whether they are genre-specific, one must know where they appear and who uses them.

Anglicisms enter the language through various routes, such as advertising, music, the Internet, television, international relations, or international politics. As it was mentioned before, English is a lingua franca and this language is used not only in colloquial speech but also in technical languages.

The intention of this paper is to answer the question why Anglicisms are adopted. The main motives for the general use of anglicisms are the following:

Language economy factor - The first reason for the use of Anglicisms is language economy. In German, it is a matter of compounds, with the help of which one tries to circumvent the long paraphrases and paraphrasings. Pfitzner believes that language economy involves two aspects. The first aspect is precision in the choice of words and the second aspect is brevity of expression, where English seems to be a very good source of economical words (Pfitzner, 1978, p. 161).

In the common language a new trend can be observed, and that is that English monosyllables are very common, e.g., dock, film, club, trend, trip, flop, trick, stop, kick, pop, tip. Very popular are also initial words, bracket forms and so-called "accü" words: laser, radar, AIDS, motel (motor-hotel), brunch (breakfast+lunch), smog (smoke+fog), pop (popular), VIP (Very Important Person).

It should also be mentioned that for the economy of language it is very important not only the length of words, but also the precision of their meaning and the accuracy of the information conveyed. It is desirable to hit the right target with as few words as possible.

Necessity - the majority of anglicisms are borrowed because of the need to fill the gaps in the language. In addition, if there are still unnamed things in the language, for which there is no suitable expression in the language and thus the anglicisms enrich the vocabulary. Carstensen named these anglicisms Bedürfnislehnwörter because they are used for special holidays or occasions (Carstensen, 1965). Kratochvílová tends to the view that the need borrowings are predominantly the technical terms, product names, but also names for facts from the Anglo-American world, which are used internationally, but also for purposes of a pictorial and as close as possible to the original representation of the local color. This includes words also for novelties in information technology such as ID-card, organizer, scanner, modem, cyberspace, talk, link, browser, chat, etc. In this category often remain also lexical units for which the attempts of Germanization were not successful, e.g., sweatshirt - sweat shirt, aftershave - after shaving, decoder - decryptor, snowboard - snowboard, e-mail - e-mail. At this point, it should also be noted that there are also examples where the German equivalents have successfully prevailed. The following can be cited as examples: Speicher instead of memory, Diskettelaufwerk instead of drive, Maus instead of Mouse (Kratochvílová, 2002).

Another group of Anglicisms are luxury loan words. These are unnecessary in the vocabulary and it depends on the speaker which word he chooses. The luxury loan words usually have a stylistic function in the language, e.g., one-man-show and one-man-show, show business and show business (Carstensen, 1965). Kratochvílová claims that luxury borrowings are used in certain circumstances, e.g., in emotionally colored statements, to increase attention, or in ironic use of the expression in question. These Anglicisms also include the so-called Occasionalisms, which are often used in advertising texts, e.g., composites with Authentic-, Bundle, Masterpiece. Slogans and headlines are also very often considered to be luxury borrowings, e.g. "At the thrifty rate", "Wash, Cut and Go" (Kratochvílová, 2002).

Expression variation and expressivity - The next motive for adopting Anglicisms is enrichment of vocabulary and text enlivenment. It is quite rare when an anglicism and a German word with the same meaning are used in parallel in the language. Most often it is only a transitional state. After some time, the older word is displaced by the newer one or there is a variation of meaning and nuances, specializations and gradations of meaning arise (Carstensen, 1965).

According to Yang, Anglicisms are very useful in journalistic texts, because there would be many of repetitions. A large average frequency of a certain word is difficult to avoid in many cases. The longer the concrete text is, the more frequent the occurrence of certain speech marks becomes. "In order to achieve a varied style, one needs as many expressions as possible for a certain object or subject. In addition to German synonyms, Anglicisms also serve as a means of variation" (Yang, 1990, p. 126). From the context written above, it follows that Anglicisms provide new synonyms and enrich the German vocabulary (ibid.).

Subject borrowing and differentiation - Anglicisms often represent the definable signs for certain subjects and techniques, also indicating their origin. They offer new possibilities of differentiation and serve as technical and scientific means of communication in many fields. The word fields are extended thanks to anglicisms, e.g., song - song, hit - evergreen.

Euphemism - The tendency to euphemisms is also connected with anglicisms. Euphemisms are used to disguise unpleasant, unpleasant facts. It is common to use anglicisms, e.g., to describe taboos in common language, but also in delicate political matters. In this case, anglicisms can sound a bit subtler and there are no negative connotations as with the corresponding German words.

6. Stylistic function of Anglicisms

The number of anglicisms penetrating the German language is constantly increasing. If one analyzes in which areas the anglicisms mostly occur, one finds that the use in the mass media is very large. Anglicisms are gaining a firm place in German-language advertising. It is precisely from advertising that most anglicisms enter the German common language.

First of all, anglicisms are used in the press as well as in the common language, no doubt for economic reasons already mentioned above. A newspaper text should be varied, topical and interesting, and anglicisms also serve to vary the linguistic expression. Anglicisms are characterized by their conspicuousness, their figurativeness by the possibilities of word plays and serve the expression amplification.

Novelty effect and learning effect - This stylistic function comes into its own with words that are not so well known and that are not yet firmly established in the German word inventory. Anglicisms that are not yet stabilized originally are distinguished by spelling such as quotation marks and italics and are also often presented me further explanation. Learning effect also introduces a linguistic filter, because the anglicisms accepted by the language community are then gradually conventionalized and mostly graphically integrated into the vocabulary by capitalization or the loss of quotation marks. This includes designations of new facts; it often happens that the objects designated by the new borrowings fall out of use more quickly.

Coloring - According to Yang, coloring is one of the most important and striking stylistic effects that can be achieved with Anglicisms in German (Yang, 1990). Pfitzner further explains that kolorit is used in art, in music, and also in literature, so that it characterizes the tonal quality, the color effect, the special mood and atmosphere of a depiction (Pfitzner, 1978). "Many Anglicisms, which in our categorization are called quotation words or exoticisms, occur in texts as illustrators of the millieu or the corresponding social group" (Kratochvílová, 2002, p. 101). A distinction is made between local color, subject color and social color.

The local color occurs when the Anglicism is used as a linguistic sign to indicate the country of origin and its peculiarity. The reader associates certain emotional ideas with the named nationality or region, e.g. gospel, sheriff, slums, campus.

Professional color is characterized by subject matter and a focus on professional or technical aspects, i.e. a particular group of people uses a specific vocabulary to describe a particular field, e.g. publicity, manager, code, computer (Veliu-Ajdini, 2009).

A social color is present when an anglicism is used in a certain social context and indicates group membership, so that a certain speech community is associated with the people belonging to it. Groups can be organized by age, by interests, by worldviews. For young people, words like jeans, job, beat, bar, band, girl, or campus occur. Another example is drug culture with the following words: trip, high, grass, speed, shit, and pot.

Pragmatic value - This group includes the luxury borrowings, which have already been defined above. "The combination of conspicuousness and vagueness can be considered as one of the typical signs of the advertising texts, which have a higher degree of expressiveness similar to the youth language" (Kratochvílová, 2002, p. 102). The word shirt contains many ideas of this commodity designation, because very many fashion trends are perceived in this area of sportswear. Anglicisms are also a reservoir of euphemistic expressions, e.g., hair stylist and hairdresser, single and single person, call girl and prostitute, beauty center and beauty farm, business class and first class.

Communicative value - This stylistic function of anglicisms concerns mainly the spheres of interpersonal communication where one cannot count on a hundred percent knowledge of German. This is usually the case when the speaker is not a native speaker. In these cases, anglicisms act as catalysts of communication processes, especially in the sphere of technical language expressions where this function brings significant advantages.

4. Conclusions

The German language, just like the other languages, is subject to a constant process of change. In connection with the newly emerging phenomena of life, new designations emerge to denote these phenomena. Mostly these designations are borrowed from the English language, which is spread all over the world and represents so-called lingua franca. There are several reasons for the use of anglicisms, the economy of language, which allows us to name the facts more precisely, shorter and more accurate; the necessity - when there are still unnamed things in the language, for which there is no suitable expression and the anglicisms enrich the vocabulary; variation of expression and expressivity, which allow us to vary the designation of phenomena; subject borrowing and differentiation - they offer new possibilities of differentiation and serve as technical and scientific means of communication in many areas; further, anglicisms are used to disguise unpleasant, unpleasant facts.

In summary, it can be stated that anglicisms are now an integral part of the German language and are mostly regarded as very positive and enriching for the German language.

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Physical Activity and Sedentary Behaviour of secondary school students during online learning at home in the COVID-19 pandemic.

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Abstract

The purpose of this study was to determine the physical activity and sedentary behaviour of secondary school students participating in at-home virtual learning during the COVID-19 pandemic. The Global Physical Activity Questionnaire (GPAQ) used in the study was randomly sent out using the social media platforms to 173 students in Bangkok between 12-18 years of age from February 1-15, 2021. The self-reported questionnaire was voluntarily filled out without any compensation and a response rate of 72.3% was achieved. The time spent on each activity per day, including but not limited to work, travel, and recreation, was analysed. According to the World Health Organisation (WHO), it is recommended that children and adolescents spend at least 60 minutes per day performing moderate to vigorous physical activity, and limit sedentary behaviour to no more than 2 hours per day. Per the 2016 Thailand Report Card on Physical Activity for Children and Youth, 23.2% and 21.8% of Thai students followed the WHO recommendations regarding Physical Activity and Sedentary Behaviour, respectively. Findings from our study illustrated that only 15.2% of participants met the WHO recommended requirements for either Physical Activity or Sedentary Behaviour over the COVID-19 pandemic. Furthermore, only 3.2% of participants met both requirements. Comparing our result with the 2016 study, the amounts of Physical Activity and Sedentary Behaviour substantially decreased, by 34.5% and 30.3%, respectively. Action should be taken to promote daily physical activity among virtual learning students during the COVID-19 pandemic.

Keywords: Physical Activity, Sedentary Behaviour, Online Learning, Secondary School Student, Adolescent, Global Physical Activity Questionnaire

1. Introduction

The World Health Organization has defined the term “Physical Activity” as any bodily movement produced by skeletal muscle which requires energy expenditures. (WHO, 2020) Physical Activity can be referred to all movement including during leisure time, travelling time, or as a part of their work. Both Moderate and vigorous-intensity activity would increase your activity while improving your health. The variety of ways to be active includes walking, cycling, sports, and physical recreation activities can enjoyably be done by anyone. Performing regular Physical Activities has been proven to help prevent and manage most Non-communicable diseases (NCDs) including diabetes, heart diseases, stroke, chronic kidney disease, and many other type of cancers. It also helps us to prevent hypertension while maintaining health body weight and could potentially improve mental health along with your quality of life. The guidelines and recommendations from the World Health Organisation provide details for different age groups and each specific population group on how much Physical Activity is needed for a healthy body. (WHO, 2010) For children and adolescents, physical activity can be undertaken as part of recreation and leisure, physical education, transportation or household chores, in the context of educational, home, and community settings. There should be an average of 60 minutes per week for both moderate to vigorous-intensity aerobic exercise and physical activities for children and adolescents across the week. Aerobic activities that strengthen muscle and bone are also recommended to do at least 3 days per week. Sedentary behaviour is defined as time spent sitting or lying with low energy expenditure while being awake. Sedentary behaviour includes during transporting, in class, at home. In children and adolescents, there are a higher amounts of sedentary behaviour that could leads to poor physical health (increasing adiposity while decreasing cardio metabolic health fitness, behavioural conduct, pro-social behaviour, and reduced sleep

By IAI ISSN 2671-3179

duration. The World Health Organisation has also recommended that Children and Adolescent should limit their time spend being sedentary, especially time spent on their electronic devices screen. Sedentary behaviour was not included in the WHO 2010 recommendations, however, a lot of research had been carried out and was later published with several measures and types of sedentary behaviour. (WHO, 2020) Physical Activity and Exercise are a significant factor to reduce your risk of premature death at all cause mortality. (Lahti Holstila A, Lahelma Eet al, 2014; Drustine JL,Burns K, Gordon B, et al, 2014; Kohl HW, Murray TD) Positive results are showed for people who have been having a regular exercise on both primary and secondary disease prevention. (Apichai W, 2016) Thailand Report Card 2016 has founded that children and adolescents have performed a physical activity at least 60 minutes per day at 23.2% while the sedentary behaviour (not more than 2 hours) at 21.8%.

2. Methodology

The "Global Physical Activity Questionnaire" self-reported questionnaire was used to collect informations from our participants. It was developed by the World Health Organisation with the aim of collecting physical activities as well as the sedentary behaviour informations from three different categories. The questionnaire consists of 16 questions. 6 questions with the topic of activities while working, 3 questions while travelling, and 6 questions asking for activities during recreation. (WHO, 2014) The age of our participants were collected along with the gender. All participants must be studying in Secondary School between Grade 7 to Grade12 in Bangkok or nearby with the age of 12-18. Each participants were asked to fill in the questionnaire while they were having an online class at home during the COVID-19 pandemic. It was sent out to 173 different students between February 1 to February 15, 2021, receiving a respond rate of 72.3% where 125 students had participated. To analyse the data from this questionnaire, the mean, median, number in minutes spent on average per day in all categories were calculated for further studies.

After the questionnaire was collected, the data was analysed according to the Global Physical Activity Questionnaire Analysis Guide. (WHO, 2014) The questionnaire consists of three domains which are

1) Activity at Work
2) Travel to and from places
3) Recreational activities.

Each domains are break down further into six different sub-domains which are

1) Vigorous work
2) Moderate work
3) Travel
4) Vigorous recreation
5) Moderate recreation
   (three questions in sub-domains 1-5)
6) Sitting
   (one question is sub-domain 6)

Grouping the GPAQ sections

There will be an answer guidelines for each questions. Whenever a participant inputs an invalid answer that doesn't respond to the guidelines, that whole response will not be included in the analysis. To prevent this from happening, a technology was used to restrict invalid answers. E.g. minutes must be written as an integer.

Analysis Guidelines and Calculations

This study classifies each participant meeting WHO recommendations on Physical activity as a percentage. There should be at least 60 minutes per day of Physical Activity.

Sedentary Behaviour

The question asks the participant how much time usually spend sitting or reclining on a typical day. The participant must not be sedentary for more than 2 hours per day.

3. Results

Findings from our study illustrated that only 15.2% of participants met the WHO recommended requirements for either Physical Activity or Sedentary Behaviour over the COVID-19 pandemic. Furthermore, only 3.2% of participants met both requirements.Comparing our result with the 2016 study , the amounts of Physical Activity and Sedentary Behaviour substantially decreased, by 34.5% and 30.3%, respectively. Work Activity and Recreational Activity results will be split into two parts which are Vigorous Intensity and Moderate Intensity.

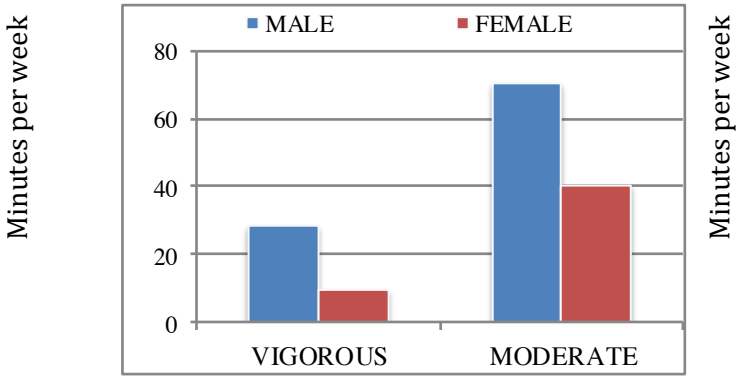

Figure 1, Work Activity

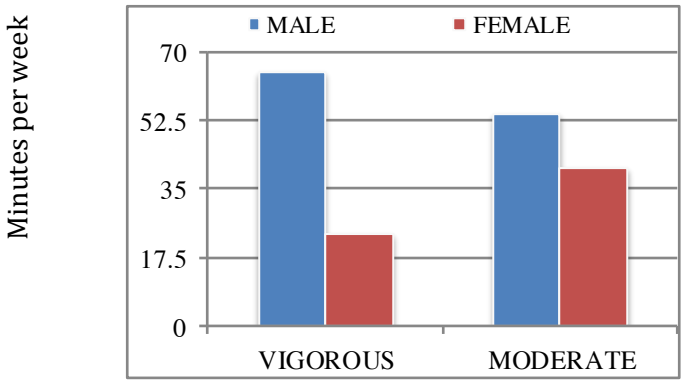

Figure 2, Recreational Activity

According to ***Figure 1***, Male students tend to spend more time on Work Activity than Female students. Male students spend around 28.17 minutes per week whereas female students spend around 9.82 minutes per week on vigorous intensity work activity. For moderate-intensity work activity, male students spend around 70.1 minutes per week while female students spend 40.22 minutes per week. When it comes to recreational activity, according to ***Figure 2***, male students tend to spend more time on vigorous-intensity recreational activity at 64.53 minutes per week with just only 53.9 minutes per week on moderate-intensity. For female students, they spend 23.27 and 40.29 minutes per week on vigorous-intensity and moderate-intensity respectively.

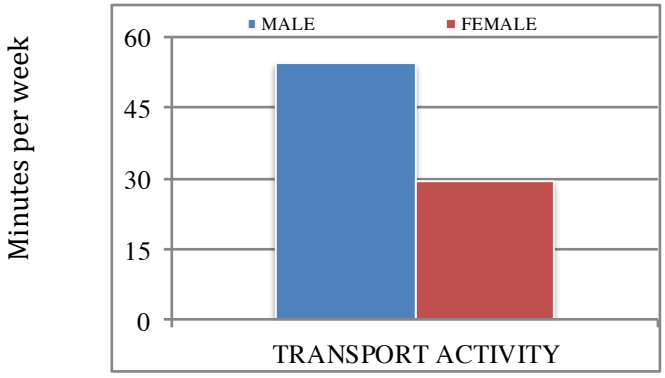

Figure 3, Transport Activity

By IAI ISSN 2671-3179

The bar graph on ***Figure 3*** illustrates time students spend on transportation activity. This only includes the activity travelling from place to place which requires your own energy expenditure. Male students usually spend 54.43 minutes per week in average to travel while female students spend around 29.25 minutes per week.

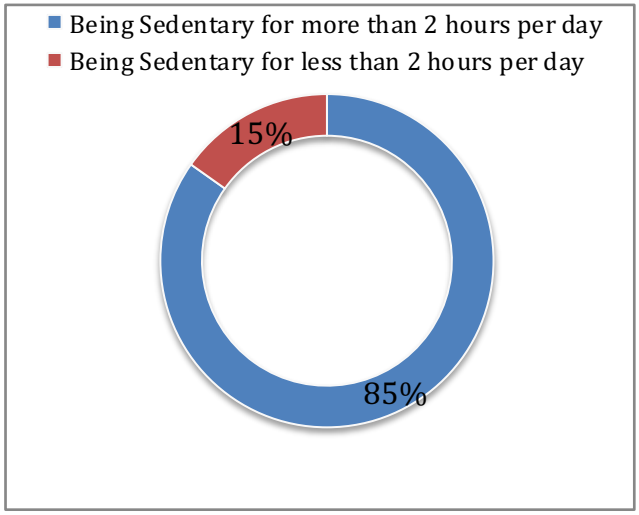

Figure 4, Sedentary Behaviour

Only 19 students meet the WHO recommendation for not being sedentary for more than two hours per day. Which is 15.2% as shown in ***Figure 4***

4. Conclusion

From our study, it can be clearly seen that during the outbreak, there are a large number of students that has not reached the minimum recommendation requirement for time spent on Physical Activity from the World Health Organisation over the COVID-19 pandemic. It can roughly be predicted that future generation kids would be spending more of their time in their house on their screen. This could leads to a risk of developing Non-Communicable Diseases (NCDs). Since more students are learning online from their home, there should be a measure for students in order to prevent the diseases. The ministry of education should come up with effective solutions by adding new curriculums to support every students to spend their time with work activity at least 60 minutes per day.

We should start concerning about the situation from nowadays. Teaching and informing students about the importance of having a healthy body would significantly be beneficial to both student and the country future. As long as people would start cooperating and taking it seriously, this would lead to a successful project and the values will be remained throughout the future generations.

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The historical context of the birth of neo-Albanianism, a reformist tendency

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Abstract

This article aims to concisely point toward an approach marginally delivered by scholars known otherwise as, Neo-Albanianism or Neo-Albanian movement of the '30s in the early 20th century. This is a period in which the already realized historical need of establishing the Albanian state, necessarily protected the inspiration towards the making of Albanians. As Aurel Plasari says in "Counter-World of Branko Merxhani", Merxhani appears as one of the most representative configurators and galvanizers of the social and philosophical thought of the Albanian intelligence of the '30s. Merxhani's merit lies in the fact that he tried to orient Albanian social and political thought towards the western way in general and towards positivism in particular, precisely at the period when the Bolshevik revolution in Russia and the Marxist ideology was rapidly spreading in the international spiritual environment. This article provides a brief overview of Branko Merxhani's ideas and his positivist approach to many social phenomena in Albania in the 1930s, such as the idea of the change of Albanian society, the role of philosophy and science as a promoter of transformations, the role and the interrelations between the individual and society and so on.

Keywords: neo-Albanianism, positivism, Albanianism, collective feeling, social change, reform movement

1. Introduction

Was Albania 'made'? An analysis of the historical conditions and the situation in which Albania was in the period between the two world wars is important to understand the spiritual constitution of Albanians in general and the place and role of social elites and in particular Neo-Albanianism. Are we still living in the period of Albanianism or neo-Albanianism? Neo-Albanianism as a mental and intellectual movement is preceded by a period which, from the point of view of many authors, is considered the period of triumph and failure of nation-states (History of the Balkans Georges Castellan p. 418).

The people of the Balkans generally emerged from the long seven-year period of World War I exhausted. Economically weak, politically perturbed, and disappointed by the so-called Treaty of Versailles, according to which, certain territories were cut and attached together according to the appetite of the former sovereigns. The Balkans, in their greed for expansion and territory, nourished nationalism instead of orientation based on the free self-determination of Anglo-Saxon-type peoples and democracies. George Castellan describes this situation quite clearly in his book "History of the Balkans" when he says: *"Old ethnic contradictions had already been transformed into hatred and the affirmation of national identity had taken aggressive and xenophobic forms." George Castellan, "History of the Balkans", p. 418.* It was precisely these contradictions that in some cases made state structures weak and consequently strengthened authoritarian and dictatorial tendencies, and in some others, such as the case of Albania, questioned their existence and even risked dissolution. The Balkans served as the last resort to satisfy the parties in conflict, although not everyone's appetites were satisfied.

But, as George Castellan writes*, when the moment of savage division between the victors and the defeated came, only a few voices were heard, the "good ones": on the one hand, those of the Allied camp - Serbs, Romanians, Greeks; against those who fought alongside Germany and Austria-Hungary - the Bulgarians and the Turks." George Castellan. "History of the Balkans." p. 420*

2. Instability of the Balkan Peninsula

Let's take a brief look at the situation on the Balkan Peninsula, which also reflected the post-World War I crisis. Although in 1918 it was more of a program than a reality, the Yugoslav union had triumphed, the "Greater Unitary Romania" had to be ratified, Greece, traumatized after the catastrophe of Asia Minor in 1922, plunged into the epidemic that had hit Europe and in 1936 recognizes the dictatorship of General Metaxas, Bulgaria in the twenty years between the two wars will be dominated by coups

and riots and although a more egalitarian society than its Greek and Romanian neighbors, the fragile foundation of power and irredentism make it quite weak. This is generally the panorama of the Balkans in the period between the two world wars.
The question naturally arises: what about Albania?

2.1 Giving Birth to a New Albania

Seen in the Balkan context, Albania is insecure. Albania starts its journey with the efforts of the Renaissance patriots who thought that by moderating Turkey they would achieve the dream of the Albanians, being liberated from the yoke of the Ottoman Empire. One of the paths that the Renaissance patriots wanted to follow to achieve autonomy and then the complete liberation of the country, was the political struggle within the empire to overthrow the sultan's absolutism and establish a constitutional regime, which would recognize the rights to the autonomy of non-Turkish peoples. Many Albanians had served with glory in high leadership positions of the Ottoman government, some others had become famous leaders in other countries such as Greece, Romania, Egypt, Bulgaria, etc. Mit'hat Frashëri writes in this regard: "Until now, Albanians have lived very little for themselves: their deeds, blood, and gifts have gone in the interest of others. They are devoted in the flesh and spirit to the good of others. "Now they have to live and work for themselves, for their Albania." *Skëndo 1919, 27*

It should be noted that unlike other people of the Balkans, Albanians have begun the effort to build Albania, after a long period of savage and corrupt Turkish rule, which left no room for the development of local leadership or institutions necessary for self-government and brought, even later in the period from 1912 to 1925, fourteen ineffective governments.
The support of the Great Powers and the solidarity of the Albanian communities abroad was crucial at the time, it was embodied in the Congress of Trieste in which on March 1, 1913, 150 representatives gathered from the United States of America, Romania, Bulgaria, Turkey, Egypt, Turkey, Italy and of course Albania, and launched resolutions calling for the recognition of Albania's independence to the Conference of Ambassadors in London, which was underway. The provisional government of Vlora rose and worked under the constant pressure and heat of the siege of Shkodra by the Serbs, the occupation of northern Albania by the Serbo-Montenegrins. In the south, the bombing by the Greeks in December 1912 of defenseless and unfortified Vlora marks the beginning of the occupation of southern Albania, which was followed by a second phase of the so-called cultural aggression. The long odyssey of internal disputes and especially the disputes over the Albanian National Bank, the rivalry between the government of Vlora and that of Esat Pasha in Durrës, the plot of Beqir Grebene in the hopes that Turkey would regain the lost territories, the discussions between the International Control Commission and Esat Pasha Toptani to force him to resign from power in order to accept the placement of the Albanian Crown Prince Vid who would later abdicate the throne and on September 2nd would leave Albania to leave power to the government of Esat Pasha, riots and the Fan Noli government, preceded by a series of other governments in the intervening period, show the difficult situation and best portray the ground on which new ideas of neo-Albanianism would be nurtured.

The Albanian state will be born as a historical necessity but it would be impossible without the will of the Great Powers and the extraordinary contribution of the American President Woodrow Wilson. "In the world family," writes Edwin Jacques, "there have been very few countries born with such great poverty in preparation for governance." *Edwin Jacques Albanians, The history of the Albanian people from antiquity to the present day. Page 372.*

Albanians, unlike other peoples of the Balkans, have been governed, although in many cases by Albanians, they have never been able to have an Albanian state, state administration and Albanian cultural, educational, health, military, legal institutions and this has made them lack in fact what Edwin Jacques calls preparation for governance.
But how have Albanians been able to preserve their identity, not disappear and assimilate, to survive the invasions, wars, chauvinist and national chauvinist appetites of the Balkan neighbors and beyond, throughout their troubled history?

For some scholars, who should be viewed with skepticism, one way has been the ability of Albanians to take advantage of vassalage and, even these scholars, go so far as to claim, for example in the case of Turkey, that it is the Albanians who left the Ottoman Empire 500 years behind in development and not the other way around.

Meanwhile, we may refer to Krist Maloki's point of view when he says: "… Tirana has a merit, for which the whole true Albanian intelligence should be envious, and that merit is called: state instinct. Kija inat e folja hakun! (Hate them but recognize their worth!). With a special genius, Tirana has been able to adopt the formalities of the nation-state and with a special genius, it has understood the importance of those three basic elements of the state." *Krist Maloki, Reflections pg. 127 Prishtina 2005.*

Is the creation of the state the work of popular instincts? Or is it the aspiration of intellectual elites like those of our renaissance who, as Enis Sulstarova says in her book Nationalist Discourse in Albania, created a series of myths through which they sought to awaken the Albanians, that is, to make them aware of their origin and history? At the same time, they sought to prove to the European public that the Albanians were an ancient nation with a rich history and culture, and, as such, they deserved to have their independent state. Enis Sulstarova Nationalist Discourse in Albania (pg. 43) states are not made, they are born, they are internally molded, they are shaped by history, even in the case when they are created as the will of the greats, as in the case of Yugoslavia, they are destined to disintegrate in Serbia, Croatia, Slovenia Macedonia, or nation-states.

2.2 Politics, Religion, Economy, and Culture in the Region

Politically Albania remains unstable with vulnerable territorial sovereignty, in the north it is divided, between the Italians in Shkodra and the Serbs who had reached as far as Shkumbin, in the south, the Greeks, Italians, and French along with the Austro-Hungarians competed for hegemony. Albania was divided, the Albanians, although strongly united under a spiritual constitution that stemmed from centuries of love for the homeland and the mother tongue, were divided in many directions.

First, feudalism had created great social divisions, a social gap between large families and peasants, and the lack of a middle class to bridge this divide made this gap deeper.

Second came religious divisions. Albanians were divided into Muslims, Greek Orthodox, and Roman Catholics. Each group was oriented from its religion to the respective religious language, relevant religious rites, celebrations, customs, specific cultural traditions, and this triple religious identity further emphasized the social gaps, creating an unfavorable bed to the detriment of the great cause, of Albanianism.

Third is the great economic backwardness. Lack of roads and bridges made the territory impenetrable, means of transport were lacking, and movement was done almost exclusively with animals on footpaths and this further affected the deepening of the divisions between different areas and that is why in Albania there is so much cultural isobar and dialectal diversity.

The country's economy was in a state of closed natural economy, with no production, no trade, and the majority of the population made a living from what is produced in the small and backward family economy. Without production, exports, and very few imports, the Albanian economy was suffering.

Fourth, the great cultural backwardness, lack of health care, and illiteracy. Severe economic conditions, lack of infrastructure, extreme poverty, lack of educational and health personnel, lack of state institutions and governance by the bajraks, (Ottoman military units) made 95% of Albanians in this period illiterate.

2.3. Strength to Form a National Identity

Albania was in the conditions of existence and perhaps this has made the Albanians preserve and strengthen more and more their national identity. Here is what Edwin Jacques says about this period: *“...., In that country lived 2 million tough, hospitable, hardworking, brave, loyal, proud and independent people. How many times these Albanians, determined to have their own government, schools, language, newspapers and cultural society, were mercilessly oppressed. But in the end, they united to face the world and to rule the fate of the nation, which had nothing left but the common language, the red flag of Skanderbeg with the black double-headed Albanian and pride in ancient ethnic identity.” Edwin Jacques Albanians, The history of the Albanian people from antiquity to the present day. Page 373.* This is an age of founding, an age of great decisions. Albania in my view has not been ‘made’ yet. This period would be the period of Albanianism, and this is where our political history begins. Merxhani himself would say: *"This is the day that starts the full construction of political Albanianism. Until that day Albanianism presented a second-hand view; had only a familial and theoretical character. It still had an amorphous appearance, with no politics, no color, no soul, no conscience; a complex that had lost any homogeneity of its own; a melted chair lying inside it.” Branko Merxhani, Works, Tirana: Plejad 2003 p.302.*

2.4 Modernization of Ideas

Although Albania had become independent and recognized by the great powers, the difficult situation, both with neighbors and within the country, raised as an imperative of the moment Albanianism, i.e. the formation of the Albanian state, territorial integrity, linguistic unity, national spirit, the establishment of state institutions, the establishment of an education and health system that was almost non-existent, etc.

The mission of the Albanian intelligence would be firstly to understand this era and secondly to take over the fate of the country to bring about the metamorphosis towards the modernization, progress, and Europeanization of the Albanian society.

It is important to know where to start, success depends on this, says one of the contributors of Neo-Albanianism, Father Anton Harapi. *"A new life has put the Albanian ahead. He will be modernized. He could not escape this current and this change, but even if he could, he would not escape. The work is now so; in what way is the Albanian doing this metamorphosis, when life can be taken in many ways? ..."One will hold him by the tail and one will hold him by the head." Father Anton Harapi, Spiritual Value, Contribution to the mental treatment of Albanians, 2009, pg. 9.*

From the analysis of the historical period of the 20s and 30s, a period in which the spirit of the tendency of Europeanism will come to life and grow, obviously, the great external and internal clashes, the great socio-political problems, the economic impossibility, and the stressed backwardness, illiteracy and great structural and super-structural deficiencies, prove the fact that Albania was at the crossroads of history, towards the east, in the lap of the cemeteries, as Merxhani himself puts it, towards Turkey and Orientalism or towards the west, towards Western civilization. This situation would significantly affect the dilemma of the

spiritual life and the approaches of the intellectual elite of the time, which, as expressed by the representatives of Neo-Albanianism, in the war motto "Old" or "Young", where it is not the biological age that differs in old and young, but their worldview, morals, beliefs, way of living and thinking of the world and life, it is their orientation towards Orientalism or the past, and Occidentalism or the future.

That part of the intellectuals who were nostalgic for the past are characterized as individualistic, as people who in the name of the armchair or a share, were ready to become when needed, patriots, monarchists or Bolsheviks, progressives and reactionaries, all at the same time. Krist Maloki connects Orientalism with laziness, idleness, exaggeration, heartless greediness, and as he puts it: *"The Albanian Oriental expects all good things for himself - sponging from others; the world for him is an inexhaustible source of tools, pleasures, and delights which he uses in every way and method, without asking where he goes and what he kills", Krist Maloki, Refleksione Prishtinë 2005, p. 153*

Between the "old" and the "young" would appear two or three other currents, those who were associated with the state administration or "neo-Albanians of Tirana", the rest of those who lined up in the pages of the magazine "Leka" who considered the debate between the old and the young as a debate between two groups who had different views because they were two different age groups. The third current Maloki, tells us *"was the only one, who approached more or less the essence of the problem, described the war between the Old and the Young as a war of mindsets and worldviews, or better: as a war between Orientalism and Occidentalism in our country "Krist Maloki, Reflections Prishtina 2005, p. 152*

It was precisely these thinkers of Neo-Albanianism, inspired by European philosophy, educated, some in the east and some in the west in the best universities of these countries, who would give their ideas, thoughts, approaches to the development of Albania and the path that it should follow both in terms of the state-building model that Albanians should follow towards a developed western Europe, and in terms of the political models to be followed, as well as the economic and socio-cultural models.

3. Conclusion

For Neo-Albanianism, Albania had already been 'made' in the sense of sovereignty. For it to be rightfully ranked where it belonged beside the countries of Europe, the imperative of the time was to become Albanians in terms of the evolutionary transformation that Albanian society had to make towards the European citizen in formation and mentality, in behavior and action, in moral and political, in ideas and philosophy. This remains imperative even today. These ideas of neo-Albanianism, when the social erosion, the spiritual decline, the nihilization of Albanian values, the abandonment of the homeland, the underestimation of everything Albanian up to the idea that today is gaining more and more space in the collective thought, that Albania cannot be 'made' with Albanians, echo currently and make the formation of the collective feeling among Albanians, that Albanians should be 'made', imperative.

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Vehicle Periodical Technical Inspection Reform Challenges in Georgia

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[2]*Co-author and scientific supervisor*

Abstract

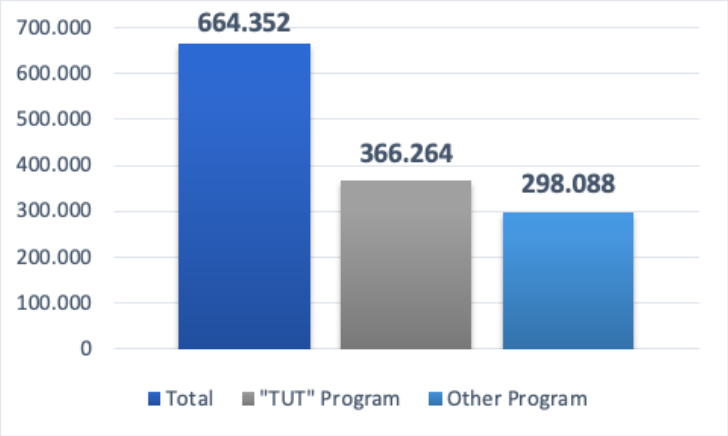
In the article we are discussing process of mandatory periodical technical inspection of vehicles in Georgia. Particular attention is paid to the evaluation of the effectiveness of the current e-program, the analysis of problems related to the program, corruption risks and etc. The article provides a way to solve the problem, which is mainly based on running an e-program and setting up a proper monitoring system.

In order to maintain the PTI system in accordance with modern standards, it became necessary to create an e-software. Initially, according to plan of state structures, the e-program should be one for everyone, which would include the existing periodical technical inspection centers in the program, would connect them with the executive structures, and finally would create a unified information system.

The creation of the e-program was defined by the following circumstances:
1. Submit inspection results online to avoid manipulation by inspectors and reduce the risk of corruption
2. Creating a unified e-database for the production and analysis of statistics
3. Providing access to the database for law enforcement and supervisory services (MIA - Police, MIA - Service Agency, Accreditation Center, Land Transport Agency)
4. Consideration of successful international practice

I. Analysis

It is true that accurate statistics cannot be produced, but they are still important.
Graphic 1. Graphic image of the vehicles in the first inspection



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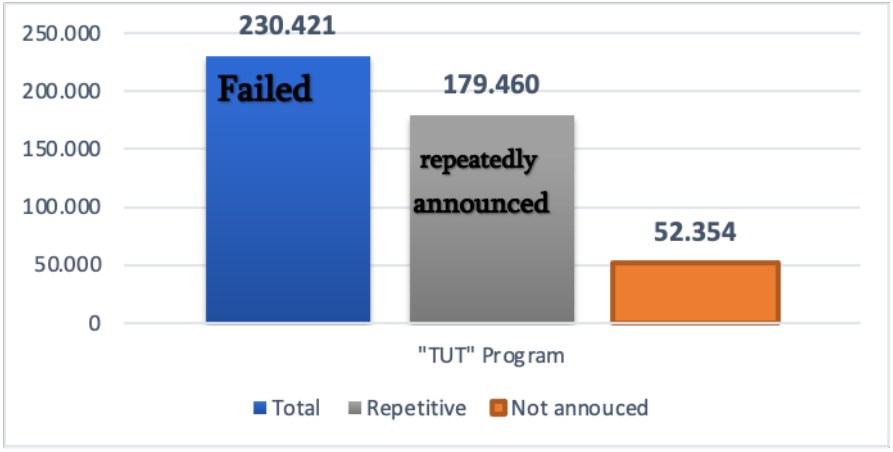

Graphic 2. On graphic presented defective and repeatedly announced vehicles

II. PERIODICAL TECHNICAL INSPECTION SOFTWARE

The earliest among these programs is Ltd. "TUT" program, which was create and mainly unite 39 test centers until 2018. The program has the technical capacity to cover new centers, however, as it turns out later, the new companies were deny to enter the existing software and created their own, which independently linked to the relevant state executive bodies.

The Accreditation Center periodically summarizes the data received from 5 e-programs and provides them to the interested persons. Based on e-programs, the Ministry of Internal Affairs imposes administrative sanctions on those car owners who have not passed the mandatory Periodical Technical Inspection within the deadline defined by law. The statistics produced by the Accreditation Center are superficial and mainly reflect the number of periodical technical inspection cases through time the information was requested. There also may be inaccuracies, as they are assembled / compiled mechanically. Because of it is not possible to automatically display daily or monthly data in a common database, it is impossible to see the inspection dynamics.

The result of 5 independent e-program is also that it is practically unclear whether the inspection is primary or repeated, or more visits have been made to the centers. Different approaches are also the result of the existence of 5 independent e-software and an incomplete information system. The capabilities of the e-program are not fully utilized by the state structures, for example: no monitoring system of inspectors is introduced at all, the component of prevention of manipulations and etc. The analysis shows that the relevant government agencies do not have information on the capabilities of the e-program, so the functions of the existing programs are low, while in the experience of European Union countries, it is the main tool for fighting against corruption.

Also, without requesting vehicle registration numbers, it is impossible to determine the unique number of vehicles inspected and, consequently, to calculate the percentage of vehicles inspected in the fleet. At the same time, it is not mandatory to produce statistical information on the failed inspections, which makes it impossible to assess the technical condition of fleet in Georgia. It is not possible to gather information, draw relevant conclusions, develop recommendations and plan preventive measures.

The Ministry of Economy and Sustainable Development took into account the requirements of business organizations and not the recommendations of the consulting company and the non-governmental sector. The following problems arose:

1. E-programs "cannot see" each other. It is not possible to clear vehicle inspection history for inspection centers if they are involved in different software
2. Different approaches in inspection process
3. Accurate statistical data cannot be processed and analyzed
4. Increased corruption risks

By IAI ISSN 2671-3179

III. CONCLUSION

The first phase of the Mandatory Periodical Technical Inspection (PTI) reform came into force on 1 January 2018 and its main objectives were: To reduce the number of road accidents and emissions caused by technical malfunctions. Mandatory PTI for all categories of vehicles came into force on January 1, 2019. In addition, the basis for the reform was: Directive 2009/40/EC of the European Parliament and of the Council of 6 May 2009, Directive 2014/45 / EU of the European Parliament and of the Council of 3 April 2014, The Association Agreement "between the European Union and the European Atomic Energy Community and their Member States, of the one part, and Georgia" and November 13, 1997 (Vienna) – "Agreement concerning the Adoption of Uniform Conditions for Periodical Technical Inspections of Wheeled Vehicles and the Reciprocal Recognition of such Inspections"

A list of essential measures is provided to reduce corruption risks in the Periodical Technical Inspection area and make the inspection process transparent and fair.

In particular:

- It is important to regulate the PTI sector structurally. Designate a government agency responsible for administration, oversight, monitoring and preventive measures, which will also be responsible for managing the e-program, processing the received information and drawing up a future action plan. Today, a similar but incomplete function is provided by the Accreditation Center and the Land Transport Agency, which needs to be provided with adequate resources (material-technical, physical). It is important to write down the functions of the relevant services according to the challenges.
- The PTI results of registered vehicles should be integrated into a centralized database. The reason for the failure of the vehicle must be explained in detail in the unified information system. It should be possible to determine the number of unique inspected vehicles. It is necessary to create a vehicle inspection history that will be accessible to any accredited center, which will be the basis for reducing the number of different approaches.
- Processing statistical data continuously. Determining the action plan and preventive measures as a result of the analysis of the information received by the e-program.
- Functionally fully load of the e-program. The most important of these is the creation of an individual monitoring mechanism for inspectors, which means placement of inspector's personal data in the program and the introduction of a rating system. In such case, the average rate of inspection failures (percentage) is set in the e-program and in case of its frequent violations, the inspector is subject to special monitoring. Training of inspectors should also be planned taking into account the content of the detected violations.
- According to international practice, if the inspector manipulates and tries to change/falsify the results of the inspection, the "anti-fraud" function of the e-program is automatically activated, the "alarm signal" is activated, the program is paralyzed and the inspector is not allowed to continue the procedure. This is the one of the most effective anti-corruption features of software.
- During inspection, the characteristics of the vehicle must be compared with the norms approved by the manufacturer. As in EU countries, inspectors should be provided with access to the information bases of vehicle manufacturers. Integration of the e-program with this feature, on the one hand, will reduce the number of manipulations and misconduct, and on the other hand, will become a protection mechanism for the inspector in disputed matters.

Expenditure patterns of elderly households in the European Union

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Abstract

The contribution of the submitted paper is the analysis of structure of consumption expenditure according to COICOP consumption purpose. The reference group were the households of the elderly – with at least one person aged 60 years or over. The paper examined the expenditure of observed age group with focus on the following twelve categories: food and non-alcoholic beverages, alcoholic beverages, clothing and footwear, housing costs, household equipment and routine maintenance, health, transport, communications, recreation and culture, education, restaurants and hotels and miscellaneous good and services. Moreover, the financial behavior of seniors was analyzed with regard to geographical, political, social and economic aspect. The data were obtained from the Household Budget Survey, which evaluates household budgets at the national level and focuses primarily on consumer spending. The analysis covered all EU countries, except for Great Britain for the last round of data collection, which was in 2015. The results showed that the most important items in the consumer basket of elderly are housing expenditures as well as catering expenditures – the basic items necessary for life. The remarkable fact is, that pensioners spend the smallest part of their expenditure on education, while their expenditure on alcoholic beverages are on average 11 times higher, e.g. in Romania it is the highest – 47 times. Data for 2020 have not been published yet, but the addition is expected in the first quarter of 2021, what would allow us to further processing and comparison of the most recent data.

Keywords: financial behavior, consumption, elderly, COICOP, Household Budget Survey.

1. Introduction

Demographic changes and population ageing represent a challenge that each country needs to face around the globe. It results in increasing share of people in post productive age. Therefore, it is also necessary to meet the basic needs of the elderly and to focus on their consumer and financial behavior at the market. It is essential to recognize the areas where there is the greatest demand for goods and services intended for this age group.

2. Data and methodology

The structure of household consumption expenditure is analyzed on the basis of the HBS database, which is an abbreviation for Household Budget Survey. This is a survey of household budgets at national level and focuses primarily on consumer spending. The survey is conducted in all EU Member States and its main objective is to calculate weights for the Consumer Price Index.

The consumption expenditure is involved in COICOP (*Classification of Individual Consumption by Purpose*) classification, which recognizes the following twelve areas (UN, 2018):

- food and non-alcoholic beverages;
- alcoholic beverages, tobacco, and narcotics;
- clothing and footwear;
- housing, water, electricity, gas and other fuels;
- furnishings, household equipment and routine household maintenance;
- health;
- transport;
- communications;
- recreation and culture;
- education;
- restaurants and hotels;
- miscellaneous goods and services.

By IAI ISSN 2671-3179

In the paper, we analyzed the consumption expenditure of households in all countries of the European Union, except for Great Britain which is not part of it since 2020. Survey data are collected and published every five years since 1988. The last three rounds of the collection were 2005, 2010 and 2015, which is the most recent reference period we were working with. The next reference period is 2020 for which data have not been published yet but the completion of data is expected for the first quarter of 2021 (Eurostat, 2021a). This would allow us for further processing and comparison of the most recent data.

The reference group were the households of the elderly – people aged 60 years or over. The analytical part uses general scientific methods such as analysis, deduction, comparison, graphical outputs on form of radar and column chart. The paper also includes a correlation analysis.

The following research questions were analyzed in the paper:

RQ1: Which item is the most important for European seniors in the expenditure structure?
RQ2: Which item is the least important for European seniors in the expenditure structure?
RQ3: How do economic, social and political aspects affect senior´s financial behavior or consumption habits?

3. Results and discussion

As regards food expenditure, Slovakia is the ninth country in the ranking and together with the other countries of the Visegrad Group, spends approximately the same amount, ahead of Poland and Hungary. These countries are above the average which is almost 17%. The highest value was recorded in Romania (more than 30%) and on the contrary, the lowest was spent in Luxembourg (9.0%). Share of expenditure on food and non-alcoholic beverages in the individual countries is shown in Figure 1.

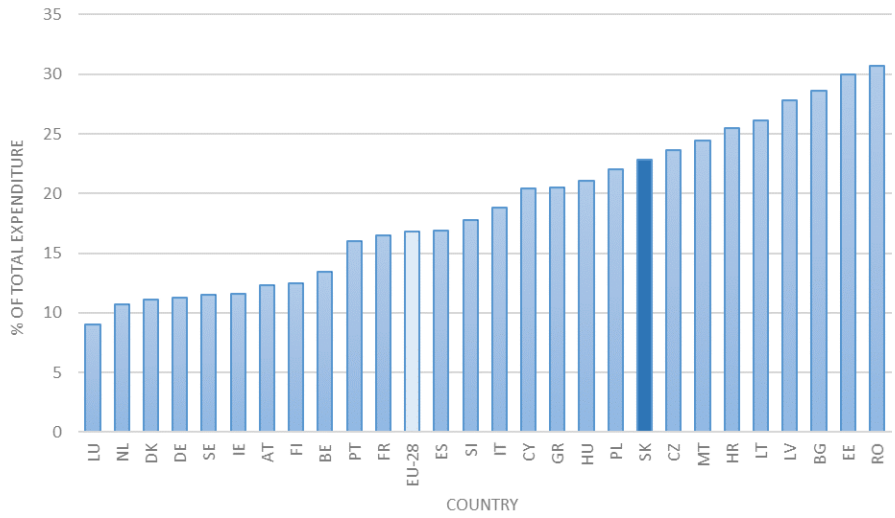

Figure 1 Household expenditure on food and non-alcoholic beverages
Source: own processing (HBS, 2021)

Pensioners' expenditure on alcoholic beverages and tobacco products is one of the lowest and least significant items. Slovakia took sixth place among EU countries and the consumption of this item is higher than the average. Only Bulgaria, the Netherlands, the Czech Republic, Estonia and Romania fared worse. The Scandinavian and some Mediterranean countries are below average. Retirees spend the least on alcohol and tobacco products in Luxembourg. The remarkable fact is that pensioners spend less on education than on alcohol and tobacco. At the same time, spending on alcoholic beverages and tobacco is, on average, up to 11 times higher than spending on education. In the case of Slovakia, this value is 14 times higher and in 47 times higher in Romania. Share of expenditure on alcohol beverages and tobacco products in the individual countries is shown in Figure 2.

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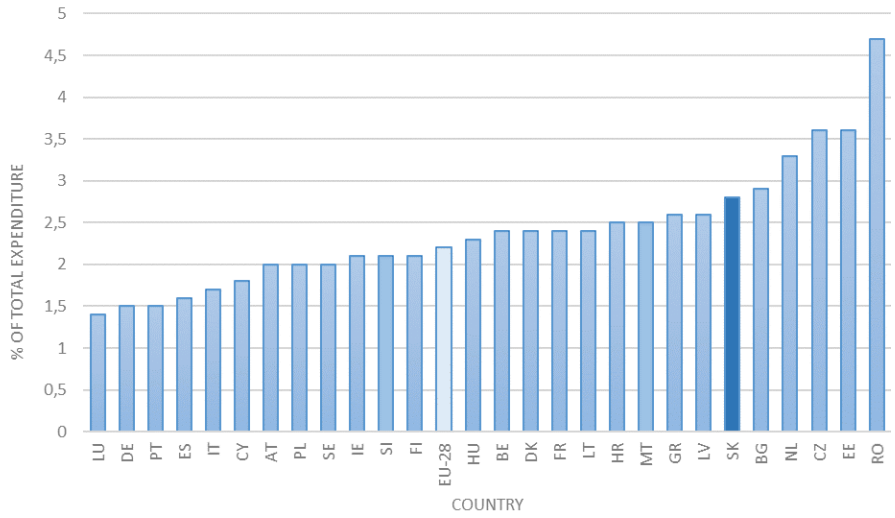

Figure 2 Household expenditure on alcoholic beverages and tobacco
Source: own processing (HBS, 2021)

The average expenditure on clothing and footwear makes up only a small part of total expenditure. Slovakia ranked sixth among the countries that spend the least money on this item, with only the following countries spending less: Portugal, France, Finland, Bulgaria and Hungary, that achieved the lowest value. Retirees living in Malta spend the most, and twice as much as the average. The share of expenditure on clothing and footwear in the individual countries is shown in Figure 3.

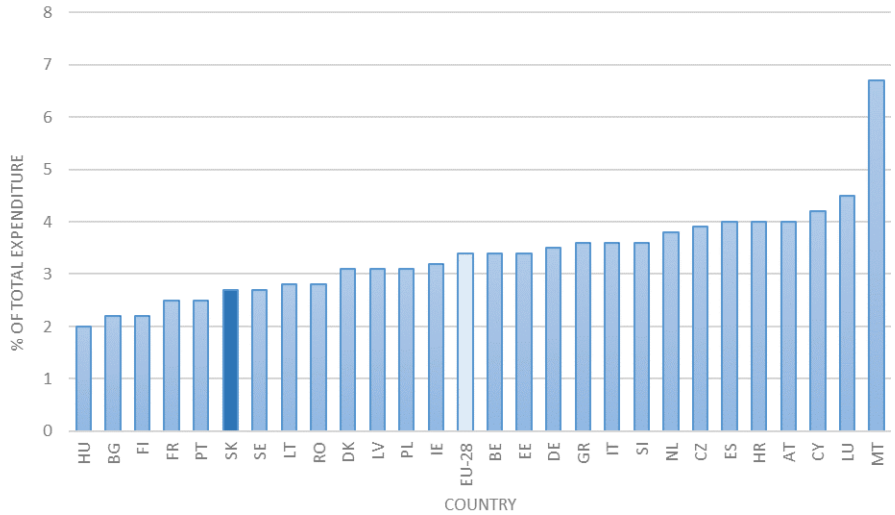

Figure 3 Household expenditure on clothing and footwear
Source: own processing (HBS, 2021)

Expenditures for housing, water, electricity, gas or other fuels represent the most important item in the structure of expenditure. Also, all types of households spend the most on this item, not just households of pensioners. On average, housing expenditures and related costs represents a third of total consumer expenditures. The highest share was observed in Hungary and Lithuania followed by pensioners in Slovakia and Romania (more than 40% in all countries). The Czech Republic has the third

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lowest value. Only people in Estonia and Malta spend less. The share of expenditures on housing, water, electricity, gas or other fuels in the individual countries is shown in the Figure 4.

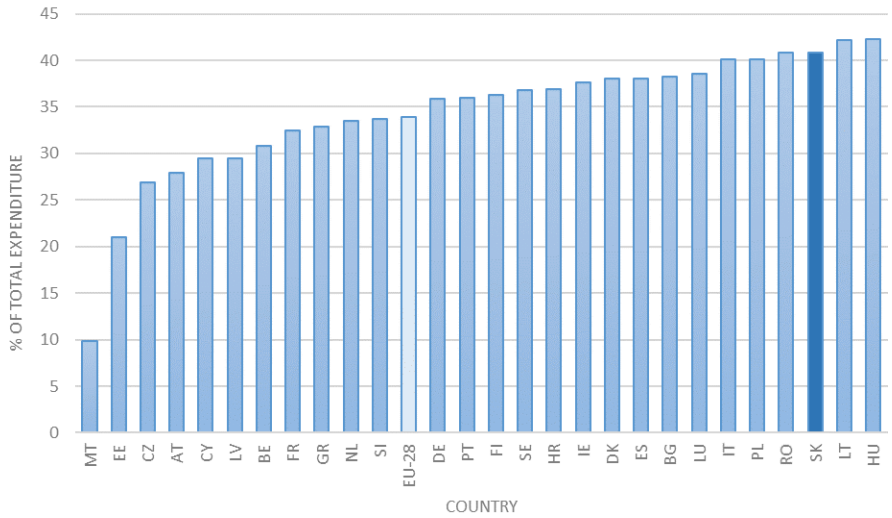

Figure 4 Household expenditure on housing, water, electricity, gas and other fuels
Source: own processing (HBS, 2021)

Expenditure on furniture and routine household maintenance is one of the less significant, as on average they spend just over 5% of total expenditure on this item. While Malta has emerged as the country with the lowest expenditure on housing it is the country with the highest expenditure on furniture and routine maintenance. Retirees spend up to 7.5% on this item, followed by Austria, Cyprus and Estonia. The countries with the lowest expenditures are Romania, Latvia, Lithuania and Croatia. The share of expenditure on furniture and routine household maintenance and the location of individual countries is shown in Figure 5.

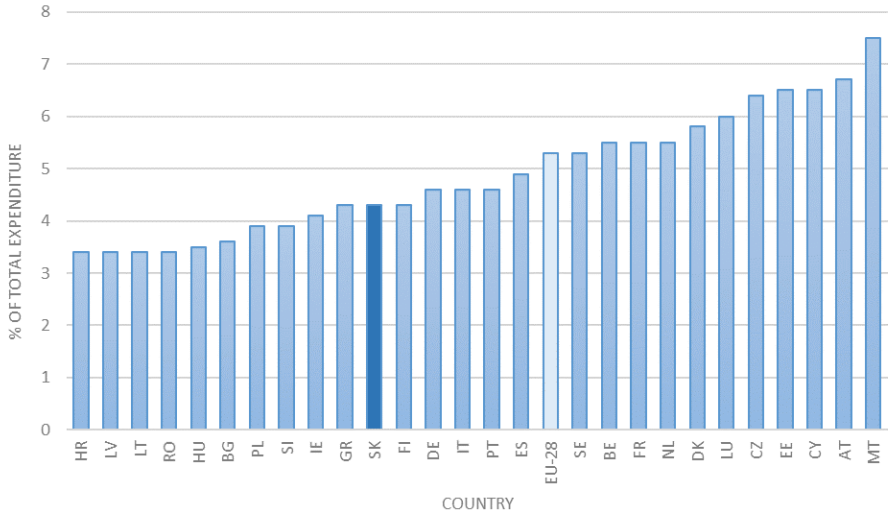

Figure 5 Household expenditure on household equipment and maintenance
Source: own processing (HBS, 2021)

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Expenditures on health do not reach high values, but they are undoubtedly an important part of consumer expenditures in this age group. This item includes the purchase of medical products, apparatus and equipment (including prescription medicines and medicines), outpatient medical services and hospital services. The average value is 4.7% of total expenditure, which is less than expenditure on food, alcoholic or non-alcoholic beverages, housing, furniture, transport or recreation. Retirees spend the most on health in Lithuania (more than 10%) and the least in the Netherlands (less than 2%). The proportion of people over the age of 65 is almost the same in both countries. The share of health expenditure is shown in Figure 6.

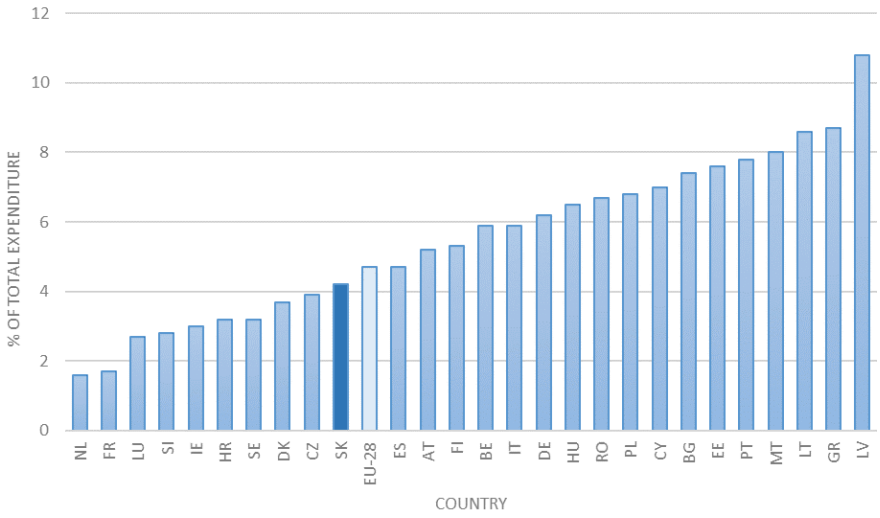

Figure 6 Household expenditure on health
Source: own processing (HBS, 2021)

Expenditure on transport is a relatively important item, as it is on average almost 10% of total expenditure. This item includes the purchase of means of transport, their operation and transport services. Retirees living in Western European and Scandinavian countries spend the most on transport. The share of transport costs in individual countries is shown in Figure 7.

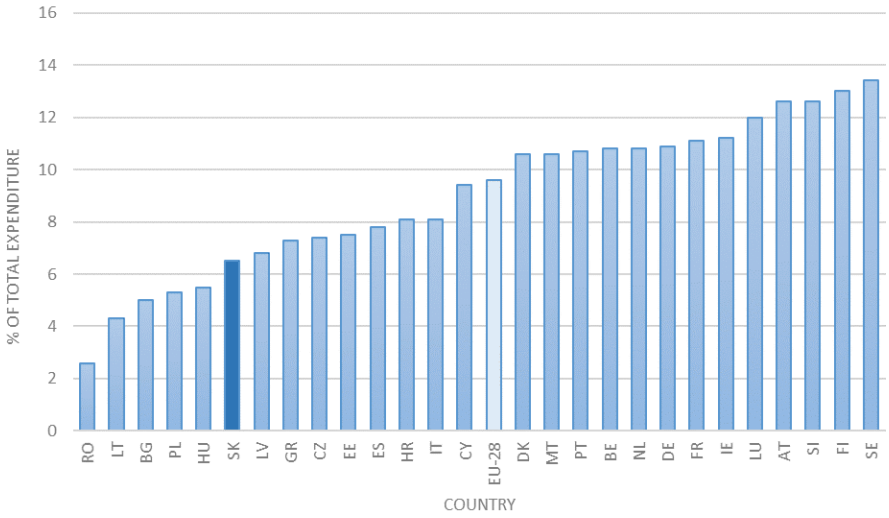

Figure 7 Household expenditure on transport
Source: own processing (HBS, 2021)

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Expenditure on postal and telecommunications services are one of the lowest. On average, it is less than 3% of total amount. The position of individual countries can be seen from Figure 8 – the highest value is assigned to Hungary and the lowest to Austria.

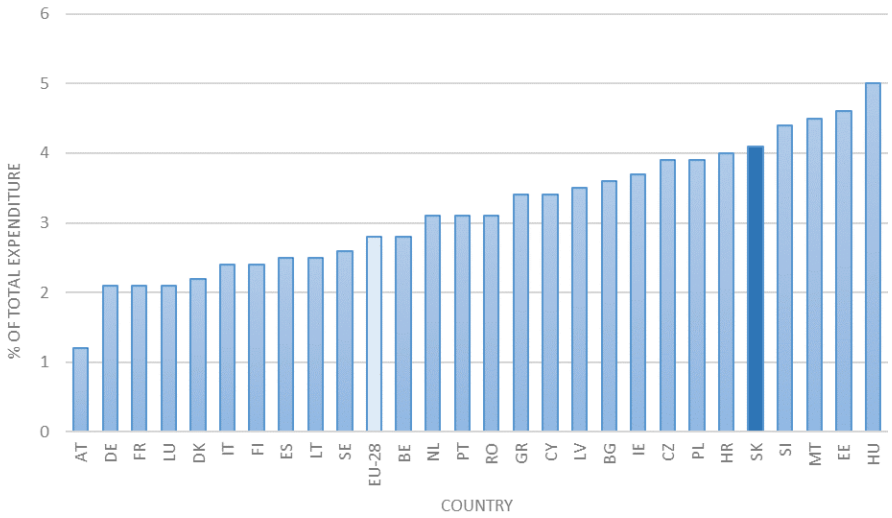

Figure 8 Household expenditure on communications
Source: own processing (HBS, 2021)

Recreation and culture are areas characterized by a relatively high share of total expenditures. The average value is about 8%. The highest share was observed in Sweden (almost 13%) and the lowest in Romania (about 2%). The share of recreation and culture costs in individual countries is shown in Figure 9.

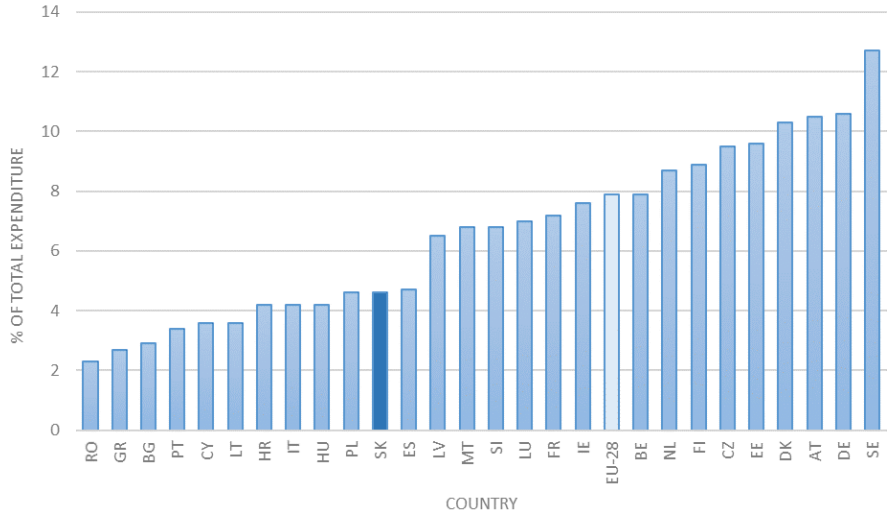

Figure 9 Household expenditure on recreation and culture
Source: own processing (HBS, 2021)

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Seniors spend the minimum on education, on average it is only 0.2%. The most is spent in Cyprus and Malta, but it is also quite low – only 1% of total costs. The share of education costs in individual countries is shown in Figure 10.

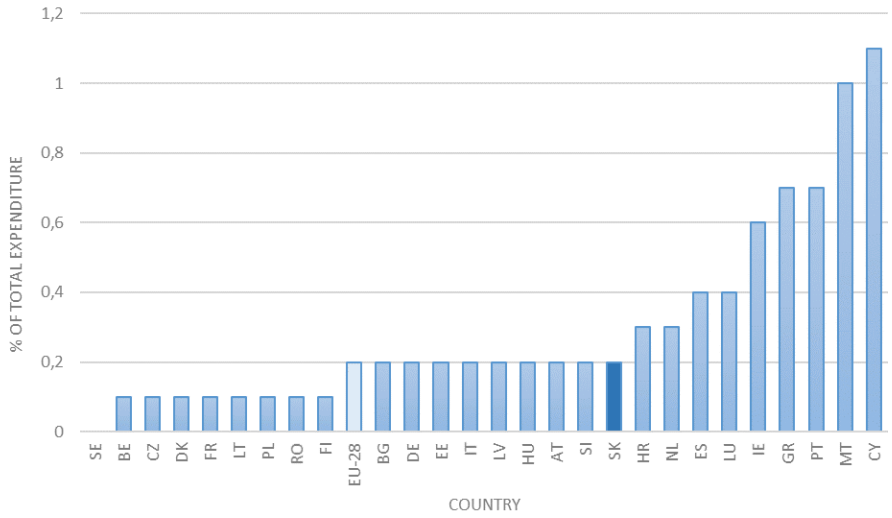

Figure 10 Household expenditure on education
Source: own processing (HBS, 2021)

When talking about restaurants and hotel services, it is quite usual among seniors. On average, they spent almost 5% on eating in restaurants or spending night in hotel when travelling. The highest value was recorded in Luxembourg (8%) and the lowest in Romania (less than a half percent). The share of expenditure on restaurants and horels in individual countries is shown in Figure 11.

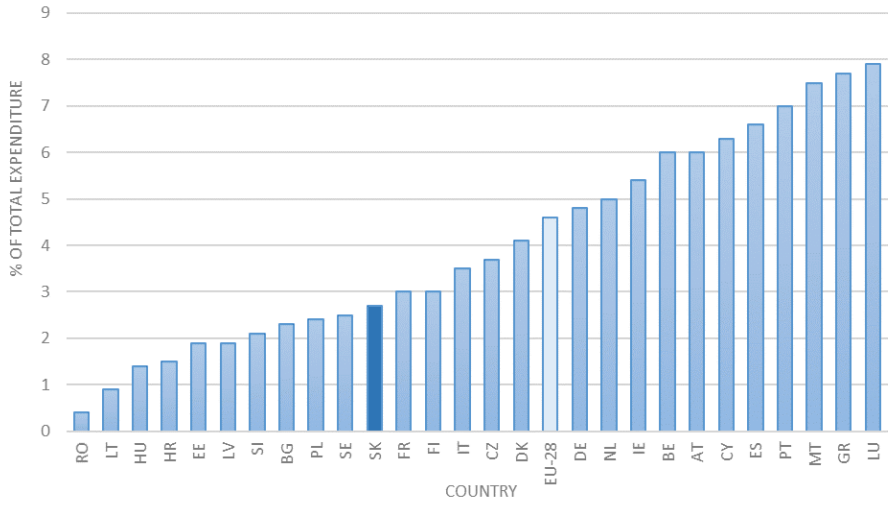

Figure 21 Household expenditure on restaurants and hotels
Source: own processing (HBS, 2021)

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Figure 12 illustrates the expenditure of elderly households on miscellaneous goods and services. Average value is almost 9% and the highest value was observed in France, while in pensioners in Romania spent the least.

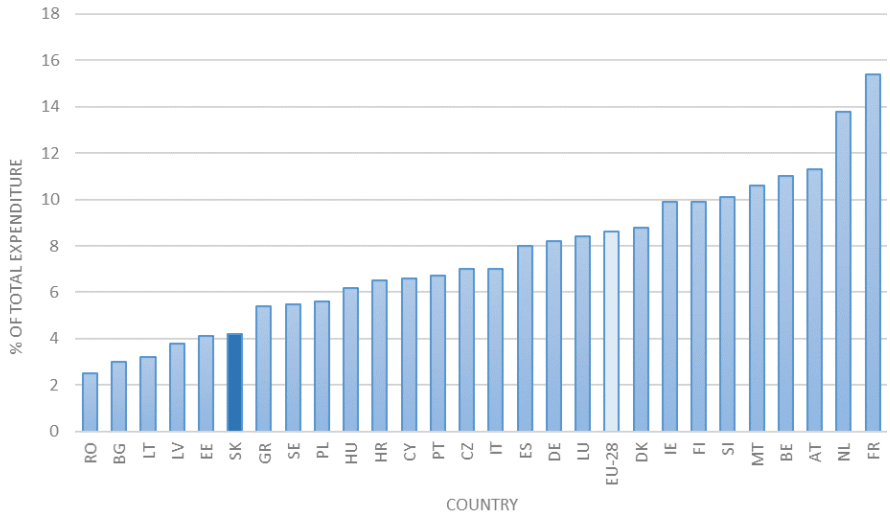

Figure 32 Household expenditure on miscellaneous goods and services
Source: own processing (HBS, 2021)

The following chart shows the distribution of pensioner's expenditure into the above mentioned areas. It shows the average situation in the EU countries over the most recent available period. It is obvious that the most important items in the consumer basket are housing expenditures and related costs, as well as expenditure on food and non-alcoholic beverages. Generally, these are the basic items necessary for life.

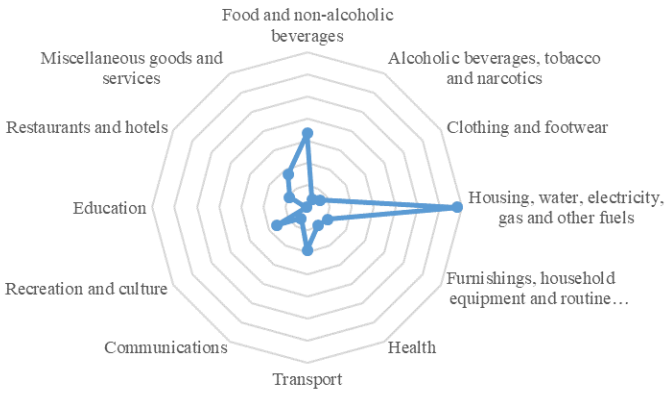

Figure 13 Structure of consumption expenditure in EU countries
Source: own processing (HBS, 2021)

As one of the aims of the paper is to analyze the geographical, political, economic and social aspects of the financial behavior of seniors, it is necessary to define particular aspects and find the suitable variables that could represent them. In this analysis, the geographical aspect is conditioned by the individual countries of EU. The economic aspect is determined as the amount of gross domestic product at market prices per capita (Eurostat, 2021b). The social aspect is represented by government expenditure

on pension (Eurostat, 2021c) and the last, political aspect is the fiscal indicator. gross public debt (Eurostat, 2021d). Following table shows the correlation coefficients between individual types of expenditures and particular aspect.

Table 1. Correlation coefficients

	economic aspect	social aspect	political aspect
Food and non-alcoholic beverages	-0.81539	-0.46251	-0.25473
Alcoholic beverages, tobacco and narcotics	-0.42124	-0.34937	-0.39874
Clothing and footwear	0.20036	-0.08430	0.05409
Housing, water, electricity, gas and other fuels	0.04965	0.10895	0.05586
Furnishings, household equipment and routine household maintenance	0.40172	0.12086	-0.05257
Health	-0.54548	-0.15593	0.05991
Transport	0.69832	0.35398	0.17834
Communications	-0.54516	-0.51794	-0.15185
Recreation and culture	0.54928	0.05716	-0.32824
Education	0.00599	-0.03333	0.41088
Restaurants and hotels	0.49484	0.36440	0.46747
Miscellaneous goods and services	0.51308	0.40185	0.27219

Source: own processing.

If we look at the individual measures of correlation, we can observe several interesting facts. There are types of expenditures in the analysis that are negatively correlated with all monitored aspects, e.g. expenditure on food and non-alcoholic beverages. Others are in all cases positively correlated, e.g. recreation and culture expenditure. In some cases, some aspect affects the observed variable positively and the rest negatively, or vice versa. In the whole observed group, the highest absolute degree of correlation was recorded in the case of the economic aspect and expenditure on food and non-alcoholic beverages, the lowest in the case of the economic aspect and expenditure on education.

4. Conclusion

To sum up, the paper was primarily focused on the analysis of structure of consumption expenditure according to COICOP consumption purpose. We tried to discover which items from consumer basket are the most important for seniors and consequently, to which items they spend the most money. The results showed that the most important items in the consumer basket of elderly are housing expenditures as well as catering expenditures – the basic items necessary for life. The remarkable fact is, that pensioners spend the smallest part of their expenditure on education, while their expenditure on alcoholic beverages are on average 11 times higher, e.g. in Romania it is the highest – 47 times. Data for 2020 have not been published yet, but the addition is expected in the first quarter of 2021, what would allow us to further processing and comparison of the most recent data.

Nomenclature

COICOP Classification of Individual Consumption by Purpose
EU European Union
HBS Household Budget Survey

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PSYCHOLOGICAL FACTORS – PREDICTORS OF SUICIDAL BEHAVIOR

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Abstract

The identification, recovery and social integration of people in various stages of existential crisis, presenting a suicidal risk, are some of the most important objectives of any modern society. In psychological and psychiatric point of view, suicide is an act determined by a psychic state with an ambivalent character which implies on the one hand the renunciation, and on the other hand the courage, being characteristic to those persons who cannot adapt to the psycho-social requirements. The suicides are defined by a constellation of personality traits that cause them to resort to the suicidal act imperatively - affective frustration, inability to adapt socially, personal insecurity, close dependence on other people, different mental disorders.
Adaptive syncopes, mainly due to primary vulnerabilities, acquired during childhood - adolescence, often lead to the structuring of personality elements with longitudinal echoes in the individual's behavior.Thus, the start of programs aimed at raising both the level of awareness among the population and multidisciplinary prophylaxis on this major public health problem is imperative.

Keywords: suicidal behavior, depression, impulsivity, self-esteem, neuroticism, stress, resilience

Introduction

Contemporary society encourages the human individual, early on, towards the exceeding of personal boundaries, thus often ignoring its adaptive capacity with longitudinal implications in the harmonious structuring of personality.

A decisive element in choosing the theme was the statistical reality regarding the alarming increase in recent years in the suicide rate among young people aged 15-19, as well as people in the category 50-54 years, placing Romania in a top of the countries with the highest incidence of suicides at these intervals.

Thus, the launch of programs aimed at raising both the level of awareness among the population and multidisciplinary prophylaxis on this major public health problem is imperative.

Personality factors and their facets, as well as other constructs in the field of psychology, are outlined as associated or predictive factors, often insufficient suicidal behavior, but grafting socio-demographic components over them causes a substantial increase in predictive level, requiring the construction of models. Interdisciplinary study on the prophylaxis of this phenomenon.

Suicidal behaviour would remain a major public health problem around the world, with Romania placing 2500-3500 annual suicides in the European average.

Suicide and suicidal behavior

The World Health Organization (1992) defines suicide as "an act by which an individual seeks to physically destroy himself, with the more or less genuine intention of losing his life, being more or less aware of the reason for the gesture" .

The etymology of the term suicide comes from the Latin words "sui" = self "caedere" = killer, meaning "self-murder", and the first to use the term was Browne (1642), physician and philosopher in "Religio medici" (De Leo et al., 2004).

Durkheim (1993) considered suicide to be the end of life, a direct result of the suicidal person's conscious awareness of the fatal effect of his action, while Maris (2002) illustrated that suicide is, by definition, not a disease but a disease. death that is caused by a deliberate self-inflicted action or behavior.

We use the general term suicidal behavior to refer to a person's thoughts and behaviors related to the intentional suppression of their own life (O'Connor & Nock, 2014). Several terms, such as deliberate self-harm and parasicide, are still widely used, encompassing under their "umbrella" all non-lethal self-harming acts, whether behind these forms of behavior is suicidal intent.

Much of the difficulty in defining suicidal behavior stems from the broad spectrum of outcomes that the term must describe, perpetuating an inaccuracy in classification (O'Carroll et al., 1996). Fatal suicidal behavior tends to have social, clinical, and demographic characteristics that are very different from those of nonfatal suicidal behavior, leading to the adoption of a number of terms in an attempt to cover these differences.

The intention to die is an important distinction in many cases and has led to the use of alternative terminology, such as the term parasuicide adopted by the World Health Organization since 1997.

In her research, Doina Cosman (2010) illustrated that through the suicidal act, the individual refrains his aggression against himself, being the same desire that determines him to commit acts of violence against others: he thus seeks to alleviate his suffering, to get rid of that part of him, which is, in his opinion, the source of all trouble. In the same direction, Leenars et al. (2018) presented suicide as a conscious act of self-induced annihilation, best understood as a multidimensional negative state of an individual whose unmet needs define a problem for which suicide is perceived as the best solution.

Psychological theories

Psychological theories on suicide fall into the following categories, namely, psycho-dynamic theories, cognitive-behavioral theories and developmentalist theories. First, psycho-dynamic theories present the suicidal act as a product of subconscious impulses. Following a Freudian line, Menninger formulates a theory in which the two fundamental instincts of man, eros and thanatos, are in a permanent state of conflict. Achieving a level of balance between the two opposite instincts determines the type of behavior of the individual who can go to areas of self-destruction or harmony. Second, cognitive-behavioral theories present the main determinants of the suicidal act as: hopelessness, cognitive mode, memory deficits and emotional disorder. At the same time, recent cognitive (Bryan & Rudd, 2006) and behavioral (Wenzel & Beck, 2008) models have guided the evolution of treatments in these areas. Third, developmentalist theories focus on the causal role that social forces and family systems play in the behavior of the suicidal person. Van Orden et al. (2010) and Durkheim (1993), and their theories bring important elements regarding the determinants and potentiators of suicidal behavior. Psychological theories are important both theoretically and clinically, as they provide a framework for understanding the complex mode of interaction between factors that combine to increase the risk of suicide. In addition, these theories help identify possible goals that can be implemented for treatment.

Constructs

Neuroticism. This area, which affects a very large number of conduct, puts in opposition to adaptation or emotional stability with inadaptation.

Depression. This facet of neuroticism measures normal individual differences in the tendency to feel depressive disorders, prone to culpability, sadness, feelings of powerlessness and loneliness.

Impulsivity. Sends to the inability to master desires and needs being perceived as so imperative that the individual cannot resist them even if he subsequently regrets it.

The extraversion (Introversion). While it is easy to describe the extraverted subject, it is, instead, much more difficult to trace the portrait of the introverted subject. In a certain way, introversion can be considered as the absence of extraversion rather than its opposite.

Stress is a syndrome, a constellation of nonspecific responses with a general adaptive character caused by the aggression of stressagents on the body.

Self-esteem is a personality trait in relation to the value an individual attributes to his person.

Resilience is the ability to succeed in a socially acceptable way, despite stress or adversity that normally carries the serious risk of a negative outing.

Objectives

The main objective of this research is to identify a predictive model of suicidal behavior by establishing the most important predictors, like personality factors and their facets, focusing in particular on neuroticism, introversion (extroversion), depression, impulsivity and other psychological factors like stress, self-esteem and resilience.

Research assumption

It is presumed that the most important predictors of suicidal behaviour in the case of evaluated participants are impulsivity, neuroticism and depression.

Instruments

For the data collection tools were used the following instruments:

- Suicidal Behaviors Revised Questionnaire (SBQ-R), Osman et al., 2001.
- The Revised NEO Personality Inventory (NEO PI-R), Costa & McCrae
- Perceived Stress Questionnaire (PSQ), Levenstein et al., 1993
- Zung Self-rating Depression Scale (SDS), Zung, 1967
- Self- Esteem Scale (SES), Rosenberg,1965
- Resilience Scale (RS), Wagnild & Young, 1993

By IAI ISSN 2671-3179

Participants

The number of participants in this research (N=207),the collected data being processed by statistical methods, the design being a descriptive-exploratory cross-sectional type.

The collected data being processed by statistical methods, the design being a descriptive-exploratory cross-sectional type**.**

Table 1. Basic statistical inventory and initial univariate analyzes of variables

Variabiles	M	SD	SKEW	KURT	N
Suicidal behavior	4,20	1,14	1,08	0,86	207
Neuroticism	105,03	10,09	- 0,19	- 0,19	207
Extraversion	109,69	9,17	0,38	0,83	207
Impulsivity	17,64	2,84	- 0,00	1,05	207
Depression	53,93	9,42	0,14	- 0,22	207
Stress	65,91	21,87	0,94	- 0,46	207
Self-esteem	26,20	5,19	0,66	- 0,31	207
Resilience	136,70	19,98	0,26	- 1,02	207

Table 2. Correlation coefficient I and determination ratio (R^2) values for explanatory suicidal behaviour models

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	**,691[a]**	**,478**	**,459**	**,840**
2	**,691[b]**	**,478**	**,462**	**,838**
3	**,690[c]**	**,477**	**,464**	**,837**
4	**,689[d]**	**,475**	**,464**	**,836**

a. Predictors: (Constant), rezilientce, impulsivity, stress, depression, self-esteem, extraversion, neuroticism

b. Predictors: (Constant), impulsivity, stress, depression, self-esteem, extraversion, neuroticism

c. Predictors: (Constant), impulsivity, depression, self-esteem, extraversion, neuroticism

d. Predictors: (Constant), impulsivity, depression, self-esteem, neuroticism

The seven predictors included in the original model lead to four regression models. The first model, which includes all predictors, explains 47.8% of suicidal behaviour (R^2 = .478), the second model comprising six predictors (after "resilience" has been eliminated) also explains 47.8% (R^2 = .478) of suicidal behaviour, the third model comprising five (after "stress" has been eliminated) explains

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47.7% (R^2 = .477) of suicidal behaviour and the fourth model with four inclusive predictors (impulsivity, depression, self-esteem and neuroticism) after being excluded" 47.5% (R^2 =.475) of suicidal behaviour.

The statistical significance of the multiple correlation coefficient is calculated using the variance test (F) ANOVA presents the results of the analysis of suicidal behaviour variance under the influence of factors included in regression models. As test F is observed is statistically significant for all four estimated models, meaning that all predictors initially included in the model can be used in the estimation of suicidal behaviour, either in a positive or negative.

For predictive models resulting from regression analysis, the following F test values have emerged:

- - for model b – F(7. 206) = 26.013, p < 0.01 which is able to explain, in adjusted form, a ratio of 45.9% (R^2 adjusted = .459) of suicidal behaviour;
- - for model c – F(6. 206) = 30.502, p < 0.01 which is able to explain, in adjusted form, a ratio of 46.2% (R^2adjusted = .462) of the evolution of suicidal behaviour.
- - for model d – F(5. 206) = 36.612, p < 0.01 which is able to explain, in adjusted form, a ratio of 46.4% (R^2 adjusted = .464) of the evolution of suicidal behaviour.
- - for model e – F(4. 206) = 45.650, p < 0,01 which is able to explain, in adjusted form, a ratio of 46.4% (R^2adjusted = .464) of the evolution of suicidal behaviour.

The fourth model is considered to be the most significant due to the very low significance threshold, as with the other three models, but mainly due to the highest f test, indicating strong interdependence between the predictors included in the models and suicidal behaviour. T-test values and significance thresholds in, where we chose to present only the last predictive, significant model that best explains suicidal behaviour.

We note that the preacher "low self-esteem" statistically explains the evolution of suicidal behavior (t = - 7.261, p < .001), followed by "depression" (t = 4.700 p < ,001), "neurorotism" (t = 3.026 p < .001) and "impulsivity" (t = 2.699 p < .001).

Based on the results obtained we can write the regression equation as follows:

b = 1.986 + 0.057 impulsivity + 0.030 depression + 0.021 neuroticism – 0.098 self-esteem.

Conclusions

Of all seven variable-predictors, three variables do not explain suicidal behavior: resilience, stress and extraversion. We can say that in the case of the 207 participants in our study, the three variables do not influence suicidal behaviour or if this happens not in interaction with other predictors.

Based on the results obtained, we can accept as true the hypothesis that the most important predictors of suicidal behaviour for the evaluated participants are impulsivity, neuroticism and depression.

Hierarchizing these predictors, we can say that the occurrence and development of suicidal behavior has a very important weight, impulsivity, followed by depression, neuroticism and last but not least a low self-esteem.

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Genetic and Genomic Analysis Using Krylov Subspace Methods

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Abstract

In Bioinformatics studying and understanding large/complex biological data is very important, particularly in the field of genomics and genetics. Complex diseases are typically caused by a combination of genetic and environmental factors not just by individual genes. Genetics studies single genes and their effects in inherited disorders. Meanwhile, genomics examinates interactions of all genes with each other and with environmental factors. Networks are one way to represent these biological and biomedical systems that consist of DNA, RNA and proteins molecules and can be useful to capture interactions between them. By using matrix functions of the network's adjacency matrix, we can evaluate the importance of entities. Important entities give information about the local or global influence (or both) of these molecules on the whole network.

The analysis of large biological data, represented by thousands of variables, usually genes, in dozens of samples, can be quite expensive. High-dimensional microarray data (a sequence of dots of DNA, protein, or tissue) from experiments are set into arrays to be easily processed. Microarrays are used to study gene expression levels of a particular condition in a given organism. Only a few genes play an important role in causing the condition, consequently dimension reduction can be applied in order to highlight the few most important genes from thousands. So, the large number of variables (genes) can be brought down to a much smaller number without losing any significant information.

Krylov subspace methods are a great tool for complex network analysis and for estimating the dominant subspace in dimension reduction problems based on their orthogonality, minimization and matrix-free properties. They can be used to evaluate centrality measures for biological entities, communicability, clustering properties, as well as top k eigenvalue and corresponding eigenvectors (without having to compute all eigenvalues). In this paper are performed different experiments using real biological networks with thousands of nodes and gene expression microarrays for different type of cancers, containing up to 54,676 gene types, 151 samples and different classes. Methods used for network properties and dimension reduction in large arrays are contemporary Krylov methods from different authors. The purpose of this paper is to highlight the advantage of these methods in large-scale and real-life applications, providing fast convergence with low storage cost.

Keywords: Krylov methods, Biological Networks, Microarray Data, Gene Expression, Complex Network Analysis, Dimension Reduction.

1. Introduction

In this era, scientists can give a great contribution to healthcare or public health research by using advanced technology equipment to conduct daily experiments but with it comes also a drawback. Thousands of biological/biomedical experiments lead to a very large amount of data that can be difficult to manage/store. Raw data are difficult to translate or give any valuable information so in order to get a more meaningful outcome before applying different methods they need to be filtered (select just e few variables that have most influence) or reduced (raw data is transformed into a smaller set of data that contains the general information of the original one). High-dimensional datasets that are obtained from most of genomic and genetic experiments, are of great interest since they focus on complex diseases that are typically caused by a combination of genetic and environmental factors, not just by individual genes. These types of data usually have much more variables p than observations n.

Genetics is the branch of biology that study genes and how certain health conditions are passed down from generation to generation. Genes carry the instructions for making proteins. Proteins direct the activities of body cells and functions. Some genetic or inherited disorders include hemophilia, cystic fibrosis or Huntington disease. Meanwhile, genomics studies interactions of all genes in an organism, with each other and with environmental factors. Genomics includes examination of complex diseases such as cancer, heart disease, diabetes, etc.

One way to represent biological and biomedical systems are networks/graphs. Networks show associations between molecules (DNA, RNA and proteins), genes, diseases and drugs used to cure these diseases. Applications of network analysis include determining protein's or gene's function. Some genomics data types are Gene Co-Expression and Protein-Interaction. Gene co-

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expression networks (GCN) have gene expression profiles of a number of genes for a certain number of samples and indicate the pairs of genes which show a similar expression pattern across samples. Protein-protein interaction (PPI) networks contain information of how proteins operate with each other to enable the biological processes within the cell. PPI networks are scale-free networks so there are always proteins with higher degree of connectivity that appear to have higher significance. Other types of biological networks are Sequence Similarity Networks (SSNs), Gene Regulatory Networks (GRN), Biochemical networks, Signal transduction networks or Metabolic networks, representing different types of information. By using matrix functions $f(A)$ of the network's adjacency matrix, we can evaluate the importance of biological entities within a network. Important entities give information about the impact of these molecules on the whole network.

Valuable information about the expression levels of many genes at the same time (known as gene expression analysis) is obtained by using the microarray tool. The most famous microarray is the DNA microarray a sequence of spots and each spot may contain million copies of the unique identical DNA molecules that correspond to a gene. In order to measure gene expression two samples of the same genes are compared. One being the reference sample kept under normal conditions and the other sample is treated with different types of drugs or techniques. This data can be represented by a matrix, called the gene expression matrix. Each column in the matrix corresponds to different types of genes and each row correspond to samples of a condition.

Only a few genes play an important role in a specific condition, consequently dimensionally reduction techniques can be applied in order to highlight the most important genes from thousands. The most popular linear dimensionality reduction technique is Principal Component Analysis (PCA). In PCA each new variable is a linear combination of original variables such that the new variables capture maximal variance. One way of finding the new k dominant/important subspace is by using Singular Value Decomposition (SVD) on the centered (or standardized) data matrix. PCA guarantees minimal loss of information during transformation and finds uncorrelated new variables but since each of them is a linear combination of all original variables it is difficult to interpret new groups. Also, in case of such large datasets where the number of variables p is much greater than the number of observations n, PCA has inconsistent results (M. Johnstone and A.Y. Lu, 2009).

Both traditional approaches, for ranking nodes according to their importance in large networks or finding the k dominant subspace for high-dimensional microarray data are quite expensive. Krylov subspace methods are a great tool for complex network analysis since they provide good and cheaper diagonal or row sums approximations of the matrix function. Krylov subspace methods as projection schemes can also be used to generate low-dimensional subspaces (Y. Saad, 2003) and estimate only the k most 'important' eigenpair of the centered (or standardized) data matrix.

This paper describes three contemporary Krylov methods used for matrix exponential approximation, and dimensionality reduction in association with other techniques. Numerical experiments are conducted using real biological networks with thousands of nodes and gene expression microarrays for different type of cancers. Data source for Biological Networks is http://networkrepository.com/ and Gene Expression Data is https://www.kaggle.com/.

2. Network analysis via Krylov

The importance of biological entities with different centralities and corresponding techniques gives us information on their local or global influence on the entire network. Sometimes it is considered both local and global influence. In that matter, two important centralities are useful i.e., exponential/resolvent subgraph centrality and total subgraph communicability or Katz centrality. These parameters are obtained from the matrix functions $f(A)$ of the network adjacency matrix A and its invariants. Exponential/resolvent subgraph centrality derived from the approximation of diagonal entries $[f(A)]_{ii}$ and total subgraph communicability or Katz centrality from the approximation of row sums $[f(A)\mathbf{1}]_i$ of the matrix function. These centralities use exponential and inverse (resolvent) functions of a matrix. Since the networks used for applications are all undirected (weighted or not), theoretical concepts presented in the paper correspond to this type of networks only.

$SC(i) = [e^A]_{ii}$ the exponential subgraph centrality of node i in a network counts the number of closed walks centered at node i, weighting walks of length k by $\frac{1}{k!}$. $RC_i(\alpha) = [(I - \alpha A)^{-1}]_{ii}$ the resolvent subgraph centrality of node i counts the number of closed walks centered at node i, again weighting walks of length k by α^k for $0 < \alpha < \frac{1}{\lambda_{max}}$. Non-diagonal elements are also important, they can evaluate the communicability between a pair of nodes i and j. The subgraph communicability $[e^A]_{ij}$ between two nodes counts the total number of walks between nodes i and j, weighting walks of length k by $\frac{1}{k!}$ which measures how well the nodes of the network can exchange information with each other. $[(I - \alpha A)^{-1}]_{ij}$ the resolvent subgraph communicability between two nodes counts the total number of walks between nodes i and j, but here walks of length k are weighted by α^k for, $0 < \alpha < \frac{1}{\lambda_{max}}$. Valuable information on node importance can be derived from the elements of each row of $f(A)$ and it is less expensive to approximate the sum of these elements with iterative methods than diagonal elements or all matrix entries.

The sum of rows $\sum_{j=1}^{n}[e^A]_{ij}$, $1 \le i \le n$ can also be used as centrality measure and give an estimation of how well each entity communicates with the others. So, when counting all walks between node i and all the nodes in the network including node i,

By IAI ISSN 2671-3179

weighting walks of length k by a penalty factor of $\frac{1}{k!}$ we have the total subgraph communicability of node i i.e., $TSC(i) = [e^A \mathbf{1}]_i$. Next, by summing $TSC(i)$ for each node i, we get the total network communicability that measures how efficient the communication across the whole network is:

$$TC(A) = \sum_{i=1}^{n} [e^A \mathbf{1}]_i = \sum_{i=1}^{n} \sum_{k=1}^{n} e^{\lambda_k} (V_i^T 1) v_{ki} = 1^T e^A 1 \qquad (1)$$

where v_{ik} is the i-th element of the normalized eigenvector v_k associated with λ_k the k-th eigenvalue of A. The total network communicability basically approximates the sum of all the entries of matrix A, by not necessary knowing any of the individual entries. Exponential subgraph centrality and total subgraph communicability of a node are expected to give similar node rankings when the spectral gap of the network $|\lambda_{max1} - \lambda_{max2}|$ is significantly large, where λ_{max1} the largest eigenvalue and λ_{max2} the second largest eigenvalue of A (M. Benzi and C. Klymko, 2013).

Between matrix functions e^A and $(I - \alpha A)^{-1}$, the first one shows better estimation of the ranked nodes depending on the intersection distance method or Pearson correlation coefficients. Also, when it comes to resolvent-based total graph communicability $\sum_{i=1}^{n} \sum_{j=1}^{n} [(I - \alpha A)^{-1}]_{ij}$ does not make a difference between poorly connected networks and the highly connected ones.

Other important centrality measures that can be used to compare ranked lists of important nodes are:

- the degree centrality of node i, given by $C_d(i) = d(i) = [A \cdot 1]_i$, where 1 is the vector of all ones.
- the eigenvector centrality of node i, uses eigenvector v_i corresponding to eigenvalue λ_i of matrix A and its neighboring nodes $N(i)$: $v_i = \frac{1}{\lambda_i} \sum_{j \in N(i)} x_j = \frac{1}{\lambda_i} \sum_j A_{ij} x_j$.
- the closeness centrality of node i to the rest of the network is $CC(i) = \frac{n-1}{\sum_{j \neq 1} d(i,j)}$, where $d(i,j)$ is the distance between nodes i and j i.e., the length of the shortest path between node i and j.
- the betweenness centrality of node i, given by $BC(i) = \sum_{j \neq i \neq k} \frac{\sigma_{jk}(i)}{\sigma_{jk}}$, where σ_{jk} is the total number of shortest paths between nodes j and k and $\sigma_{jk}(i)$ is the number of those shortest paths which pass through node i.
- the PageRank of node i is given by $PR(i) = \sum_{\{j|(j,i) \in E\}} \frac{PR(j)}{d(j)}$

Note that exponential subgraph centrality, resolvent subgraph centrality, total communicability centrality and Katz centrality rankings converge quickly to eigenvector centrality (global influence of nodes) when the spectral gap of A is large enough. So, eigenvector centrality can be used instead of the four function-based centrality measures. To define when the spectral gap $|\lambda_{max1} - \lambda_{max2}|$ is large enough is a complex procedure itself. Spectral analysis can also be conducted using Krylov methods to approximate the k-largest eigenvalues and corresponding eigenvectors.

For a symmetric matrix A, the m-th Krylov subspace generated by A from vector b is defined as $\mathcal{K}^{(m)}(A, b) = span\{b, Ab, A^2 b, \dots, A^{m-1} b\}$. Whereas the m-th Block Krylov Subspace is defined as $\mathbb{K}^{(m)}(A, V) = span\{V, AV, \dots, A^{m-1} V\}$ for a symmetric matrix A and V a random matrix. Krylov subspace methods for symmetric matrices as adjacency matrix A are based on the standard Lanczos iteration (Y. Saad, 2003):

Step 1. Choose initial vector $v_1 = r_0 / \|r_0\|_2$, set $\beta_1 = 0, v_0 = 0$
Step 2. For $j = 1,2, \dots, m$ do
  Step 3. $w_j = A v_j - \beta_j v_{j-1}$
  Step 4. $\alpha_j = t_{jj} = (w_j, v_j)$
  Step 5. $w_j = w_j - \alpha_j v_j$
  Step 6. $\beta_{j+1} = t_{j,j-1} = \|w_j\|_2$
  Step 7. If $\beta_{j+1} = 0$ then STOP
  Step 8. $v_{j+1} = w_j / \beta_{j+1}$
Step 9. End For

Due to the limited memory of a computer, storage of the Lanczos orthonormal basis for $\mathcal{K}_m$ becomes a challenge and during the process they also start to lose orthogonality. Restarting the standard Lanczos iteration a few times (usually using preconditioners) can help the reorthogonalization process. The standard restarting process produces the sequence of Lanczos decompositions $AV_m^{(k)} = V_m^{(k)} T_m^{(k)} + \beta_m^{(k)} v_{m+1}^{(k)} e_m^T$ where the columns of $V_m^{(k)} = [v_1^{(k)}, v_2^{(k)}, \cdots v_n^{(k)}]$ form an orthonormal basis of $\mathcal{K}_m(A, b)$, $T_m^{(k)}$ a tridiagonal matrix and e_m unit vector.

By IAI ISSN 2671-3179

The diagonal element approximations of $f(A)$ using Krylov is $f(A) \approx V_m * f(T_m) * {V_m}^T$ and row sums approximation is by $[f(A)\mathbf{1}]_i \approx \|\mathbf{1}\|_2 * V_m * f(T_m) * e_1$ where $\mathbf{1} = [1, 1, 1, \dots, 1]$ and $e_1 = [1, 0, 0, \dots, 0]$. As mentioned above the exponential function e^A used as centrality measure for ranking nodes has advantages over resolvent $(I - \alpha A)^{-1}$ and Krylov subspace methods are very effective in exponential matrix approximations. Approximating $exp\ (A)$ for undirected networks depends a lot on the diameter of the network $d(G)$ given by the maximum shortest path length in the network. Largest the length of the shortest path in a network, less approximation time is needed of $exp\ (A)$ entries.

A technique for the $f(A)b$ product approximation that only requires the evaluation of $f(A)$ at each restart of the Lanczos iteration and preserves orthogonality is described by M. ILIĆ et al. (2009):

Input: Matrix function f, symmetric matrix A, vector b, Krylov subspace size m and the maximum number of restarts $Itmax$.
Step 1 Set $\beta_{m+1}^{(0)} = \|b\|_2$, $v_{m+1}^{(0)} = b/\beta_{m+1}^{(0)}$, $\rho_1 = \beta_{m+1}^{(0)}$, $f_k = 0$ and restart parameter $k = 0$
Step 2 While $k < Itmax$ & not converged
Step 3 Set $k = k + 1$
Step 4 Expand standard Lanczos decomposition: $AV_m^{(k)} = V_m^{(k)} T_m^{(k)} + \beta_m^{(k)} v_{m+1}^{(k)} e_m^T$ for $\mathcal{K}_m(A, v_{m+1}^{(k)})$.
Step 5 Perform the Eigen decomposition: $T_m^{(k)} Y_m^{(k)} = Y_m^{(k)} D_m^{(k)}$ where $D_m^{(k)} = diag(\mu_1^{(k)}, \mu_2^{(k)}, \dots, \mu_m^{(k)})$.
Step 6 Evaluate the restart function $G_k = g_k(D)$.
Step 7 Update matrix function: $f_k = f_k + \rho_k V_m^{(k)} Y_m^{(k)} G_k [Y_m^{(k)}]^T e_1$
Step 8 Set $\rho_{k+1} = \rho_k \beta_m$
Step 9 End While
Output: Approximation f_k.

Matrix $Y_m^{(k)}$ has the normalized eigenvectors of $T_m^{(k)}$ as columns and $\mu_i^{(k)}$ for $i = 1,2, \dots, m$ are the eigenvalues of $T_m^{(k)}$. The restart function g_k is evaluated using matrix function f, diagonal matrix D, numbers $\alpha_i^{(j)} = [\, e_m^{(j)}]^T Y_m^{(j)} e_i^{(j)}$ and $\gamma_i^{(j)} = [\, e_1^{(j)}]^T Y_m^{(j)} e_i^{(j)}$ for $j < k$ and $i = 1,2, \dots, m$ and previous quantities $g_j(\mu_i^{(j)})$. First, the restart function initiated by setting it to $f(D)$ and it does not change if the restart parameter is only 1. Then if $k > 1$ and for $j = 1,2,.., k-1$, first gD is set to zero and for $i = 1,2, \dots, m$ the new $gD = gD + \alpha_i^{(j)} \gamma_i^{(j)} \left(old\_gD - g_j\left(\mu_i^{(j)}\right)\right) / \left(D - \mu_i^{(j)}\right)$. After loop *For i* is finished, set $old\_gD = gD$ and after loop *For j* is finished, $g_k(D) = gD$ is returned.

Now, considering the above method for $[e^A\mathbf{1}]_i$ approximations, standard Lanczos iteration using $exp(T_m)$ for $[e^A]_{ii}$ approximation and estimation of eigenpairs (λ_i, x_i) of A, some experiments are conducted. Three different biological networks are considered representing yeast protein-protein interactions, yeast genetic interactions and Caenorhabditis elegans (type of worm) gene co-expression. Table 1 contains some general information about these genomic data like number of molecules (nodes), number of relations between molecules (edges), highest degree of molecules and the average molecule clustering coefficient across the network.

Table1. General information about genomic datasets.

Network	Nodes	Edges	d_{max}	$C(G)$	Type
Bio-SC-Protein	1458	1948	56	0.0708304	Undirected
Bio-SC-GT	1700	37000	549	0.347454	Undirected/Weighed
Bio-CE-CX	1520	246000	375	0.211165	Undirected/Weighed

Figure 1 is the network representation of Bio-SC-Protein dataset and its corresponding adjacency matrix is shown in Figure 2. The adjacency matrix A is a sparse, symmetric (since the graph is undirected) and large square matrix of size 1458 × 1458 and has 3896 non zero elements.

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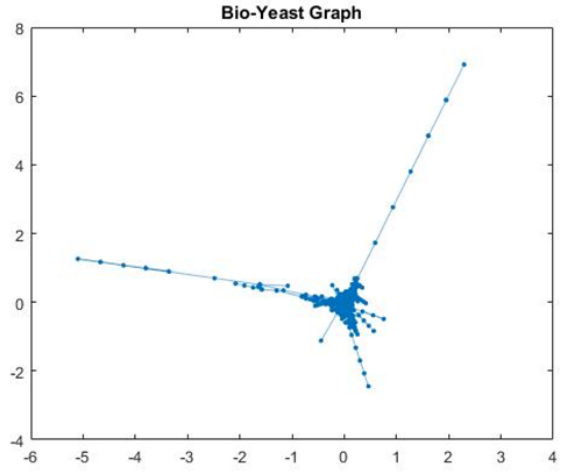

Figure 1. Bio-SC-Protein network.

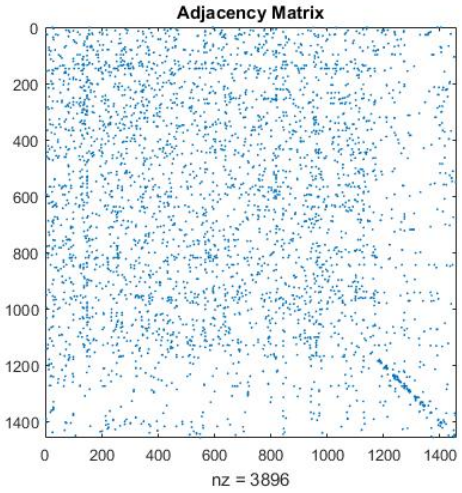

Figure 2. Bio-SC-Protein adjacency matrix

All centrality measures mentioned in the paper are performed for ranking top k important molecules, top k percent of important molecules or all molecules in the graph and then to evaluate the estimations the Pearson correlation coefficients are used (Table 2). Once again it is noted that exponential subgraph scores $ESC(i)$ and total subgraph scores $TSC(i)$ are estimated using the Lanczos approach. Elapsed time using Lanczos for total entries approximation of $exp(A)$ is 0.576774 seconds (0.0096129), which is faster than the Scaling and Squaring Method approximation (the most used and optimal method for relatively small sizes of A) with 0.682185 seconds (0.01136975 min). Experiments show that as the dimensions of A increase for the next two datasets the time gap between these two methods also increases significantly, respectively 0.280156 seconds for the Bio-SC-GT network and 0.566121 seconds for the Bio-CE-CX network. Since all three networks are undirected and do not have a significant large spectral gap so it does not indicate any valuable information. The diameter on the other hand for Bio-CE-CX and Bio-SC-GT network is larger compared to the Bio-SC-Protein network, hence the approximation time of the two for $exp(A)$ is briefer compared to the Yeast Protein Network. Elapsed time for approximating row sums scores of exp (A) $(TSC$ scores) with the modified restarted Lanczos iteration is 0.377804 seconds (0.006296 min); differing from ESC score approximation with 0.19897 seconds.

Table 2. Correlation coefficients for all centralities used in Bio-SC-Protein Network.

	Page rank	**Degree**	**Eigenvector**	**Closeness**	**Betweenness**	**ESC**	**TSC**
Page rank	1	0.979526	0.399938	0.332179	0.806247	0.679343	0.626720
Degree	0.979526	1	0.337945	0.423184	0.846312	0.629219	0.664686
Eigenvector	0.399938	0.337945	1	0.176210	0.272121	0.761052	0.723954
Closeness	0.332179	0.423184	0.176210	1	0.437560	0.192252	0.566521
Betweenness	0.806247	0.846312	0.272121	0.437560	1	0.523874	0.686216
ESC	0.679343	0.629219	0.761052	0.192252	0.523874	1	**0.747351**
TSC	0.626720	0.664686	0.723954	0.566521	0.686216	**0.747351**	1

As seen in Table 2 the correlation coefficients between the complete sets of diagonal and row sums scores of exp (A) are very high for all the networks, which vary from 74% (Bio-SC-Protein network) to 89% (Bio-SC-GT network). For the Bio-SC-Protein network the ranked molecule lists based on ESC and TSC scores, differ evidently (not very similar top 10% important molecules) since spectral gap $|\lambda_{max1} - \lambda_{max2}| = 0.4245043$ of the two largest eigenvalues $\lambda_{max1} = 7.5350046$ and $\lambda_{max2} = 7.1105003$, evaluated with Krylov, is not significant. When using high-dimensional datasets it is not convenient to approximate all entries of exp (A), since TCS scores can be much used as a centrality measure and computed faster. To get an idea on the communication of proteins (same goes for genes) across the whole Bio-SC-Protein network the Total Graph Communicability is computed TC= 3.839940437e+05, that surely indicates high information exchange between molecules.

Standard and modified versions of restarted Lanczos used in biological network analysis, give valuable information beyond the evaluation of important molecules, such as analyzing graph Laplacian properties and evaluate the probability distribution of each molecule $p(i) = ESC(i)/EE(A)$ where $EE(A)$ is the Estrada index i.e., the sum of all the subgraph centralities $\sum_{i=1}^{n}[e^A]_{ii}$.

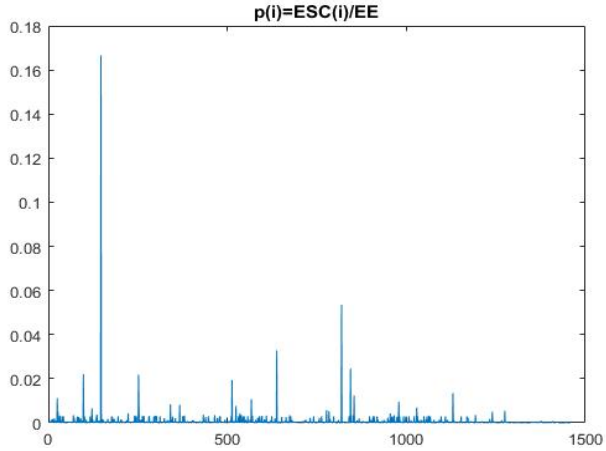

Figure 3. Probability distribution of protein i in Bio-SC-Protein network.

The Laplacian is also a large sparse matrix L, so Krylov and Block-Krylov methods can be used for spectral clustering techniques, estimating the algebraic connectivity (λ_{nim2} the second smallest eigenvalue of L) and the Feidler vector (eigenvector corresponding to λ_{nim2}).

3. Principal component analysis via Krylov

As mentioned in the introduction section, traditional dimensionally reduction techniques as PCA can be inconsistent when it comes to highlight important genes, since the number of samples is less than the number of genes in the gene expression matrix. Since PCA uses SVD on the centered gene expression matrix $X = U \cdot \Lambda \cdot V^T \in R^{n \times p}$ where V is the loadings matrix and $Y = UD$ are the principal component scores, accelerating the process in case where $p >> n$ is very useful. A novel technique was presented by X. Liu et. al. (2013) using limited memory Block Krylov subspace that accelerates the Simple Subspace Iteration (SSI) by reducing the number of iterations without having additional matrix-block multiplications. At first, the usual SSI iteration is applied starting from an initial approximation $W^{(0)}$ and iterate $W^{(i)}$ is computed. Next, in order to reduce the number of iterations this last update uses an intermediate iterate $\widehat{W}^{(i)}$ to compute the next iterate $X^{(i+1)}$. The intermediate iterates $\widehat{W}^{(i)}$ are obtained by solving the following subspace optimization problem:

$$\widehat{W}^{(i)} = \arg\min_{W} \|XW\|_F^2 \qquad (2)$$
$$\text{subject to } W^T W = 1,\ W \in \mathcal{S}^{(i)}$$

for a chosen subspace $\mathcal{S}^{(i)} \coloneqq span\{W^{(i)}, W^{(i-1)}, \cdots, W^{(i-m)}\}$ with a block Krylov subspace structure of size m. We highlight the difference between collection matrix in bold and its blocks and the proposed algorithm is the following:

Input $X_{n \times p}$ and k. Initialize $\boldsymbol{W} = W^{(0)} \in R^{pxk}, \boldsymbol{Y} = Y^{(0)} = XW^{(0)}$, and $m = i = 0$;
Step 1 while "not converged" do
/*Block Subspace Optimization*/
Step 2 Compute $\boldsymbol{P}_W$ and perform stabilization by Technique 1;
Step 3 Compute $\boldsymbol{P}_Y$ with the same column deletions as for $\boldsymbol{P}_W$;
Step 4 Compute the eigenvalue decomposition of $\boldsymbol{P}_W^T \boldsymbol{P}_W = U_W \Lambda_W U_W^T$.
Step 5 Perform stabilization in by Technique 2 to shrink Λ_W and U_W;
Step 6 Compute $\boldsymbol{R} = R_m^{(i)} \coloneqq [Y^{(i)}, \boldsymbol{P}_Y U_W \Lambda_w^{-\frac{1}{2}}]$ and eigenvalue decomposition of $\boldsymbol{R}^T \boldsymbol{R}$;
Step 7 Evaluate $\hat{V}$ that consists of the k leading eigenvectors of $\boldsymbol{R}^T \boldsymbol{R}$;
Step 8 Compute intermediate iterate $\widehat{W}^{(i)} = \boldsymbol{Q}\hat{V}$ and $\hat{Y}^{(i)} = \boldsymbol{R}\hat{V}$ (which equals $X\widehat{W}^{(i+1)}$)
/*Simultaneous Iteration*/
Step 9 Compute $W^{(i+1)} \in orth\left(X^T \hat{Y}^{(i)}\right)$ and $Y^{(i+1)} = XW^{(i+1)}$;

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Step 10 Increment i, update m, $\boldsymbol{W}$ and $\boldsymbol{Y}$, and continue.
Output U, Λ, and V

This algorithm is called the LMSVD algorithm (X. Liu et. al., 2013) and it is available as a Matlab directory at https://www.caam.rice.edu. LMSVD performs eigen-decompositions on symmetric positive definite matrices $\boldsymbol{P}_W^T\boldsymbol{P}_W$ of size $(k \cdot m) \times (k \cdot m)$ and $\boldsymbol{R}^T\boldsymbol{R}$ of size $(km + k) \times (km + k)$, which shrink due to deletions. In step 2 matrix $\boldsymbol{P}_W = P_W^{(i)} \coloneqq (I - W^{(i)}(W^{(i)})^T)\left[W^{(i-1)}, W^{(i-2)}, \cdots, W^{(i-m)}\right]$ of dimensions $p \times (k \cdot s)$ is stabilized using technique 1 i.e., deleting the columns of $\boldsymbol{P}_W$ whose Euclidean norms are below a threshold $\varepsilon_1 > 0$. Matrix $\boldsymbol{P}_Y = P_Y^{(i)} \coloneqq \left[Y^{(i-1)}, \cdots, Y^{(i-m)}\right] - Y^{(i)}(W^{(i)})^T)\left[W^{(i-1)}, W^{(i-2)}, \cdots, W^{(i-m)}\right]$ in step 3 goes into the deletion of the same columns of $\boldsymbol{P}_W$. After decomposition in step 4 another stabilization technique (Technique 2) is performed on in Λ_W and in U_W, by deleting the eigenvalues and corresponding columns, that are less than $\varepsilon_2 > 0$. In step 8 $\boldsymbol{Q} = Q_m^{(i)} \in orth\left(W_m^{(i)}\right)$ is an orthonormal basis for $\mathcal{S}^{(i)}$ such that matrix $W \in \mathcal{S}^{(i)}$ is expressed as $W = \boldsymbol{Q}V$ and it is constructed as $\boldsymbol{Q} = Q_s^{(i)} \coloneqq [W^{(i)}, \boldsymbol{P}_W U_W \Lambda_w^{-1/2}]$.

Once the SVD decomposition is obtained, the new dimension-reduced data points are stored in the z_i rows of matrix $Z = YV^T \in R^{n \times p}$ and are called projected points where $Y = XV \in R^{n \times k}$.

In Table 3 general information is shown about different microarray data, representing gene expression levels for different types of genes and a number of samples of a specific condition.

Table 3. Gene expression data

Condition	Genes	Samples	Classes
Leukemia	22284	64	5
Breast Cancer	54676	151	6
Brain Cancer	54676	130	5

Considering the first dataset of Leukemia to find statistically significant components (less than n), the scree test is plotted, as shown in Figure 4. Top dominating eigenvalues are evaluated using The Krylov–Schur algorithm, a generalization of the thick restart procedure for non-Hermitian problems (G. W. Stewart, 2002). It is noted that the gene expression matrix is centered first.

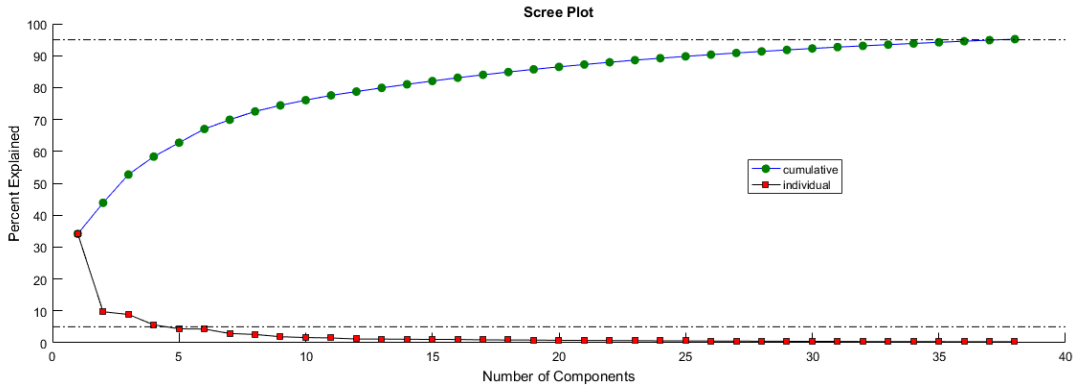

Figure 4. Significant components using Scree Plot for Leukemia.

Four principal components $k = 4$ have individual significance more than 5% which altogether explaining 58% of the total variance. Running LMSVD and then computing the four principal component scores, we focus on evaluating the percentage of genes that go into the first and second principal components using different percentage of dependence (between genes and leading PCs). Figure 5 shows the variation of important genes in the first two PCs, for dependence levels starting from 50% up to 95%.

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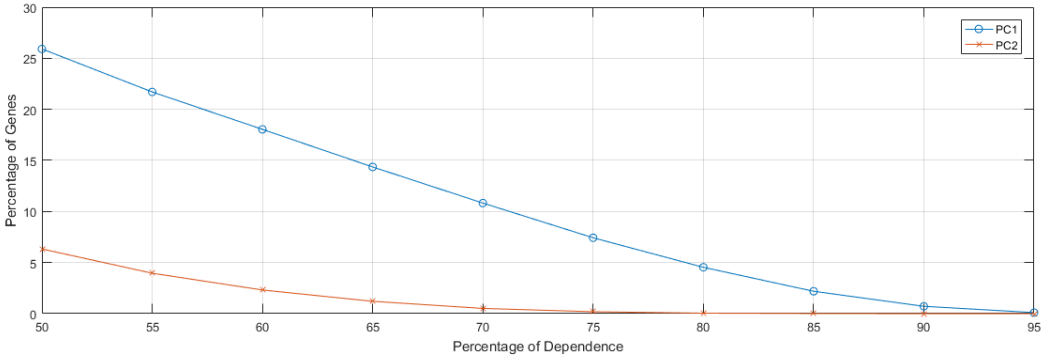

Figure 5. Gene percentage into the first and second PC, for different dependence levels.

For an optimal dependence level of 80%, for the Leukemia data, 4.5% of the 22284 gene types belong to the first principal component, with explained individual variance 34%. A very few as 0.05% of these 22284 genes go into the second principal component, with explained individual variance almost 10%. For the same optimal dependence level applied to microarray data Breast Cancer and Brain Cancer, the percentage of the most important nodes vary from 3.6% to 3.9 % of the same number of genes (54676) included only in the first principal component. With explained individual variance that vary from 26% -32%.

4. Conclusions

Although Krylov methods are efficient tools for dimension reduction and network analysis providing fast convergence and low storage cost (Limited Memory Block Krylov) for both array and graph representations of biomedical data. Compared to standard approaches like The Scaling & Squaring Method and Padé Approximation (for complex network analysis) or PCA and Sparse PCA (for the dimensionally reduction), real data experiments show that Krylov subspace- based methods have advantage in the case of high-dimensional datasets, especially when the number of genomic molecules (parameters p) exceed the number of samples (observations n). Approximating top k eigenvalue and corresponding eigenvectors, centrality measures, clustering properties of molecules and also help increase performance for other techniques are just a few benefits/applications of Krylov methods. The strategies mentioned in this paper and contemporary modifications do not restrict to gene and genome analysis. They can be applied in social, infrastructure, economic network but also in data processing, machine learning, PDEs analysis and so much more.

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