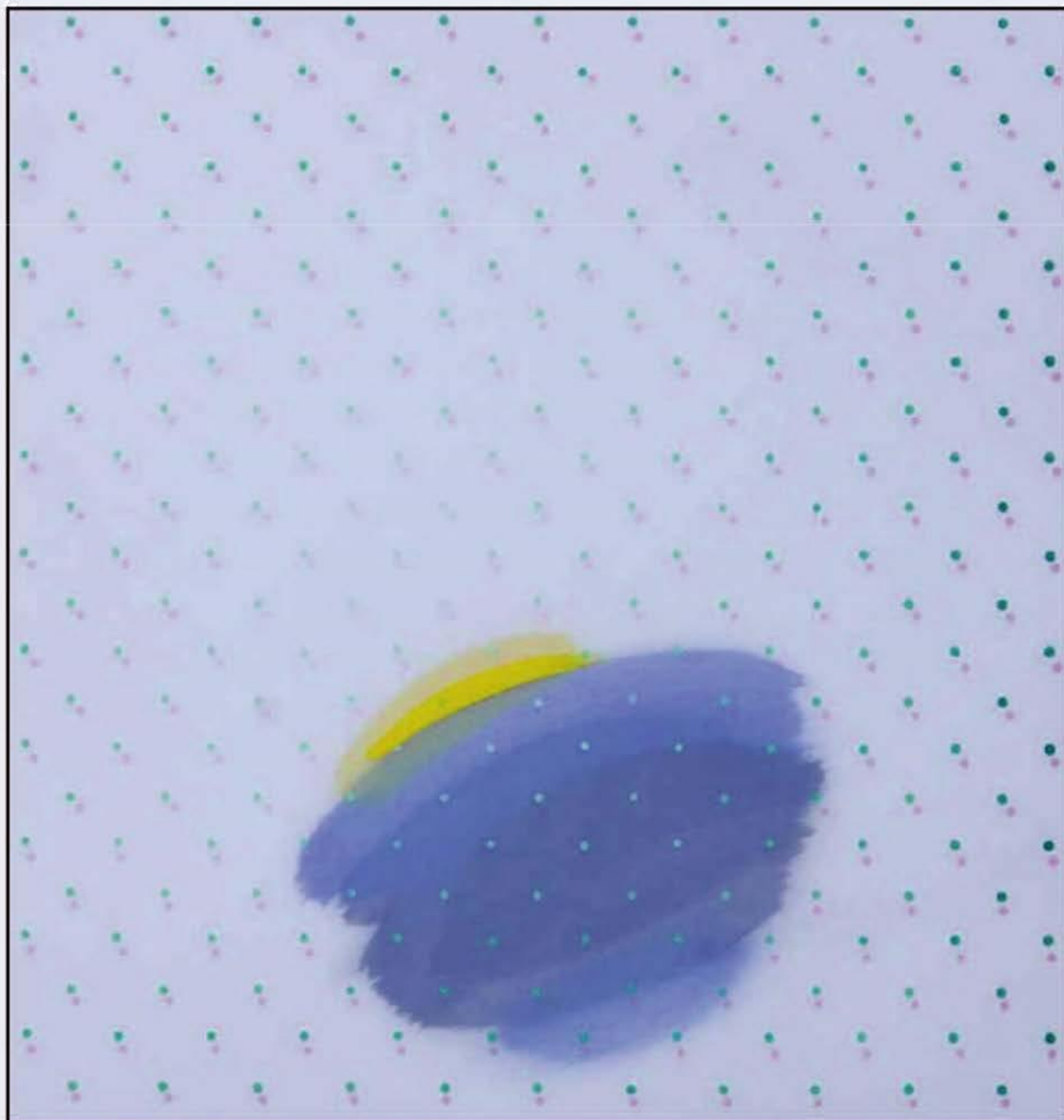


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Implementation of online learning in higher education and accounting modules Perspective of accounting teachers

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Abstract

Through this research, I have analyzed the benefits and difficulties that have resulted from the application of e-learning within accounting modules. The main source of data was the professors who teach accounting at the faculties of economics, where a random sample of 25 professors from different universities in Kosovo was included. Within the benefits of implementing E-learning, we can consider that they are the application of innovative teaching methods and it is considered that it can be a more effective process of communication with students in terms of notification and consultation. The biggest difficulties found in the study are those of the technical aspect, precisely in the necessity of solving technical problems which are reported by students especially during the lecture, then the dedication of time to conduct online activities with students. Descriptive statistical analysis was used to present the first results of participation, while correlation analysis was used to measure the relationship between difficulties, advantages, and evaluation of quality factors of online learning as I have singled out in terms of preparation, content, evaluation of technical conditions, time and achievement of student competencies. It is considered that the preparation of the course for E-learning and the content were less difficult compared to the traditional teaching, and in terms of the time it turns out to be appropriate. What can not be considered appropriate and unsuccessful is the activity and active participation of students during lectures, and for this, a method should be applied which obliges and enables the control of each student during the presentation of the course. Based on the research results it can be concluded that online learning was effective and has produced a new innovative form of teaching, which requires specific technical time and conditions for its better realization. In this context, the accounting modules in Kosovo have been realized with great success and I consider that this should continue to be improved.

Keywords: E-learning, Accounting module, High education, Educators

1) INTRODUCTION

Given the effects of online learning as well as the aspect of the pandemic that affected the entire education system in Kosovo and around the world, I found it appropriate to analyze the impact of online learning on accounting modules, exactly where I am also a lecturer. It is considered that the coronavirus pandemic (Covid 19) has greatly affected, changing the way of life. This pandemic has had a major impact on education or has changed the methodology of teaching and learning, while on the other hand it is said that approximately 90% of students were not able to physically go to school or university (Kandri, 2020). Also, the tertiary institutions that were closed had to turn to online teaching and in a short period to implement quality teaching and learning only online (Palvia, et al., 2018). Research predicts that online learning will become a way of education by 2025, to provide high quality and affordable education for 'non-traditional' students (Hillier, 2018)

According to the authors (Buelow, Barry, & Rich, 2018) it is considered that online learning provides students with greater access to formal learning environments from which they are physically distant and flexibility to begin their learning journey at any time while being able to work and study. It is considered that mixed learning, the systematic integration of traditional classroom learning combined with digital learning solutions, is a relatively new pedagogical method in higher education. (Galy, Downey, & Johnson, 2011). According to research, mixed learning is said to influence changing teaching methods, patterns, and practices, which may change the paradigm in which academic institutional emphasis differs from traditional teaching to active learning. (López Gavira & Omoteso, 2013).

A virtual learning environment is said to be a web-based software system that includes a collection of tools and applications that enable online communication, collaborative learning, uploading of learning content, student assessment and feedback, and course administration. Originally developed for distance learning, but now commonly used as part of a blended learning approach (Harvel & Hardman, 2010) Virtual learning environments remain one of the most significant tools for developing teaching and learning practices that can adapt to the changing landscape of education and pedagogy. Institutional implementation and student engagement with virtual learning environments have been slow (Subhash & Cudney, 2018) but

over the last decade, there have been tangible efforts to utilize virtual learning environments to support teaching and learning in higher education (Apostolou, Dorminey, Hassell, & Watson, 2013).

Through this research, I have analyzed the benefits and difficulties that come as a result of online learning/e-learning during the pandemic, exactly those that resulted from the application of online learning within accounting modules at the University of the Republic of Kosovo, in the Faculties of Economics.

2) Literature Review

Online learning in the field of accounting has become widespread among students due to its potential to offer more flexible and asynchronous learning activities, thus offering some of the convenience of on-campus courses with full face-to-face contact. (Means, Toyama, Murphy, & Baki, 2013). In this context various digital learning tools have been developed including learning management systems (Lim & Morris, 2009) rich media solutions have also been offered (Harvel & Hardman, 2010) electronic summaries, and podcasts. Based on previous studies, it clarifies that blended learning has many positive effects. Some researchers have reported that blended learning increases students' motivation to learn, reflect, and collaborate; reduces dropout rates; and eliminates geographical barriers (Du, et al., 2013).

Recent research reveals that students are more satisfied with blended learning because of the flexibility and access it offers, as well as the opportunity to be more active in the learning process due to different digital learning tools e.g. games (Hsu, 2012). Although the promises of blended learning are broad, some studies have highlighted the negative effects of blended learning. These include technical difficulties, feelings of student isolation, students being overwhelmed, and the feeling that online tools are too invasive in their daily lives. However, according to a meta-analysis, most research in this area tends to focus on student experiences. Therefore, more research is recommended on how the mixed curriculum affects exam results when compared to regular campus programs (Buelow, Barry, & Rich, 2018).

The internet, social media, and being online are said to be an integral part of daily life. It is shown that there is a common expectation that these new sources of communication will be used in the education process. In most countries, universities are looking for ways to take advantage of the opportunities offered by this new

approach and to incorporate it effectively, making this way of learning more attractive and efficient and enhancing the higher education system. There we understand that e-learning means the adoption of electronic educational technology in teaching and learning. It is shown that it can be done either as a mixed course (where only part of the course is offered online) or as entire courses offered online (Cassidy, 2016).

It includes various technological tools such as webinars, lectures/videos on demand, multi-media components (3D presentations, animations, hypertext, hypermedia); various other online activities (Du, et al., 2013). Based on research, it is shown that the use of technology transformed the delivery of courses to be partially or completely independent of time and place (Galy, Downey, & Johnson, 2011). According to the European Commission, the use of new multimedia technologies and the Internet enhances the quality of learning, thus enabling easier and wider access to educational facilities and offers opportunities for long-distance exchanges and cooperation.

Online learning offers several potential benefits of e-learning for students, educators, and higher education institutions, where each of these participants in the educational process will face many challenges. For students, the most difficult ones include good time management skills, self-reliance, regular engagement, and communication with the lecturer. Students may also suffer from a lack of vital personal interactions, not only with faculty but also with colleagues participating in the module. (Grabinski, Kedzior, Krasodomska, & Herdan, 2020).

Students are also offered a more flexible learning process, which is especially convenient when studying several subjects at the same time and if they are asked to combine study with professional work. And the e-learning system can improve communication between faculty and students (Harvel & Hardman, 2010). In many corporations moving towards online activities, prospective graduates should be able to develop skills that will assist them in their future careers. Skills like awareness, independence, and creativity are key. So graduates will be required to continue education and self-education to maintain their competencies at a high level (Subhash & Cudney, 2018). It is considered that for higher education institutions, the inclusion of e-learning in the curriculum means investment in IT infrastructure and updated teaching tools. It is said that e-learning tools can be especially useful when dealing

with large groups of students, as they simplify the assessment process and make it more efficient and less time-consuming.

Students who participate in online course delivery are required to engage in online activities regularly, which is sometimes difficult with courses offered on campus. However, it is important to consider how e-learning modules are perceived by educators. It is necessary to determine which factors play an important role for educators, which elements help them run effective online modules, and which barriers need to be overcome. Great importance is attached to the role of educators, which has changed, as they are no longer just experts who provide a certain kind of knowledge, but also individuals who help solve problems related to e-learning devices, as well as guides of courses (Malan, 2020).

The lecturer in this process is considered the problem solver, or the person causing the problems. One of the factors that can help facilitate the e-learning process is the possibility of receiving professional and technical assistance and support during the implementation of the e-learning process, both for teachers and students. Various technical problems can cause educators extra work and instead of focusing on the teaching process, they become more administrators and facilitators of the teaching process. The financial constraint has been cited as one of the most fundamental barriers for academics when using online technology (Lim & Morris, 2009).

3) METHODOLOGY AND RESEARCH DESIGN

The research was conducted through a structured questionnaire, which was attended by a total of 25 University level professors in Kosovo. The research took about 30 calendar days and the data were administered by me by sending questionnaires to various professors. Data were analyzed through the SPSS program. Initially, descriptive analyzes were performed through the presentation of frequency and percentage, then correlation was used to measure the relationship between different factors, and factorial analysis was performed.

The purpose of the research

Through this research, I have analyzed the benefits and difficulties that come as a result of online learning/e-learning during the pandemic, exactly those that resulted from the application of online learning within accounting modules at the University of the Republic of Kosovo, in the Faculties of Economics.

The main research question is:

1. What were the benefits of online learning within the accounting modules, in the opinion of the professors?
2. What were the difficulties of online learning within the accounting modules, in the opinion of the professors?
3. What were the differences between traditional and e-learning within the accounting modules, in the opinion of the professors?

4) RESULTS

The research was attended by a total of 25 teachers, who were surveyed for the benefits offered by online learning, namely in the field of accounting. Of these 13 were male and 12 female, while their work experience ranged from 1-5 years 24%, another 20% had experienced between 6-10 years, another 20% 11-15 years experience, 24% 16 -20 years of experience and 12% more than 20 years of work experience in higher university education.

Gender	N	%
Male	13	52
Female	12	48
Work experience	N	%
1-5 year	6	24.0
6-10 year	5	20.0
11-15 year	5	20.0
16-20 year	6	24.0
Over 20 year	3	12.0

The benefits realized from E-learning

Most of them agree that learning online helps to teach from wherever you are, but they may not qualify this process very well, due to problems that may occur. They say there is a good level of time-saving, but it is also a new form and new teaching methodology, which somehow provides more effective communication with students.

	We do not agree at all		I do not agree		Neutral		Agree		I completely agree	
	N	%	N	%	N	%	N	%	N	%
Better effectiveness of the teaching process (implementation of learning endpoints which are set in the course / syllabus)	7	28.0%	10	40.0%	3	12.0%	4	16.0%	1	4.0%
Possibility of bringing teaching at any time and from any place (convenient for me)	5	20.0%	2	8.0%	3	12.0%	13	52.0%	2	8.0%
Save time (no need to come or go on campus, easier sharing of online teaching materials)	2	8.0%	3	12.0%	6	24.0%	12	48.0%	2	8.0%
Satisfaction with the use of the innovative teaching method (adapted to changes in technical / technological progress)	1	4.0%	10	40.0%	4	16.0%	7	28.0%	3	12.0%
More efficient communication process with students (e-mail, announcements, e-consultations)	2	8.0%	9	36.0%	6	24.0%	5	20.0%	3	12.0%

Difficulties arising from E-learning

They say that there is a lower level of working materials, compared to those in lectures physically, but there are technical problems that greatly hinder the process of working online. They often need the help of information technology technicians.

	We do not agree at all	I do not agree	Neutral	Agree	I completely agree
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	N	%	N	%	N	%	N	%	N	%
Large amount of work, related to the design and creation of course materials	1	4.0%	5	20.0%	2	8.0%	13	52.0%	4	16.0%
Necessity to overcome technical problems during course preparation and course submission	0	0.0%	4	16.0%	3	12.0%	11	44.0%	7	28.0%
A sense of excessive mechanism of the learning process (limited opportunity to establish closer, personal relationships with students)	1	4.0%	2	8.0%	7	28.0%	3	12.0%	12	48.0%
The necessity of solving the technical problems reported by the students	0	0.0%	1	4.0%	2	8.0%	12	48.0%	10	40.0%
The need to dedicate time to conducting online activities with students (participating in discussions, answering their questions via email, administering e-forums)	2	8.0%	3	12.0%	5	20.0%	8	32.0%	7	28.0%

Factor analysis results

To arrive at a correct answer, I applied the factor analysis test, where based on the results of the KMO Bartlett test, we have p-value = 0.000 which indicates that the data are acceptable and we continue with the interpretation of the following results.

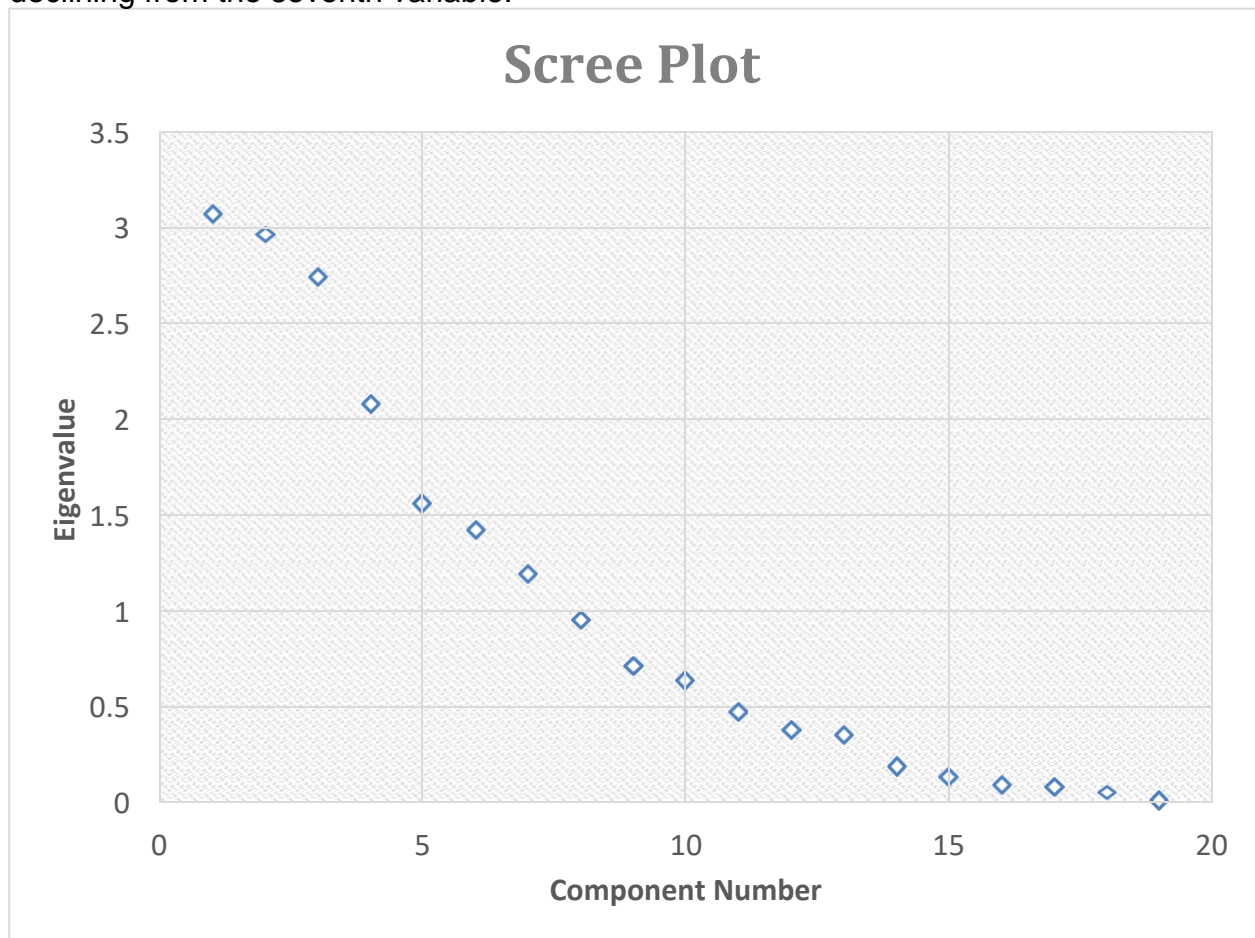
KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.301
Bartlett's Test of Sphericity	Approx. Chi-Square	262.537
	df	171
	Sig.	0.000

According to the table below we see that the data are classified into seven factors, so the variables are classified into 7 main factors.

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.067	16.140	16.140	3.067	16.140	16.140	2.781	14.639	14.639
2	2.963	15.596	31.736	2.963	15.596	31.736	2.505	13.182	27.821
3	2.738	14.411	46.147	2.738	14.411	46.147	2.200	11.577	39.399
4	2.070	10.897	57.044	2.070	10.897	57.044	2.174	11.441	50.840
5	1.560	8.212	65.255	1.560	8.212	65.255	2.071	10.900	61.739
6	1.416	7.455	72.710	1.416	7.455	72.710	1.788	9.411	71.151
7	1.186	6.242	78.952	1.186	6.242	78.952	1.482	7.801	78.952
8	0.933	4.912	83.863						
9	0.705	3.712	87.575						
10	0.636	3.348	90.923						
11	0.484	2.548	93.471						
12	0.376	1.981	95.452						
13	0.345	1.814	97.266						

14	0.180	0.946	98.211						
15	0.133	0.702	98.914						
16	0.091	0.481	99.394						
17	0.072	0.380	99.774						
18	0.034	0.180	99.954						
19	0.009	0.046	100.000						
Extraction Method: Principal Component Analysis.									

This ranking is also seen through the graph below, where the variables start declining from the seventh variable.



In the second are classified these variables a Large amount of work, related to the design and creation of course materials (0.812), then A sense of excessive mechanism of the learning process (limited opportunity to establish closer, personal relationships with students) (0.743) and Teaching in e-learning classes compared to traditional classes takes (0.886), which are about saving materials or rather cutting materials in online learning, compared to traditional or physical. We call this factor the shortening of materials for students. The third factor has two variables, si The contents of online learning compared to those of traditional learning are (0.884) the To prepare e-learning classes compared to traditional classes, the lecturer needs (0.808) which show that online learning enables a more professional approach as it enables combination and is named as the factor of mixed learning.

In the fifth factor are variables like The activity of students during the e-learning session compared to the traditional one is (0.856) and The level of development of students' social competencies during e-learning classes compared to traditional classes is (0.881) so we are dealing with the combination of traditional learning with that of online learning, and on the other hand, we have a development of competencies through online learning, where we can call it the development of student competencies through online learning. The sixth factor is the variable Necessity to overcome technical problems during course preparation and course submission (0.741) which raises technical problems, so this is a major shortcoming that follows the online learning in Kosovo, ie in the accounting program. Finally, in the seventh factor, we have the variables The time of online learning with that of traditional learning is (0.678) and The transfer of material to students during online learning compared to traditional learning is (0.826) which represent the time and possibility of combining online learning with the traditional one.

Rotated Component Matrix							
	Component						
	1	2	3	4	5	6	7
Better effectiveness of the teaching process (implementation of learning endpoints which are set in the course/syllabus)							
Possibility of bringing teaching at any time and from any place (convenient for me)	0.836						
Save time (no need to come or go on campus, easier sharing of online teaching materials)	0.848						
Satisfaction with the use of the innovative teaching method (adapted to changes in technical/technological progress)							
The more efficient communication process with students (e-mail, announcements, e-consultations)				0.741			
A large amount of work, related to the design and creation of course materials		0.812					
The necessity to overcome technical problems during course preparation and course submission						0.741	

A sense of excessive mechanism of the learning process (limited opportunity to establish closer, personal relationships with students)		0.743					
The necessity of solving the technical problems reported by the students							
The need to dedicate time to conducting online activities with students (participating in discussions, answering their questions via email, administering e-forums)				0.762			
The preparation of the e-learning course compared to the traditional classes is:							
The contents of online learning compared to those of traditional learning are:			0.884				
To prepare e-learning classes compared to traditional classes, the lecturer needs:			0.808				
Teaching in e-learning classes compared to traditional classes takes:		0.886					
Studies for e-learning classes compared to traditional classes take the student:							
The time of online learning with that of traditional learning is:							0.678
The transfer of material to students during online learning compared to traditional learning is:							0.826
The activity of students during the e-learning session compared to the traditional one is:					0.856		
The level of development of students' social competencies during e-learning classes compared to traditional classes is:					0.881		
Extraction Method: Principal Component Analysis.							
Rotation Method: Varimax with Kaiser Normalization.							
a. Rotation converged in 7 iterations.							

5) CONCLUSION AND RECOMMENDATIONS

The research was conducted during 2021, exactly in April 2021, which included 25 University level professors in Kosovo, namely professors of Economic Faculties, accounting modules. From the research it was noticed that the professors have a professional approach within the online teaching, carefully handling the communication with the students and the time of defining the lectures, the preparation of the materials, and the form of the evaluation.

We also note the fact that there are difficulties in learning online, especially in technical terms, work efficiency, and the need to solve problems during the online process. On the other hand, the work of online learning in accounting modules is highly valued, as this represents a new form of teaching, which is a close relative that can serve to increase quality.

In the framework of factor analysis we single out the Time factor, a large number of work materials to be sent to students, teaching contents and their preparation, communication with students, the technical aspect, and forms of conveying materials. In this context, we say that very real elements have been presented which have been topics of discussion, but which have not been researched. In this form, I have provided a result that confirms the controversies about online learning in accounting modules.

As part of the research, I can give some recommendations, which should be primary for each faculty and professor of accounting modules, but also others.

- Create a convenient online learning platform that saves time.
- To define criteria on which the materials and their quantity are drafted.
- Provide professional support in designing and preparing online learning materials.
- Communicate with students to be more effective and provide additional platforms on which online activities take place.
- Providing technical support at all times, both for teachers and students.

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MULTIFUNCTIONAL PUBLIC SPACES AS A SOLUTION FOR REVITALISATION OF CITY FRAGMENTS

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Abstract:

The concept of multifunctional public space can be seen as sustainable, since it covers wide variety of functions and provides space for different needs and activities of the citizens in one place, instead of occupying a wider area. To realize this potential, we must develop the concept of revitalization of the existing public spaces even more in terms of sustainability, before we start building on new and green locations.

The object of this interdisciplinary research is finding appropriate solutions regarding revitalization of the neglected public spaces that are part of public buildings. On the territory of city of Skopje, many public buildings are surrounded by gray, polluted and neglected public spaces that have no particular function, nor aesthetic or ecological significance. The Covid-19 pandemic made the people to be more aware of the significance that open public spaces offer to their citizens in terms of their physical and mental health.

The proposal for new multifunctional public space that is part of the Transport station in Skopje is designed to be context-sensitive and sustainably treated space. It is intended this project to be a new meeting point, with a strong modern attitude in its forms that respects the historical, social, natural and cultural context in which it is placed. Having in mind that this location is situated in dense urban matrix in the center of the city of Skopje, the sustainable strategies recognized in this research were found as applicable solutions in the presented project. These strategies and measures can also be applied in wider urban context on cities with similar social and environmental problems.

The sustainable urban revitalization should be understood as multidisciplinary approach: analyzing all the possible aspects important for certain location in order to achieve quality solutions that will serve well for present and future generations enabling them to live in healthy, ecological, sustainable and socially vibrant environments.

Key words: Multifunctional public space, Sustainable urban revitalization, Public buildings, Open public space, Physical and Mental health.

1. INTRODUCTION

In today's modern societies, a great need exists for careful, thoughtful evaluation and planning of man-made and natural resources, in terms of both current and future usage [1]. Cities, towns, buildings and public spaces must be carefully planned for their habitants and for the complete environment. In that manner, this research explains the analytical and design methods applied on a specific location in the center of the city of Skopje. The analyzed location currently is an unappealing, dehumanized asphalt parking in the center of the city below of the railway station. Reviewing the scientific literature on low-carbon cities, green cities, healthy cities [2], [3], [4] as well as conducting this research, helped us to come to the conclusion that this location should be designed as: multifunctional, compact, walkable, healthy, barrier-free and socially vibrant space that will deliver a high quality life to the people gravitating in this area. This conclusion led in defining the concept of this project: transformation of the analyzed location into a multifunctional public space in a form of representative landmark of the city.

The sustainable urban discourse has been analyzed and discussed by many theoreticians and many institutions mainly because of its importance on global level. Reviewing the scientific literature as well as the existing frameworks related with sustainable urban principles, *The Copenhagen Agenda for Sustainable Cities* [1] was found as very useful for this research. This framework of ten principles was created by fifty most important urban experts in the world. They shared their opinion on: what are the

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most important steps for creating sustainable cities. Representing all parts of the world and from a wide range of disciplines, they all agreed that for making cities sustainable we need a radical change of mindset, new strategies and new governance models to support development and foster a new generation of urban leadership [1].

Another important framework of urban principles is given in the publication *Cities for People in Practice* (2015) by Chris Busch and CC Huang [3]. This publication represents a guide for creating sustainable urban forms and transportation solutions to some of the most pressing challenges facing modern cities, including congestion, pollution, and urban sprawl [3]. These eight principles are essential ingredients to sustainable, economically vibrant cities that deliver high quality of life for their residents. They are the following ones:

1. Walk - Develop neighborhoods that promote walking.
2. Connect - Create dense networks of streets and paths for non-motorized transit.
3. Transit - Build extensive, high quality transit with good connections between modes.
4. Cycle - Prioritize bicycle networks that offer protected lanes.
5. Mix - Zone for mixed-use neighborhoods.
6. Densify - Actively encourage greater density around major transit hubs.
7. Compact - Set growth boundaries and plan for compact regions with short commutes.
8. Shift - Increase mobility by regulating parking and road use [3].

All the mentioned principles such as: Mix; Walk; Connect; Transit; Compact, Densify and Shift are being incorporated in the proposal project made for the analyzed location.

According to Jan Gehl, [4] external activities are influenced by many conditions. The physical environment is one of the factors that influence activities in many different ways. There are three types of outdoor activities that take place in public spaces, and each of these activities requires a specific physical space:

1. Essential activities - Necessary activities take place in all conditions: going to school or work, shopping, waiting for public transport, etc. These activities take place throughout the year, regardless of the exterior, and the citizens have no choice regarding them.

2. Optional activities - Optional activities happen because the citizens have a desire for them and they happen only in the exterior that provides them and has good conditions for them. This category includes walks in the fresh air, sitting in the sun, walking around enjoying, and so on. These activities occur when the time and place are pleasant and the exterior of the city or neighborhood is encouraging them to do so and are particularly dependent on the physical conditions of the environment. When the outdoor space is of poor quality, only the necessary activities take place, the citizens rush to go home. When the outdoor space is quality, people stay on the street and in the city, sit outside, socialize and cover a wide range of different activities. The good environment expands the activities in the city.

3. Social activities - Social activities are all activities that involve people in public spaces. These include: children's games, meetings, conversations, various activities, and most often - passive contact, simply watching and listening to other people. These activities can be considered as a result of the two previous categories (necessary and optional activities). Social activities occur spontaneously as a result of people moving and being in the same space. This means that social activities indirectly depend on whether and how good the space is designed for the necessary and optional activities to take place. The nature of social activities depends on the context in which they occur. Passive contact often occurs in the city center and on the streets, which should not be underestimated. It is most freely said that social activity happens whenever two people are in the same space. This has a lot to do with city and space planning. Although physical morphology has no direct impact on the quality, content, and intensity of social connections, architects and planners have an impact on creating a quality public space that encourages activities [4].

Some of the principles given in these three frameworks are found suitable for conducting further analyses on the chosen location (Fig.1 and 2) and discovering ways to apply them through suitable urban strategies on the analyzed case.

The object of this interdisciplinary research is finding appropriate solutions regarding revitalization of the neglected public space that is a part of public building. The selected public building is surrounded by polluted and neglected public spaces that has only one function: parking of cars and buses.

This space has nor aesthetic or ecological significance. The chosen location is one of the best examples of this negative trend that is part of the everyday life of the Skopje's residents (Fig. 1).



Figure 1. The parking incorporated in the Transport station designed by Kenzo Tange 1965 in Skopje, Source: authors



Figure 2. Plan of the chosen city fragment - the Transport station in Skopje and its wider context, Source: authors

2. PURPOSE OF STUDY

The climate in Skopje (dry hot summers and wet cold winters), demands the open public spaces to be designed in bioclimatic manner in order to protect the visitors from high exposure on sun, rain and snow so that the visitors can have a pleasant stay. Another big problem for the people that work, study, shop, dine or sight see in this city fragment is the absence of open public spaces for resting and enjoying the city free of charge [5]. The problem with the social cohesion in this area is also evident. The conducted questionnaire showed that the residents, as well as the people working in the surrounding buildings do not have open public space where to enjoy the nature and gather. The children do not have enough open space for playing. The old people do not have open parks for walking and gathering. The

young people living in the surrounding houses and buildings wrote in the questionnaire that they are lacking of an open space where they can perform music, theatrical performances and different kind of student's competitions, exhibitions and gatherings....

The analyzed location is in the center of the city and has a very complex socio-political and architectural position. In the immediate vicinity of the river Vardar it is embedded between two opposite architectural concepts (Fig. 3, Fig.4). From one side of the location is the neighborhood Madzir Maalo (dating from the beginning of the XX century) - a symbol of the city's spontaneity, tradition, presenting different stages of the historical development of Skopje. The location is nested inside the Transport Station, a symbol of the Modern in Skopje. From the other side of the location is the settlement Aerodrom relatively new settlement with new buildings dating from 1980 till present day.



Figure 3. The neighborhood Madzir Maalo, **Figure 4.** The Transport Station - symbol of the Modern in Skopje, Source: Archive of NRM

Madzir Maalo started to settle in 1873 when the railway line Thessaloniki - Mitrovica was built. It is one of the first neighborhoods in Skopje on the right side of the river Vardar with orthogonal street pattern. In that period, Skopje can be characterized as a town with oriental features built on medieval Byzantine and ancient foundations. The neighborhoods in Skopje until the XX century were positioned on the left side of the river Vardar and characterized as organic urban matrixes: houses with courtyards - closed towards the narrow and organic streets. Only Madzir Maalo was developing as an anthropomorphic settlement on the right side of the river, spontaneously: houses had open yards, gardens and wells; neighborhood fountains; picturesque streets. After the withdrawal of the Ottomans, during the Balkan and World Wars, the neighborhood tended to Western European influences that resulted in building larger houses with neo-classical, neo-baroque features owned by the wealthier families. This neighborhood has remained the same for a long period and was not developing, nor restoration of those beautiful houses was conducted. For the last two decades, there has been a constant pressure for building hotels and tall residential buildings due to the expensive land in the downtown area [6].

After the Second World War, the new political order planned the city as a functionalist city by zoning the main urban zones: housing - work - recreation. After the catastrophic earthquake in 1963, when 80% of the total built fund of the city was demolished, Skopje grew into a modern city and a city of solidarity. On the international competition from 1965, eight plans were made for the central area and at the end, the ninth plan was made as a combination of the best ideas [7]. All plans were in the spirit of modernism - completely opposite to the previous character and look of the city. New modern and brutalist buildings create a completely different image of the city, opposite of the oriental spirit followed by the Western European tendencies. The massive concrete blocks, the clear geometric shapes composed in large functional ensembles made Skopje a city for the new modern man. The new buildings tended to be "progressive" in design style, a tone set by Tange's response to the demand of "a new architecture for a new revolutionary society" [7]

The density in the center of the city grows every day by adding new building on every location that was empty and green [6]. This trend especially escalated when the project Skopje 2014 emerged [6]. Due to the Skopje's high population density and pollution [8,9,10], the opportunity to plan prosperous, livable, low-carbon city is urgent [11,12]. In the 21st century, the world is beginning to notice the first effects of climate change. That is why the concept of multifunctional public space can be seen as sustainable, since it covers wide variety of functions and provides space for different needs and activities of the citizens in one place, instead of occupying a wider area.

The chosen location placed between the vernacular concept and the mechanical modern concept (Fig.3, Fig.4), must offer a solution that will be a harmonious fusion of all the aspects considered: historical, social, cultural, economic, ecological, ect. The new solution must correspond with the historical and cultural heritage in this area and in the same time has to offer a solution to the existing problems this city is facing, as a post-socialist city; city in transition. This city must increase the percentage of multifunctional public surfaces, in order to meet the needs of its citizens. Without developing and applying urban strategies oriented towards sustainable planning, this crowded and polluted asphalt city will not reach its full potential.

The purpose of the study that further was developed as an architectural project proposal was: designing a multifunctional public space in front of a building that represents a cultural heritage of great importance for the city that celebrates the life of the past and future generation of this city. The multifunction character of the location will enable revitalization of the location by redesigning the existing parking and adding a number of new urban contents. Revitalization of locations in the center of the city that have lost their mining through time by adding new urban contents that enlighten the context of social cohesion represents very important sustainable urban principle [1], [4], [12].

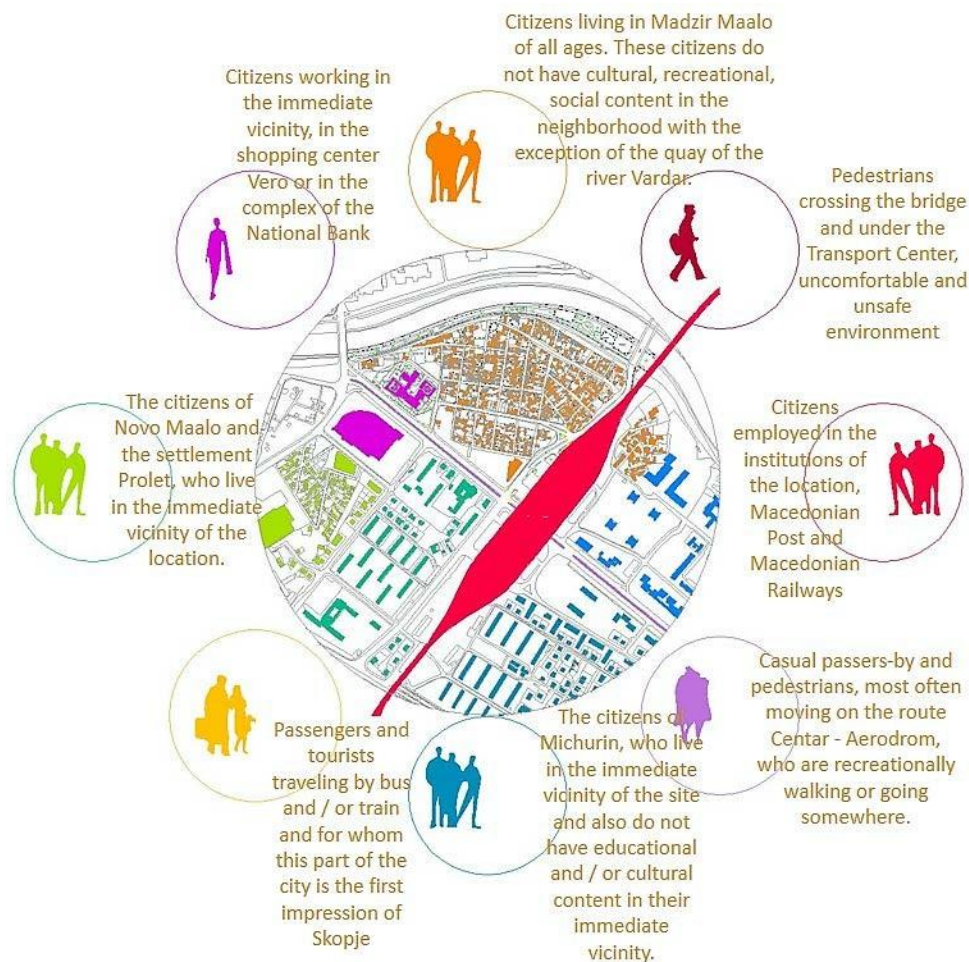


Figure 5. Analysis of the functions and frequency of the people, Source: authors

3. RESEARCH METHODS

Environmental planning is a decision-making process that addresses environmental parameters when creating human designed environments. It is an interdisciplinary field that includes urban planning, landscape architecture, architecture, engineering, related arts, natural sciences (biology, geography, meteorology, physics...) and social sciences [12]. Different analytical methods and various scientific findings were used in order to come up with precise answers regarding the real problems at the analyzed location.

One of the research methods used in this research is mapping and analyzing of open public spaces in front of public buildings in the selected city fragment. This method enabled the researchers to identify and choose the public space that is in the worst condition in the selected city fragment (Fig.1, Fig.2). That was achieved by conducting interviews with the local citizens and people that gravitate in this area, as well as making observation of the chosen public space during prolonged period (6 months). These two methods helped in discovering the capacity as well as the potential usage of the selected space.

Another important research method that helped in enlightening the present situation was conducting urban and architectural analysis of the built environment inside the chosen city fragment. Conducting historical and social analysis that lighten the context in which this public space is situated, followed. Conducting bioclimatic analysis helped in defining the solar radiation during all year around, measuring the air temperature on location during day and night in summer period, defining the air circulation (rose of dominant winds) on the location and presence / absence of greenery. The analysis of the pedestrian walking routines, as well as analysis of the necessary and possible programs and functions and their impact on the citizens was crucial in designing the new project proposal. Analysis of the functions and frequency of the people was very important step of the conducted methodological procedure. This analysis helped in discovering the percent of functional usage of this public space, which was only 8%. Conducting comparative analysis of the possible usage and the possibilities that this space offers with the actual usage of the space was one of the biggest results of the conducted analysis (Tab. 1).

Table 1. Comparative analysis of the possible usage and the actual usage of the space

Public space function:	Parking	Connectivity - walking zone	Commercial - shops	Events	Public WC	Socialization corners	Space for sports	Green Market
Present situation	Yes	No	No	No	No	No	No	No
New project proposal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

4. FINDINGS AND RESULTS

The interviews as well as conducted architectural, urban, historical, social, bioclimatic and environmental analysis helped in determining the best character of the new proposal for this open public space: MULTIFUNCTIONAL public space that will gather all the people gravitating in this area. A multi-functional space can be described as a true integration of different functions in time and space [13].

The functions of the multifunctional public space were clearly defined after a questionnaire was given to the citizens of this urban fragment to state what is lacking in this area. The interview showed that 72% of the citizens of this neighborhood said that they need a green market nearby, 81% said that this public space is very unsafe and needs more lights, small stores and public bathrooms. The young people (32%) said that the discotheque that was near this location is closed so they prefer a new open space for gathering at the night that involves music, performances and cultural programs. The people that work nearby (45%) said that they need an open space where they can sit, relax eat their lunch closer to the river Vardar. These results defined the new program content of the chosen public space: green market, parking,

public bathrooms and shops, place for gathering during the day and night. All these functions (shopping, gathering, relaxing, playing, parking cars and bicycles, organizing events) should be performed on one place in different periods of the day, or in different days of the week.

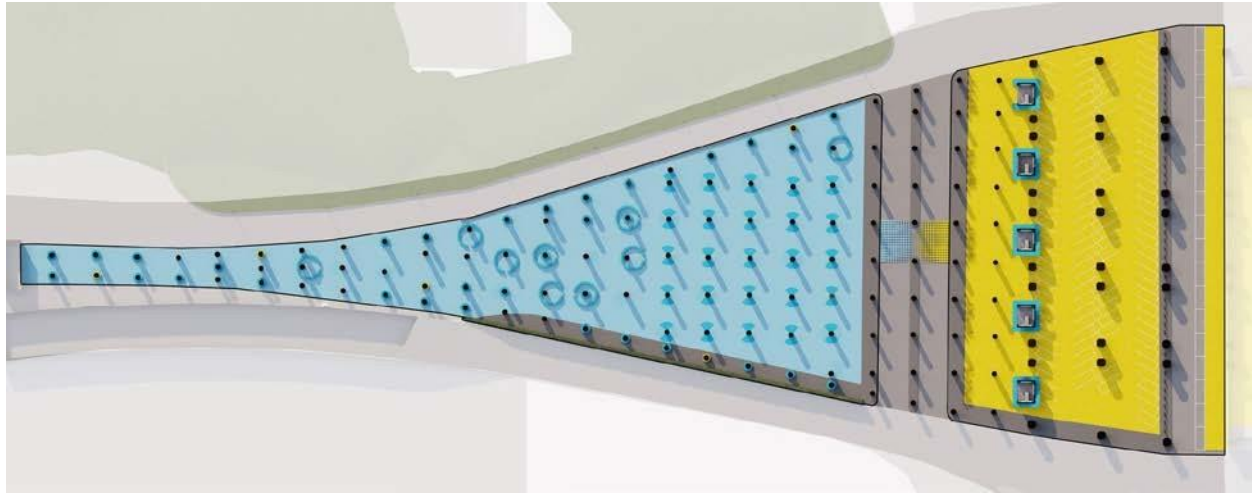


Figure 6. New project proposal (Source: authors)

THE DESIGN IDEA OF THE PROJECT-PROPOSAL ON THE CHOSEN LOCATION



Figure 7. The yellow zone – the first zone of the new project proposal, Source: authors

In the first zone, the parking of cars remains, because it has been noticed that it is used and this project would not want to jeopardize that. This area is painted yellow, which is association of the sun and illuminates this part of the site (Fig.7). In the existing five concrete cubes, service contents such as: coffee shop, cafeteria, toilets, pizzeria and bakery are inserted, which would encourage attendance. They have luminous inscriptions that attract attention and further illuminate the space at night. These cubes are wrapped with a bench that has a changing height, which allows several activities, such as: sitting, leaning, using as a desk to consume food and drinks, etc.



Figure 7. The blue zone – the second zone of the new project proposal, Source: authors

The second zone, intended for parking of buses is completely unused and is usually empty during the day and week. This space is pleasant and sunny, and the proximity of the river is felt and seen. The space is painted with a blue color that is associated with water. Rings are placed around the pillars, which have the function of benches and support desks, which offer various opportunities for social interaction of visitors. This sunny space, ventilated and open towards the river Vardar, would be ideal for strengthening social cohesion and will represent a new public place for socialization. Additionally, ivy is placed on the fence towards the bridge - a natural green barrier, which would have a positive impact on noise and CO2 emission reduction from cars. This space offers several purposes, at different times of the day or week:

1. *Green market*, which would function one or two days a week. In this way, the citizens from nearby can buy fresh fruits and vegetables, while the producers would get a new place to sell products. The space offers a pleasant atmosphere and thermal comfort. In summer, wind Povárdarec refreshes and plays a role in passive cooling. The location is covered and offers shade in summer, and in winter offers protection from atmospheric influences such as rain and snow. The building expansion in this area shows the huge need for a new market for the citizens who gravitate around this city fragment.

2. *New active space for holding various events and fairs in the open*. This space, especially in the warm Skopje nights, would be a great concert and exhibition space, which will no longer scare the citizens, but will entice them to visit it.

3. *Space for socialization and recreation* - Turning the last part of the location, oriented towards the river Vardar, into a public space for socializing and enjoying the beautiful views by setting up benches and counters for leaning. The space would be active throughout the week throughout the day and night and suitable for all age groups of citizens.

4. *Light installation* that would extend along the entire length of the concrete slab. The installation of light and sound equipment would project different visual textures, images and sounds (sky, universe, forest, water, paintings by famous Macedonian authors) on the upper part of the space. This installation has a dual function: it makes the space attractive and safe, as well as interesting and educational for visitors during the evening and night hours. The lighting installation would be visible and dominant at night and is planned for every day of the week with variable lighting themes.

5. CONCLUSIONS AND RECOMMENDATIONS

City planning should be people centered, rather than design centered. A city is a constantly evolving organism, and city planning must take a broader perspective than the design of individual buildings. To realize this potential, we must develop the concept of multifunctional public spaces that will bring life and joy in the city. We need to create awareness among the young architects, urbanists and city users to think about resource reduction and motivate them to change their behavior and consumption patterns. Reuse of "brownfield" locations instead of new ones is very important sustainable principle for improving the qualities of a city. Revitalization of locations in the center of the city that have lost their mining through time by adding new urban contents that enlighten the context of the nature and social cohesion - making it a socially vibrant place represents an imperative in the conducted research.

Benefits of incorporating projects of this kind that support the sustainable urban planning in the city of Skopje as well as in other cities facing similar problems should be:

- Improving mobility and walkability,
- People centered city planning, rather than design centered urban solutions,
- Redefine city values: a sustainable city depends on the attitude and behavior of each urban individual and user. The sense of citizenship and individual responsibility towards sustainable values should be encouraged rather than plain consumerism.
- Incorporating more and different out-door activities (such as walking, bicycling, exercising, gathering, playing, performing...)
- Improving social cohesion,
- Supporting a harmonious and prosperous society.

Implementing multi-functionality within communities creates spaces that have multiple purposes. Due to their access to diverse uses in one place, these spaces can contribute to a community's vitality. These multi-functional spaces often are appealing not only to the citizens that live nearby, but to diverse community members, including activists, artists, academics and social entrepreneurs, allowing them to act as incubators for new ideas, knowledge exchange, shared experience and experimentation. This connection of diverse communities can inspire innovative thinking and provide opportunities for collaboration and partnerships across traditional boundaries.

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Introduction of traffic light of pedestrian crossing to improve pedestrian safety

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ABSTRACT

Pedestrians have to share the road with vehicles so it is important they take care when crossing the road. As a pedestrian, plan where you will walk and always choose the safest place to cross a road. Signalized pedestrian crossings consist of signal displays, line markings and lighting. Signalized pedestrian crossings give priority to vehicles, and pedestrians are allowed to cross only when the signals halt vehicle traffic on the through road. Signals must be timed to give pedestrians long enough to complete their crossing before the signals change to allow vehicle traffic to start passing through the crossing again. A high volume of pedestrian traffic is needed to justify the delays to road traffic that signalized pedestrian crossings cause. Pedestrian phasing should be considered at all signalized intersections where pedestrians are likely to be present. The increasing of traffic volume at intersections has been arise a problems like road accidents, conflicts and congestions. These problems can be solved by providing an efficient traffic signal control at the intersection for continuous and efficient movement of vehicles through the intersection. Most pedestrian crashes occur while the pedestrian is attempting to cross the road. A range of treatments can help pedestrians to cross safely, including the use of signalized pedestrian crossings. This paper presents the improvement of pedestrian safety by introducing traffic lights at pedestrian crossings. The green signal time should be long enough to allow pedestrians to cross safely. For even greater safety when crossing a pedestrian crossing, it is necessary to introduce a method by pressing buttons.

KEYWORDS

Traffic light signals, pedestrian, safety

1 Introduction

Traffic lights in urban transport systems are often designed to take into account the situation on the road, i.e. detect vehicles and optimize road traffic flow. A wide variety of methods is employed to detect vehicles - from cameras through induction loops, laser radars and the method of pressing a button. Those include the need for the pedestrian to: identify that the lights need to be activated (which is the case at only selected crossings), find a push button, walk up to it and activate it. Another assumption is that the pedestrian will wait until the light changes to cross the road, regardless of the situation on the intersection.

Recent advances in pedestrian pushbutton design, led by the development of accessible pedestrian signals (APS), have created a new method of communicating traffic control information to pedestrians. Some APS devices have beaconing features and/or verbal (speech) message capabilities obtained by pressing and holding the pedestrian pushbutton for approximately three seconds. Other features, such as the extension of the walk interval, may also be activated with an extended pushbutton press. Recent research has suggested that three seconds may be excessive since holding the pushbutton this long is hard for some users. Additionally, most pedestrians may not hold the pushbutton for this length of time. The problem lies in determining how long the APS pushbutton should be pressed for a pushbutton information message and/or special accessibility features. The pushbutton detector is the common form of detection used for pedestrians. Located on a pole near the crosswalk, the detector is actuated by a pedestrian pressing the button. When the button is pressed, an electrical circuit opening takes place stopping a low-voltage current

flow to the traffic signal controller and registering a call for pedestrian service. The circuit remains open for as long as the pushbutton is pressed. Once the initial call for service is made, the duration of the circuit opening or the number of additional button presses has no effect on controller operation. A controller can also be programmed to provide an extended pedestrian phase timing in response to an extended button press. With such a feature, the controller can regularly provide pedestrian timing that is the minimum permissible while allotting additional crossing time when needed by pedestrians who move or react slowly or who don't use visible cues and thus wait to confirm audible/vibrotactile cues before starting a crossing. If the pedestrian who needs a special feature fails to hold the pushbutton long enough to get that feature, the effectiveness of the device is reduced and its purpose is not fulfilled. The problem lies in determining how long the APS pushbutton should be pressed to get special accessibility features. Ideally, obtaining the special features should require pushbutton activation duration longer than the time most pedestrians hold the pushbutton, but shorter than the time that a pedestrians with disabilities might find difficult (i.e., less than three seconds). It is needed to determine the appropriate duration of a pushbutton activation to obtain the pushbutton information message and other special features that may be available in APS devices.

2 Objective

The objective of this research was to develop and introduction of light signals on pedestrian crossings and establishment of line coordination on part of Blvd. Makedonsko Kosovska Brigada with the intersection on Blvd. Nikola Karev to the intersection with Blvd. Bosnia and Herzegovina in Skopje, by providing the required level of traffic service, where traffic will have a minimal limiting factor for the overall development of the space. In addition, the realization of the following goals was enabled, according to their priority, such as:

- Creation of optimal spatial conditions for uninterrupted activities in that part of the City;
- Creation of optimal traffic conditions for the movement of motorized and non-motorized traffic;
- Installation of traffic lights at intersections and pedestrian crossings in the area of coverage and introduction of line coordination (green wave).

3 Scope of research

The increasing of traffic volume at our intersections has been arise a problems like road accidents, conflicts and congestions. These problems can be solved by providing an efficient traffic signal control at the intersections for continuous and efficient movement of vehicles and pedestrians through the intersection. According to traffic signal, signal timing is most important which is used to decide green time of the traffic light shall be provided at an intersection and how long the pedestrian walk signal should be provided.

The scope of research are 4 intersections located in north part of City of Skopje defined at the place where Blvd. Macedonian Kosovo Brigade crosses with (Figure 1):

- Str. Prohor Pchinski which forms a three-legged intersection;
- Str. Jon Kenedi and the str. Slavej Planina that formed it four-legged intersection;
- Str. Augustu Cesarec which is forming a three-legged crossroads;
- Str. 2nd Macedonian Brigade which forms a four-legged intersection



Figure 1: Scope of research

Research methodology and data collection

In order to make optimal traffic solutions of the fourth intersections, used parameters includes:

- traffic flow rate for all movements (through, left and right)
- geometric characteristics such as number and width of lanes
- vehicles approaching speeds
- saturation flow rates per hour on each approach

4 Results

Various kinds of techniques and computer tools have been developed to help traffic engineers find the optimum traffic signal timing and to predict the performance of signalized intersections in terms of delays and queue lengths. One of such techniques is the Webster's method. The results for all four intersections were obtained using the Webster's method.

Protective time for vehicles

The protection time between individual phases is calculated according to the form:

L_i (m) – distance traveled by the vehicle from the "STOP" line to the point of conflict in the phase which is completed

L_i (m) – distance traveled by the vehicle from the "STOP" line to the point of conflict in the starting phase

$V_i = 30 \text{ km/h} = 8,3 \text{ m/s}$ – vehicle speed in the passing phase

$V_z = 40 \text{ km/h} = 11,1 \text{ m/s}$ – vehicle speed in the starting phase

Protective time for pedestrians

The protection time between the conflicting flow of vehicles from the passing phase and the pedestrian phase encountered was calculated according to the formula:

$$t_{pp} = \frac{L_{1ii}}{V_i} \quad (1)$$

L_{1ii} - distance traveled by the vehicle from the "STOP" (dashed) line to pedestrian crossing in the passing phase

$V_i = 30 \text{ km/h} = 8,3 \text{ m/s}$ – vehicle speed in the passing phase

Minimum green time for pedestrians:

L_p (m) length of pedestrian crossing in meters;

$V_p = 1,2 \text{ m/s}$ accepted pedestrian speed

The regime of operation of the traffic light signalization was defined by programs - signal plans, which alternately manage the pedestrian and driving streams without interruption. When switching on, the traffic lights at the intersections will operate with a two-phase, three-phase and four-phase system with cycle lengths with certain values as shown in the pictures.

For the yellow time on the main and the secondary direction, is accepted $t' = 3$ seconds. For the red-yellow time is accepted $t_c' = 1$ second.

Two-phase system

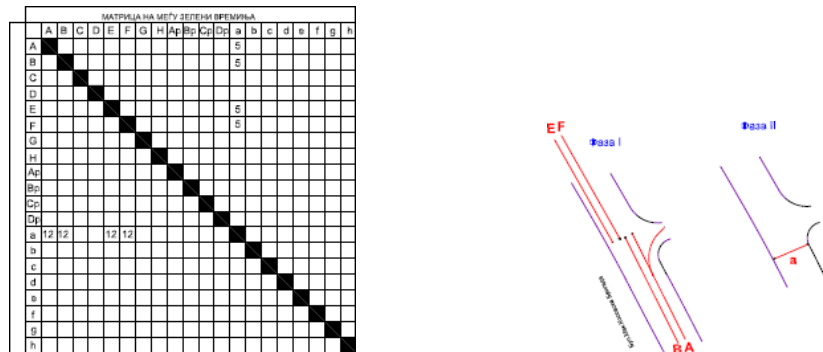


Figure 2. Signal phasing and Flow Directions of pedestrian crossing Blvd. „M.K. Brigada”- Prohor Pchinski

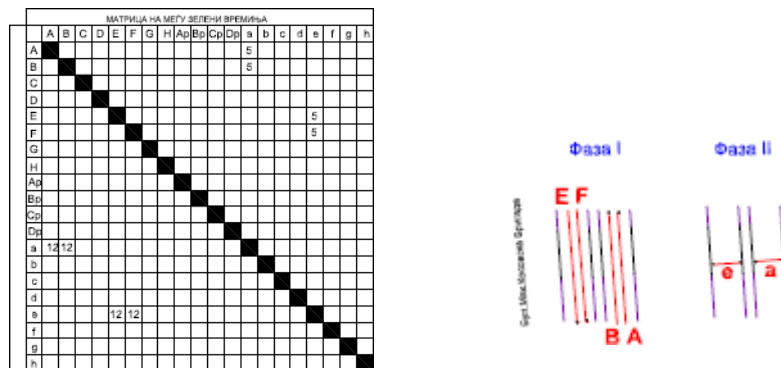


Figure 3. Signal phasing and Flow Directions of pedestrian crossing Blvd. „M.K. Brigada ”- Trudbenik

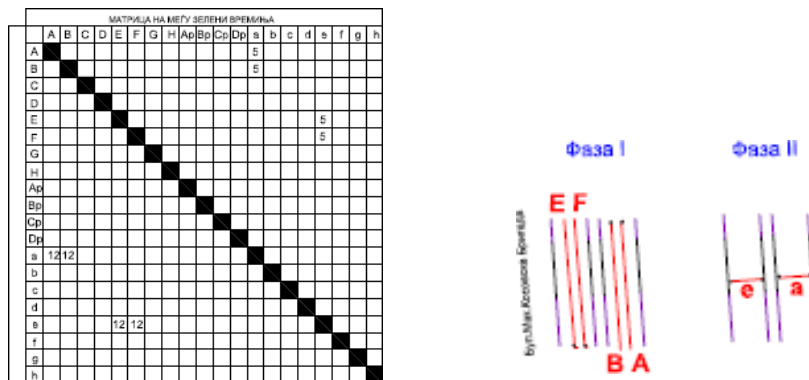


Figure 4. Signal phasing and Flow Directions of pedestrian crossing Blvd. „M.K. Brigada ”- August Cesarec

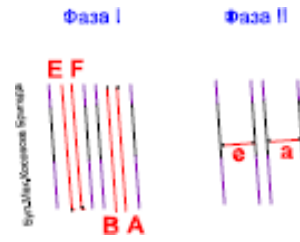
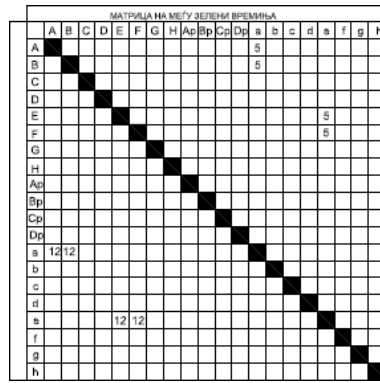


Figure 5. Signal phasing and Flow Directions of pedestrian crossing Blvd. „M.K. Brigada” - Rajko Zinzifof

Three-phase system

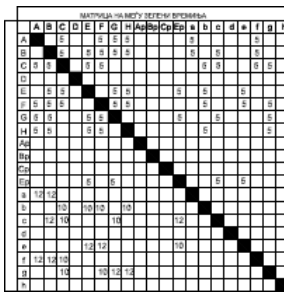


Figure 6. Signal phasing and Flow Directions of pedestrian crossing Blvd. „M.K. Brigada” - 2nd M. Brigada

Four-phase system

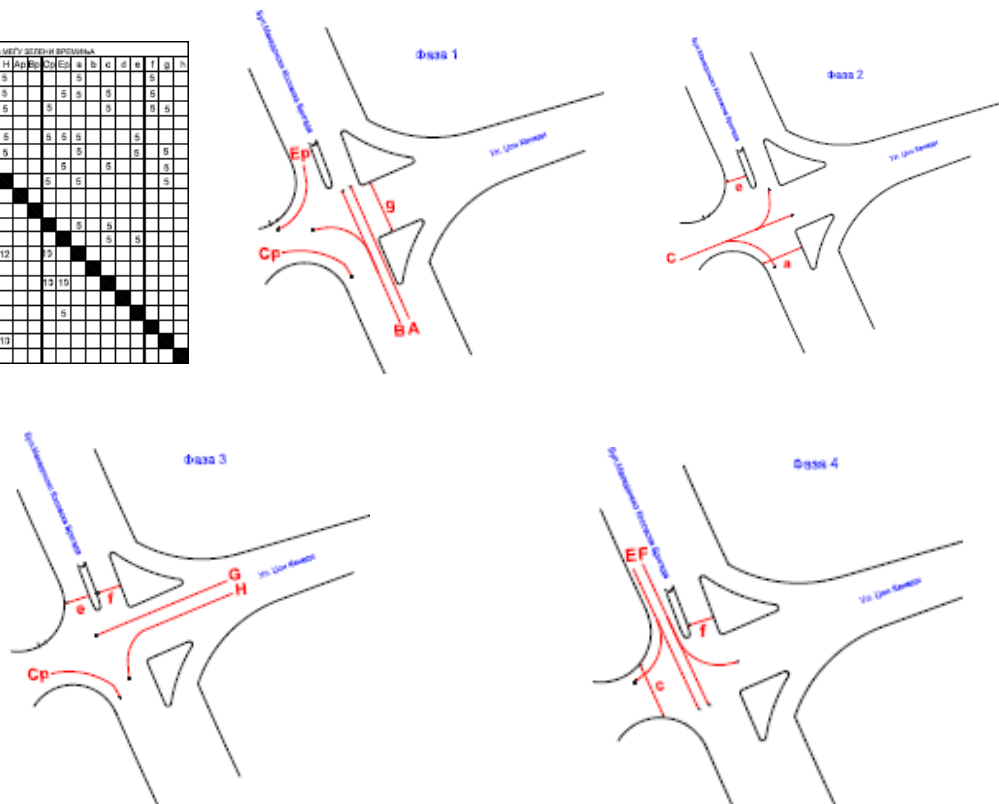
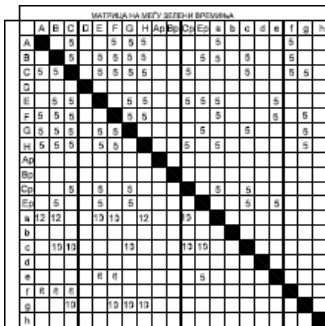


Figure 7. Signal phasing and Flow Directions of pedestrian crossing Blvd. „M.K. Brigada” - Jon Kenedi

The synchronization of the signal plans is made in such a way that the inclusion of the signal plans will not take place at the same time at all intersections, and it is clear that in this mode of operation there will be no conflicts, i.e. congestion in the flow of traffic. This way of turning on provides sufficient long green light for vehicles coming from both directions on Blvd. Macedonian Kosovska Brigada without a problem to pass the green light at the next crossroads. Phase A and phase E are synchronized at all intersections in both directions of movement for peak and extra peak period. Synchronization is performed at a design speed of $V_p = 50 \text{ km/h} = 13.8 \text{ m/s}$.

Conflicts are marked with signal groups whose light signals, in order to avoid direct conflict between the participants in the traffic (vehicles - pedestrians), must not be given the green light at the same time. Computerized traffic lights are software designed and programmed, if for any reason an error occurs and at the same time a green light appears on conflicting signal groups, they immediately switch to a yellow flashing light, or shut down completely.

5 Conclusion

The paper results with introduction of traffic light signals for pedestrians and establishing line coordination between intersections. Signal plans provided enough long green light for vehicles coming from both directions to pass the green light at the next crossroads (project speed of 50 km/h). In conditions when the traffic lights work, all traffic participants move in strictly defined time intervals, which are communicated by the traffic lights. When the traffic light device works in the "turn signal" option or is completely out of use, then all traffic participants move in accordance with the set horizontal and vertical traffic signals.

When introducing light signals, a push button was applied, which should enable the announcement of changing the signal plan by pressing a button, LED confirmation for receiving the announcement, directional button for the blind and visually impaired and an acoustic signal for the blind. and visually impaired people who turn on only when the pedestrian signal is green. Counters will also be used, the purpose of which will be to get a visual display of how long they will be connected and how long the light signals will last, which will contribute to greater caution of pedestrians and drivers. The introduction of traffic lights comes from the need to increase pedestrian safety.

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Improving the performance of data warehouse using column store indexes

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ABSTRACT

With the development of electronic devices, information systems, and several services, there is generated a lot amount of data. Also, the number of Internet of Things (IoT) devices is continually growing and today there are many IoT devices that generate sensorial data. As a result, the volume of data warehouse (DW) enormously is growing, and this presents a challenge in storing, managing, and processing data, especially when we have to deal with IoT systems. There are various problems like difficulties in collecting data, great delay in execution of the queries, long time for generating reports, impact in functions of the software, etc. This can affect the loss of opportunities and business chances of companies. The purpose of this paper is to show how to improve the performance of data warehouse systems that are used for decision support systems, in which an increased volume of data is expected and the need to shorten the response time of complex queries. To confirm the relevance of indicated improvements, experiments, and appropriate performance measurements have been made, where different ways of organizing and indexing data are compared including column store indexes. From the obtained results you will see that using this kind of data organization and indexing (column store indexes), offers increased performance in the processing and execution of queries, as well as the elimination of problems that occur in data warehouses.

KEYWORDS

column store, data warehouses, data processing

1 Introduction

Getting information quickly and in time plays a very important role in general systems management, and especially in companies to incorporate them into their business goal strategies. Therefore, for a company to operate successfully (in addition to employees and professional management), it needs to collect, organize and process data to provide the analysis needed to make managerial and other business decisions.

Due to the recent rapid development of technology, a large amount of data is generated and in this way, data warehouses are overloaded with data through various sources that provide data including sensors.

So as the volume of data increases, the efficiency and performance of data warehouses fall and become more critical. As a result, companies face a variety of problems: information cannot be obtained quickly, difficulties and delays in data analysis arise, the query execution process can take hours, all data cannot be stored in one place, etc.

Figure 1, presents a chart with approximate data managed by DW by TDWI Reports¹. The blue bars show the actual capacity of DW that are managed by companies, while the red bars show how the capacity of DW is predicted to be after 3 years. 27 % of companies think that their capacity after 3 years will be between the ranges 10-100 TB, so it is necessary for a new technology that will provide a solution to this data increase.

¹ TDWI Reports (The Data Warehousing Institute) – <https://www.tdwi.org>

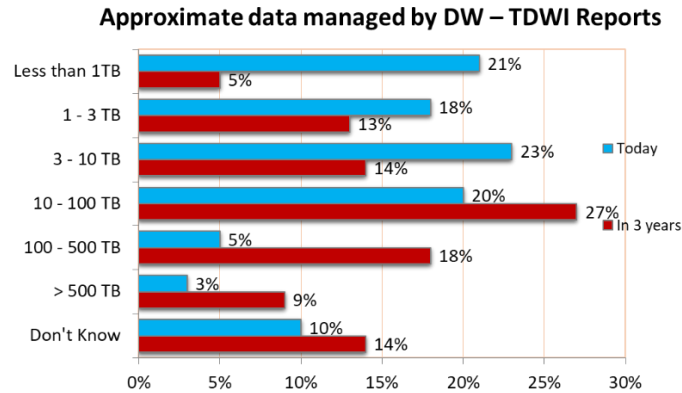


Figure 1. Approximate data managed by DW – TDWI Reports [1]

Query optimization, data compression, and other factors affect the increase of search speed, but among other things, the main factor influencing the increase of search speed is the use of indexes of different types.

Companies and other institutions would like to process data and get the response interactively, they want to store a large amount of data, to be able to easily process that data and get the results of the queries without any delay.

The purpose of this study is to show the companies and institutions how they can benefit by using column store indexes in increasing the speed of search and appearing results, enabling data processing more easily and efficiently, enabling more data to be stored in their systems. All these opportunities in some way contribute to the success and business opportunities of companies.

2 Data Organization with Column store Index

In a traditional format row-store, data is stored in units called “data pages” with sizes of 4 kb or 8 kb [2]. When the data page is filled with rows, there is created a new data page that will store the incoming rows. This process continues until all rows are systematized.

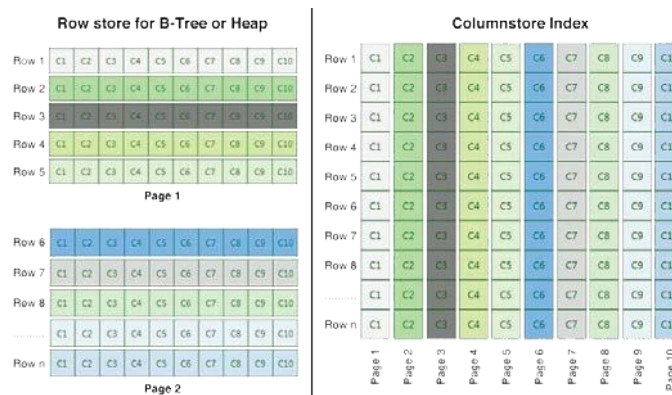


Figure 2 – Row store (left) vs. Column store (right) [3]

The column store format is the opposite of the row-store format. The values of a column are stored next to each other in compressed form. Unlike the row-store format, in column-store format, each column is stored in a separate set of pages, which means in the page there are column values and not row values [4].

The advantage of column store is when reading values from a specific column on the table. The other values are not read. In the row store format this is impossible because in the data page are stored the values of the row, and to read a value from a column, you need to read an entire row, respectively an entire page should be taken into memory.

When data is organized in the column, it is of the same type (defined above the same domain), with multiple repetitions compared to the row-store format. The column-store uses Vertipaq data compression technology and it is achieved a rate up to 15 times compared to compression when the data is stored with row store (page

compression) [5]. With this compression, the queries need less input/output (I/O) requirements because the amount of the data transferred from disk to memory is obviously reduced. This I/O reduction enables better performance and shortens the time of query execution.

Another advantage of column-store is elimination. When a user executes queries, the DBMS eliminates columns even segments (part of the column) that are not required for the query and it takes only that data that needs to be processed. Each segment has metadata where it is stored the minimum and maximum value of each column for the segment. When the query is executed, the filtering condition is controlled with the values in the metadata. If it is detected that none of the rows in the segment are required for the query then it skips the entire segment without reading from the disk.

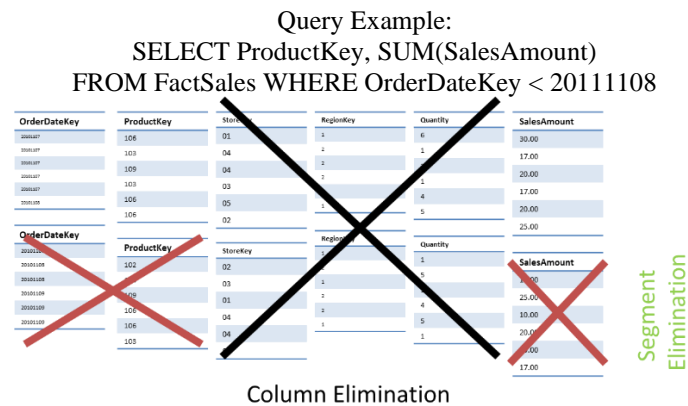


Figure 3 – Column/Segment Elimination [6]

With the elimination of unnecessary columns and segments, it is enabled for transferring data faster from disk to the memory and this impacts and increases the performance of query execution.

3 Performance Evaluation – Row-store vs Column-store

To compare and evaluate the performance of the two general indexing methods: classical-row-store and column-store, and to confirm the advantages and cases in which the last type of indexing has an advantage, a data warehouse system with a snow-flake schema has been done which has some dimensions and one fact table that is overloaded with 150 million rows with a capacity of 7 GB (see figure 4).

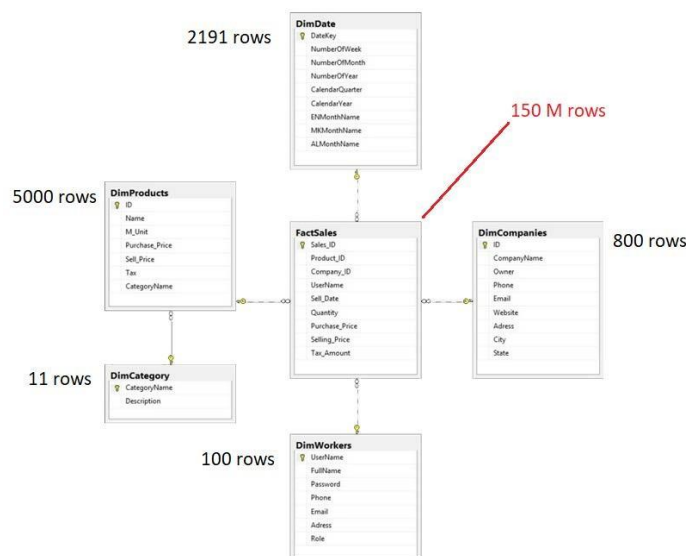


Figure 4 – Schema of DW database

The above schema contains 6 tables. In the center, is placed the fact table loaded with generated data, and around the fact table, are placed dimension tables that describe the facts. In addition to the fact table, there are also created 3 copies of the fact table, and each of them is indexed with a different type of indexes. In table 1 you can see the information about index type, compression type, and capacity.

Table	Index Type	Compression Type	Capacity of Table	Size of Table - %
FactSales	Clustered and Nonclustered-rowstore	Uncompressed	6952 MB	100.00%
FactSalesNCSI	Non-Clustered Columnstore	Columnstore	6145 MB	88.40%
FactSalesCCSI	Clustered Columnstore	Columnstore	1814 MB	26.20%
FactSalesCCSIArchive	Clustered Columnstore	Columnstore Archive	1571 MB	22.30%

Table 1 - Table sizes by creating different indexes and compressing with different methods

From the above table, you can see that the size of the table has changed and a reduction has been achieved by ~80 %. This difference is due to the fact that the data stored with column-store format enables a higher level of compression because the values are of the same type.

Test queries

There are combined three types of queries which include different ranges of values. To compare the advantages of the indexes in different cases of data processing and analysis, these queries are executed considering different types of indexes (row-store and column-store) in all four fact tables.

The first query (Q1) takes into account all the values from the columns Quantity and Purchase_Price (2 columns with 150 million values = 300 million values), which means that this query process a longer range of values. The second query (Q2) processes a shorter range of values. It takes into account only values that are recorded in the 2010 year. And the third query (Q3) finds only one value.

Query 1 – (Q1): The total quantity and total amount of products sold for each year.

```
SELECT d.NumberOfYear, SUM(f.Quantity) AS Quantity_Sold, SUM(f.Purchase_Price) AS
Purchase_Price
FROM FactSales f INNER JOIN DimDate d ON d.DateKey = f.Sell_Date
GROUP BY d.NumberOfYear
ORDER BY d.NumberOfYear DESC
```

Query 2 – (Q2): The total quantity and the total amount according to product categories that were sold in 2010.

```
SELECT c.CategoryName, SUM(f.Quantity) AS Quantity, SUM(f.Purchase_Price) AS
Purchase_Price
FROM FactSales f INNER JOIN DimProducts p ON p.ID = f.Product_ID INNER JOIN
DimCategory c ON c.CategoryName = p.CategoryName INNER JOIN DimDate d ON
d.DateKey = f.Sell_Date
WHERE YEAR(f.Sell_Date)= 2010
GROUP BY c.CategoryName
ORDER BY c.CategoryName ASC
```

Query 3 – (Q3): Show the First Name and Last Name of the worker that has done the transaction with number 44790643.

```
SELECT w.FullName
FROM FactSales f INNER JOIN DimWorkers w ON f.UserName = w.UserName
WHERE f.Sales_ID = 44790643
```

In table 2 you can see the performance specification of the machine where the experiments are done.

CPU	Intel(R) Core(TM) i7-10750H CPU @ 2.60GHz (12 CPUs), ~2.6GHz
RAM	8 GB
Disk	SAMSUNG MZALQ512HALU-000L2
OS	Windows 10 Pro-64-bit (10.0, Build 19043)
DBMS	Microsoft SQL Server 2016 (RTM) - 13.0.1601.5 (X64)

Table 2 – Performance specification of the machine

Result evaluation

Measurement parameters taken from the executed queries are:

- Execution Time – Total execution time in second
- CPU Time – Time in seconds for data processing in CPU
- Query Cost - Is a parameter that represents in percentage the performance of the executed query
- Logical Reads - Indicates how many data pages are being read from the internal memory

Execution of the first query – Q1:

	Rowstore Indexes		Columnstore Indexes		
Index Type	Clustered	Non-Clustered	Non-Clustered Columnstore	Clustered Columnstore	CCSI with Archival Compression
Execution Time (s)	24.553	21.727	4.654	2.302	2.529
Query Cost %	52	42	2	2	2
CPU Time s	141.299	144.467	19.654	10.251	12.675
Logical Reads	892614	633883	0	0	0

Table 3 – Results from Q1 execution

Table 3 presents results from Q1 execution by using row-store indexes (Clustered Index-CI and Non-Clustered Index - NCI) the query cost is much higher, while on the other side by using column store index (Non-Clustered Column-store Index - NCCSI, Clustered Column-store Index - CCSI, Clustered Column-store Index with Archival Comp. - CCSIA) the query cost is much lower. Also, the execution time is much shorter when it is used column store index types.

Execution of the second query – Q2:

	Rowstore Indexes		Columnstore Indexes		
Index Type	Clustered	Non-Clustered	Non-Clustered Columnstore	Clustered Columnstore	CCSI with Archival Compression
Execution Time (s)	14.63	11.061	8.021	5.868	6.243
Query Cost %	53	40	2	3	2
CPU Time s	47.659	54.202	55.047	40.578	48.547
Logical Reads	892539	633588	0	0	0

Table 4 – Results from Q2 execution

Table 4 presents results from Q2 execution. Here you can notice that by using row-store index types (CI and NCI), the query cost and time execution is much higher, while by using column store index types (NCCSI, CCSI, and CCSIA), the query cost is lower, and time execution is faster.

Execution of the third query – Q3:

Index Type	Rowstore Indexes		Columnstore Indexes		
	Clustered	Non-Clustered	Non-Clustered Columnstore	Clustered Columnstore	CCSI with Archival Compression
Execution Time (s)	0.08	0.124	0.238	0.316	0.416
Query Cost %	0	0	34	36	30
CPU Time s	0	0	0.283	0.109	1.248
Logical Reads	4	4	0	0	0

Table 5 – Results from Q3 execution

Table 5 presents results that are completely different from tables 3 and 4. Here you can notice that by using row-store index types, the results are better compared to column-store index types. This is because column-store indexes are not adapted for queries that have a high level of selectivity, but still in this case the execution time is not very long.

In figure 5 below are presented only the values of the execution time by the three queries. Here you can distinguish that query execution time of Q1 and Q2 is much longer in the tables which are indexed with row-store index types (CI and NCI), while on the other hand, the query execution time is much shorter in tables that are indexed with column-store indexes (NCSI, CCSI, and CCSIA). By comparing Q1 time execution (row-store CI) with Q1 time execution (column-store CCSI), we can conclude that in this case it is achieved improvement 11 times.

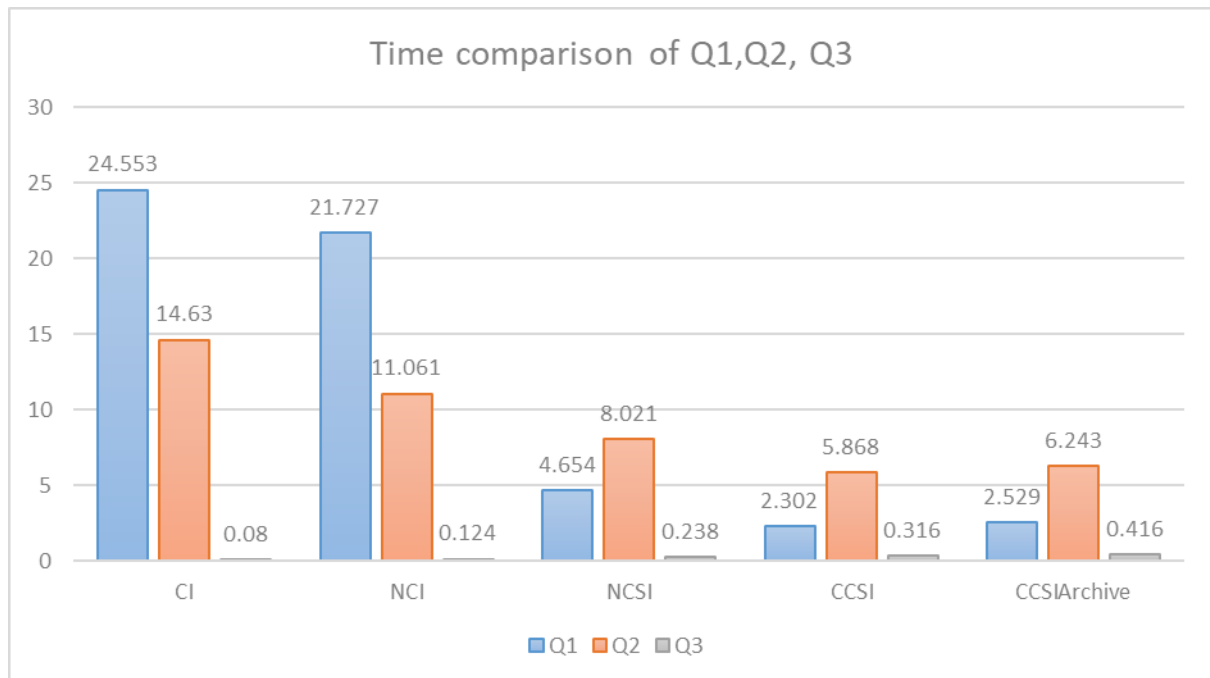


Figure 5 – Execution time comparison of the three queries – Q1, Q2, Q3

Query Q3 shows that the execution time in tables with row-store index types is shorter than in tables indexed with column-store index, but still, the difference is not very big.

4 Conclusion

Companies are one of the main factors influencing the development of technology because they constantly want to sophisticate their information systems. The development of technology produces a huge amount of data and as a result the volume of data stored in DW systems continually is growing.

Overloading DW causes various problems during data analysis and retrieval of information such as report generation can take hours, information is not received quickly, the process of executing the queries is very slow, difficulties storing data, etc.

In general, getting information quickly and on time plays an important role in system management, especially in companies, because this affects the decisions and success of companies, so it is necessary to improve the performance of DW systems. To achieve this, it should be applied the latest technology (column-store index) for organizing, indexing, and processing data, which is built and adapted for DW databases that contain large amounts of data.

There are some limitations to column store indexes. They are not suitable for queries that search a single row, or a shorter interval of rows. They are not suitable for queries that have a high level of selectivity. In such cases, it is better to use row store indexes.

The results obtained from the experiments show that using the column store indexes we have improvement up to 11 times (and according to Microsoft experiments the improvement is achieved up to 100 times). Based on these results we can conclude that companies, but also other organizations by using column store indexes, obviously benefit in increasing the speed of search and the appearance of results, data processing is much easier, enabling systems to store more data and all these affect the success and business opportunities of companies.

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Evaluation of the methodological aspect of teaching in higher education using MCDM technique*

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ABSTRACT

Evaluation processes in higher education towards quality assurance (QA) and quality control is complex process. The pillar that integrates all aspects of evaluation is the study program itself. Before announcement, it is a subject of accreditation process and must answer multiple criteria before approval. After completion of the study program, graduates acquire the qualifications provided within the accredited study program. In order to be as efficient as it is possible, it has to embrace two important aspects in terms of qualifications delivery: what is delivered (what types of qualifications) and how those qualifications are delivered (what methods are used)? The second aspect can be evaluated using optimization technique Analytic Hierarchy Process (AHP), providing unique approach of quality → quantity transition in objective manner, thus enabling data processing and generating readable reports.

KEYWORDS

AHP – Analytic Hierarchy Process, QA –Quality Assurance, EHEA – European Higher Education Area

1 Introduction

There are a lot of different answers, perceptions and definitions regarding the question “What is quality in higher education”? Quality in higher education can be defined as multidimensional construct, simultaneously dynamic and contextual, differently perceived from all the different categories of stakeholders in higher education. And there are multiple stakeholders: providers (HE institutions or Universities), teachers and staff, students (direct consumers) and others (organizations, agencies, legal aspects, students’ organizations, government bodies, trends, media etc.). EHEA obliges the countries to implement quality assurance / control mechanism in their systems as one of the key responsibilities of HEIs. According to the EU legislative, quality assurance involves the systematic review of educational provision to maintain and improve its quality, equity and efficiency. It encompasses school self-evaluation, external evaluation (including inspection), the evaluation of teachers and school leaders and student’s assessment. The pillar integrating multiple aspects of evaluation is the study program itself. It is a subject of accreditation process before announcement and must meet multiple criteria before approval. When students graduate and complete the study program, it is expected to acquire the necessary qualifications provided within the study program. Two qualitative aspects in terms of qualification delivery are important:

- What is delivered (what types of qualifications are provided), and
- How those qualifications are delivered (what techniques, methods, methodological approaches are used).

The focus regarding the second aspect is on general principles, pedagogy/methodology and management strategies used during the classes (delivery of the knowledge). In pedagogy terms, it is significant how teachers teach, in theory and in practice. In methodology terms, we speak about the logical scheme based on views, beliefs and values through set of procedures, techniques and approaches that a teacher (group) can develop in order to help students.

The evaluation of the second aspect of a specific study program is done using Analytic Hierarchy Process as Multi Criteria Decision Making technique to detect the level of fulfillment of several specific teaching / methodological criteria by each course within the study program, via unique approach of quality → quantity transition manner. The case study is done on a real study program and students at the end of studying or just graduated, thus having fresh impressions regarding the questions of the evaluations' questionnaires. Networking the importance scale of those criteria with the individual criteria fulfillments of the courses, final form of quality report towards methodological aspect of the study program is generated. The result than can be manipulated for conclusions or used in further data processing, if greater evaluation model is created in terms of quality assurance in higher education.

2 Research activities, techniques and case study

Analytic Hierarchy Process is a structured space technique for organizing and analyzing problems where complex decisions are need to be taken in complex environments, where many variables or criteria are considered in the prioritization and selection of the alternatives or projects. It offers unique approach to make choice of preferences, based on the criteria that are available. AHP transforms the comparisons, which are most often empirical, into numerical values that are further processed and compared. The weight of each factor allows the assessment of each one of the elements inside the defined hierarchy. This capability of converting empirical data into mathematical models is the main distinctive contribution of the AHP technique when contrasted with other comparing techniques. After all the comparisons are made, and the relative weights between each of the criteria to be evaluated have been established, the numerical probability of each alternative is calculated. This probability determines the likelihood that the alternative has to fulfill the expected goal. The higher the probability, the better the chances the alternative has to satisfy the final goal of the portfolio.

AHP hierarchy is consisted of (Figure 1):

- Goal – what is the final aim of the analysis / question to be answered
- Criteria (and sub criteria) – what are the criteria that decisions are depending on, and
- Alternatives – what are the possible alternatives that the best one will be chosen from.

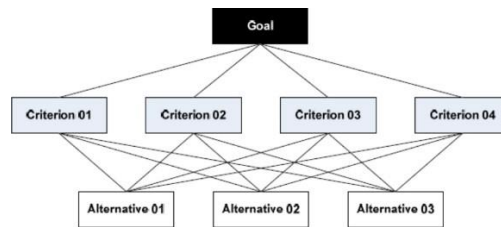


Figure 1. AHP hierarchy (3 level)

Judgement matrix is formed from the pair-wise comparisons of the criteria:

$$AA = \begin{pmatrix} 1 & aa_{12} & \cdots & aa_{1n} \\ aa_{21} & 1 & \cdots & aa_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ aa_{n1} & aa_{n2} & \cdots & 1 \end{pmatrix} \quad (1)$$

aa_{iii} is a decision-maker value returned for the criteria ii and jj as a 1-9 value (Table 1), reflecting the preference of the criterion ii in relation to criterion jj . If ii is preferred to jj , then $aa_{ii} > aa_{ji}$. Also, following rules are applied: $aa_{iii} = aa_{iii}^{-1}$, $aa_{iii} > 0$ and $aa_{iii} = 1$ for $ii = jj$. These data are then used in several calculations towards measuring the criteria's weights (importance), consistency check step and overall model synthesis (finding the best alternative).

Table 1: Saaty's preference table

Scale	Compare factor between element ii and element jj of AA
1	Equally important
3	Weakly important
5	Strongly important

7	Very strongly important
9	Extremely important
2,4,6,8	Intermediate values

Normalized matrix $bb = [b_{iii}]$ is derived from matrix A , using the method of normalized arithmetic means:

$$b_{iii} = \frac{a_{iii}}{\sum_{i=1}^m a_{iii}} \quad (2)$$

The importance values of the criteria are calculated within the vector of criteria's weights $WW = [w_{ii}]^T$, $i = 1, \dots, m$ calculating the arithmetic mean for each row of the matrix B :

$$w_{ii} = \frac{\sum_{i=1}^m b_{iii}}{m} \quad (3)$$

The endurance of the model and the final result are based on the consistency check. The weight vector must satisfies the following equation:

$$AAWW = \lambda_{\text{maximum}} WW \quad (4)$$

Maximum Eigenvalue $\lambda_{\text{maximum}} \geq m$ ($\lambda_{\text{maximum}} = m$ for ideally consistent matrix) of the initial pair-wise comparison matrix AA can be obtain as it is shown:

$$\lambda_{\text{maximum}} = \frac{1}{m} \sum_{i=1}^m \frac{(AAWW)_{ii}}{w_{ii}} \quad (5)$$

Then, the consistency check can be performed, calculating the Consistency Index (CI) and Consistency Ratio (CR):

$$CI = \frac{\lambda_{\text{maximum}} - m}{m - 1}, CR = \frac{CI}{RI} \quad (5)$$

RI is the average random index with the value obtained by different orders of the pair – wise comparison matrices (Table 2). If $CR \leq 0.10$ (10%), the result is acceptable, meaning the judgement of the decision makers are fine and consistent. If inconsistency is greater than 10%, judgements need to be re-conducted.

Table 2: RI index

N	1	2	3	4	5	6	7	8	9	10
RI	0	0	0,52	0,89	1,11	1,25	1,35	1,40	1,45	1,49

The final step of AHP is synthesis of the data. Matrix of alternatives and criteria $[a_{ii}]$ is constructed, where a_{ii} refers to the quantification (value) of the alternative ii regarding to the criterion jj (local preference regarding each alternative is denominated). The weights of the alternatives aww_{ii} , $i = 1, \dots, m$ are calculated with summation of normalized elements related to the preferred value of the alternative's columns values, related to each criterion separately:

$$aww_{ii} = \sum_{i=1}^m \frac{a_{ii}}{\sum_{i=1}^m a_{ii}} w_{ii}, i = 1, \dots, m \quad (6)$$

Four teaching/methodological aspects were chosen to be evaluated towards overall courses quality:

- Teaching activities in terms of planning, organization and final realization in relation to the needs of the students – Criterion 1;
- Practical work in terms of practical application of the knowledge and the course content / practical examples

delivery through the course – Criterion 2;

- Application of new educational methodologies, tools and techniques (digital and other) – Criterion 3, and
- The possibility to individually work with the teacher – mentoring, supporting and guiding the students – Criterion 4).

Two questionnaires were constructed and conducted, towards gathering the necessary data to be processed using the AHP technique:

- Questionnaire Q1 about the mutual importance relationship of the four criteria / methodological aspects, and
- Questionnaire Q2 about the courses' level of fulfillment of each (out of the four) criteria (contribution in achieving those criteria).

The questionnaire Q1 was constructed towards evaluation of the mutual relationship / importance of the all existing criteria pairs, using the 9-level scale (Table 1). The questionnaire Q2 was constructed towards evaluation of the level of fulfillment of the four criteria by each course of the study program, using the Likert's scale (1 – No fulfillment, 2 – little fulfillment, 3 – Partial fulfillment, 4 – Good fulfillment, 5 – Complete fulfillment).

- Example question: What is the level of fulfillment of the four criteria for the course Databases?
- Example answer: Course: Databases, Criterion 1 – 5, Criterion 2 – 4, Criterion 3 – 3, Criterion 4 – 4.

The evaluation was conducted on a real study program – Computer engineering and technology, First cycle of studies at Goce Delcev University in Stip, NMK. Generations of students enrolled in year 2017 and 2018 were targeted to answer the questionnaires: 23 out of 47 initially enrolled students in 2017, that finished their studies, and 38 out of 37 initially enrolled students in 2018 that had no delay in their study. In total 38 courses were subject of evaluation in total value of 220 ECTS (out of 240 ECTS total for the study program), which is 92% of the total credits' balance of the study program completion.

3 Results and discussion

The first questionnaire results, processed using AHP to derive the relative importance of the criteria, with the weight vector showed in Table 3.

Table 3: Relative importance of the criteria

Criteria	Priority vector / Criteria weights
Teaching activities in terms of planning, organization and final realization in relation to the needs of the students	0,12206
Practical work in terms of practical application of the knowledge and the course content / practical examples delivery through the course	0,39905
Application of new educational methodologies, tools and techniques (digital and other)	0,15940
The possibility to individually work with the teacher – mentoring, supporting and guiding the students	0,31949

With analysis of table 3 and the results, it is clear that according to the students, Criterion 2 – Practical work in terms of practical application of the knowledge and the course content / practical examples delivery through the course is most important, with criterion's weight = 0,39905. On the other hand, Criterion 1 – Teaching activities in terms of planning, organization and final realization in relation to the needs of the students is least important, with criterion's weight = 0,12206. It can be seen that both the relative importance indexes of Criterion 2 and Criterion 4 are pretty close, meaning that are complement to each other in the knowledge delivery methodologies and approaches that need to be taken into consideration during the courses. The inconsistency is $CI = 0,01026$, or 1,02%, meaning that the judgements regarding the importance of the criteria made by the students are more than enough consistent.

The results from the questionnaire 2 regarding to the courses' average criteria' fulfillment levels, as well as the

synthesis of the AHP model, producing the final report about the courses' quality regarding the four criteria is generated (Table 4).

Table 4: Model synthesis and final report

Course	Sem	CR1	CR2	CR3	CR4	Priority	Idealized value
Introduction in computer science	1	3,273	3,364	3,045	2,773	0.020620	0.696495
Computer elements	1	2,75	2,611	2,667	2,5	0.017232	0.582056
Mathematics 1	1	4,24	4,042	3,667	4,174	0.026816	0.905775
Programming, basics	1	4,2	4,083	3,625	4,167	0.026835	0.906407
Discrete mathematics	1	4,583	4,348	3,87	4,739	0.029311	0.990049
Linear algebra	1	3,842	3,556	3,222	3,333	0.022961	0.775573
Digital logic	2	3,696	3,636	3,409	3,682	0.023991	0.810342
Mathematics 2	2	4,292	4,174	3,864	4,273	0.027624	0.933071
OOP	2	4,52	4,417	3,917	4,792	0.029606	1
Algebraic structures	2	4,348	4,143	3,818	4,727	0.028501	0.962700
Informatics	2	4,1	3,722	3,778	4	0.025608	0.864979
Computer architecture	3	4	3,474	3,368	4,105	0.024660	0.832961
Software engineering	3	3,826	3,409	3,318	3,409	0.022823	0.770912
Data structures and algorithms	3	4,36	4,083	3,875	4,667	0.028286	0.955437
Probability and statistics	3	4,261	4,13	3,826	4,435	0.027787	0.938583
Graph theory	3	3,895	3,944	3,444	4,222	0.026147	0.883165
Databases	4	4,28	4,292	3,957	4,667	0.028859	0.974775
Visual programming	4	4,083	4,261	4,043	4	0.027298	0.922066
Computer networks	4	4,48	4,417	4,042	4,5	0.029088	0.982527
Operating systems	4	3,72	3,5	3,5	3,826	0.024053	0.812443
Graphics and visualization	5	3,727	3,857	3,905	3,667	0.025092	0.847535
Internet programming	5	4	4,13	3,917	3,708	0.026135	0.882761
Information theory	5	4,095	3,9	3,75	4,4	0.026892	0.908350
Advanced algorithms	5	3,8	3,789	3,368	4,316	0.025778	0.870718
System software	5	4,067	3,929	3,929	4,071	0.026437	0.892963
Digital signal processing	6	4,235	4,133	3,8	4,467	0.027815	0.939515
Microcomputer systems	6	4,1	3,947	3,611	4,158	0.026361	0.890390
Basics of operational research	6	4,095	3,75	3,7	4,2	0.026020	0.878876
Mobile application development	6	4,25	4,286	3,846	3,846	0.026966	0.910824
Artificial intelligence	7	4,389	4,294	3,941	4,471	0.028522	0.963398
E-commerce	7	4,412	4,235	4,063	4,563	0.028708	0.969668
Data management and storage	7	3,929	3,5	3,583	3,833	0.024324	0.821598
Geoinformatics	7	4,133	4,083	3,833	4,25	0.027177	0.917965
Security of computer systems	7	4,222	4,133	4,067	4,313	0.027760	0.937656
Applied software engineering in real environment	7	4,333	4,077	4,154	4,615	0.028432	0.960370

Distributed computer systems	8	4,067	4,067	3,615	3,786	0.025866	0.873695
Information systems	8	3,778	3,75	3,75	3,733	0.024827	0.838604
Machine learning	8	4,471	4,267	4,067	4,533	0.028780	0.972125

The course Discrete Mathematics has highest average in terms of Criterion 1: Planning and organization of teaching/ class. The course Object Oriented Programming has highest average in two criteria: Criterion 2: Encouraging practical work / application of knowledge within the courses' content and Criterion 4: Guiding, supporting and/or mentoring students (individual work with the student). Finally, the course Applied software engineering in real environment has highest average in terms of Criterion 3: Application of new educational technologies during the class activities.

The model synthesis / the final report points the course Object Oriented programming as relatively most efficient course towards achieving high levels of the four methodological criteria examined in this research, networking with their relative importance. On the other hand, course Computer Elements is noted as relatively least efficient course regarding the same conditions.

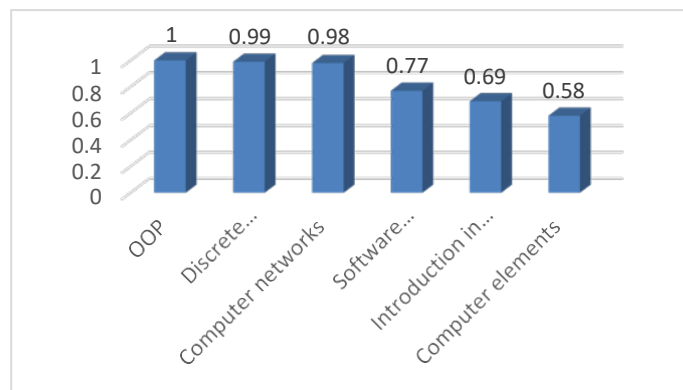


Figure 2. Three most and least efficient courses

4 Conclusion

Given the fact that students assessed Criterion 2 – Practical work in terms of practical application of the knowledge and the course content / practical examples delivery through the course, via AHP processing as most important, it can be concluded that the practical experience level they gain through the study program is crucial, towards their readiness to enter the labor market. Criterion 1 - Teaching activities in terms of planning, organization and final realization in relation to the needs of the students was assessed as least important, meaning that the structure of the practical realization of the course is something not crucial for the knowledge delivery from the perspective of the students. The final report points to the OOP as most efficient course and of course to the least efficient, that need to change the approach and the use of the methodologies regarding the four criteria towards their improvement and using the most efficient courses as reference.

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Analyses of the Impact of Gamification and Educational Games as Learning Strategy

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ABSTRACT

The focus of the research study is on analyses, assessment and evaluation of educational games as learning strategy for university students from several different higher education Institutions. In order to realize these analyses, several mobile educational games have been developed to be used for student learning process. The research study main research questions investigate gamification and the impact Mobile Educational Games affect students' success, motivation and willingness to learn, how much does it promote competition among students, in increasing students' attention and interest in the learning process; in improving student success; Research on the aspect of game adaptation by students and teachers. Depending on the findings, the study suggest recommendations and ways by which universities can improve on their curriculum so that students improve their knowledge and transfer of skills. Given the widespread use of digital technologies across their studies, competencies are needed to properly drive the digital change. This assessment of learning strategy using educational games is in the form of strategic digital skills, that from an educational viewpoint is an essential measurement in order to identify knowledge level and skills transferred to students during the learning process.

KEYWORDS

gamification, resources for learning, educational games, learning strategy

1 Introduction

Students find the traditional way of learning difficult and boring, so teachers need to find interactive tools to make their classroom more interesting and motivate students to learn more. Teachers today are using technology to engage students and encourage students to learn.

As science becomes increasingly data-driven (Ahmed et al 2017), there is a need to prepare the next generation of youth with the wide variety of skills and tools necessary for future scientific careers.

In this research study, addressed is the diverse gameplay capabilities present in youth, arguing that educators and designers can and should leverage these in increasing learning using educational science games (SRIVASTAVA et al 2018). Numerous studies like those of (Pechenkina et al 2017), (Cuevas et al 2017) and

(Keengwe, 2018) have shown increased interest in learning by students when mobile devices are integrated into learning environments. Over 80,000 applications are classified as educational and learning base (Keengwe, 2018). There are very few educational applications in the Albanian language, so this application

and educational game will make a small contribution to our education system. It will be an example for teachers and a new resource for students to learn. The mobile phone recently has a huge impact on our society. Prominent areas include social life, business, health and education. Adaptation and use of IT in the education system have a positive impact on teaching, learning and research. It will increase flexibility so that teachers and students have access to learning resources regardless of time and geographical barriers.

Gamification is receiving an increasing attention as a teaching methodology because the potential to motivate and to engage students in their learning process (Hirsh-Pasek et al, 2015). But gamification can also be challenging for teachers when deciding whether implementing gamification in their course or not.

We approach the main drivers and barriers to gamification implementation in the classroom from a teachers' perspective. The gamification of education has been defined as the use of game elements in a learning environment.

2 Purpose of the Study

The purpose of the research study is on analyses, assessment and evaluation of educational games as learning strategy for university students. In order to realize these analyses, several mobile educational games have been developed to be used for student learning process.

3 Research Methods

The research methodology used is triangulation technique which combines qualitative and quantitative methodology. As research method used quantitative method using questionnaire and focus groups. Hypothesis H1: The use of educational games have a positive impact on improving student knowledge and understanding.

As teachers play a key role in introducing pedagogical innovations in the classroom, especially technology-related innovations (Sarraf, 2013) teachers play a key role in adopting the use of gamification in their courses: Main research questions of the study are:

- RQ1: What is the Impact level of Mobile Educational Games on Increasing Students' Attention and Interest in the Learning Process?
- RQ2: What is the Impact of Mobile Educational Games on Improving Student Success?
- RQ3: What are the aspect of game adaptation by students and teachers?
- RQ4: How Mobile Educational Games affect students' motivation and willingness to learn?
- RQ5: Whether Mobile Educational Games promote competition among students?
- RQ6: Which are the main drivers' teachers serving in higher education institutions find to use gamification in their courses?
- RQ7: Which are the main barriers teachers in higher education institutions find in using gamification in their courses?

4 Findings and Results

The expected findings and arguments of the work provides sufficient information on the factors that influence the use of educational games and their impact on the learning process as well as the most impacting

factors assessed in the learning process and their alignment with instructional pedagogies.

Data was gathered through online structured interviews on a sample of teachers serving in higher education institutions. Snowball sampling was used for selection of participants (Goodman, 1961) in this study. A final sample of 46 interviews of Professors from 4 (four) different Institutions serving in higher education institutions was analyzed. Only interviews from Professors that reported having used gamification in their courses were analyzed.

1 - What is the Impact level of Mobile Educational Games on Increasing Students' Attention and Interest in the Learning Process? (Very Low - Very High)

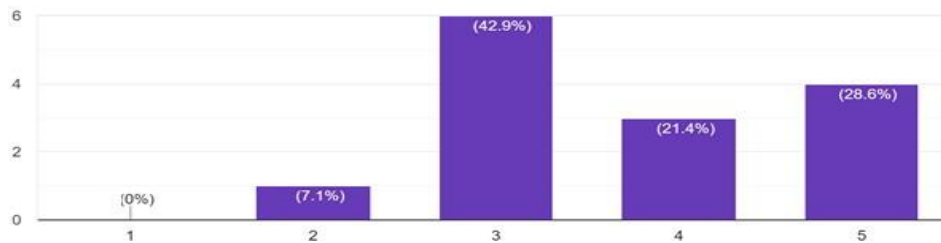


Figure 1. Impact on attention and interest

Regarding the evaluation on What is the Impact level of Mobile Educational Games on Increasing Students' Attention and Interest in the Learning Process? The results show that the higher level in total 50% consider as very relevant and out of them 28.6% that are teaching for several years using gamification and they consider it is very high, then 21.4% of them consider the impact as high, while 42.9% of the educators' participants in the study are neutral and finally 7.1% are of an opinion that the impact is not so relevant.

2- What is the Impact of Mobile Educational Games on Improving Student Success? (Very Low - Very High)

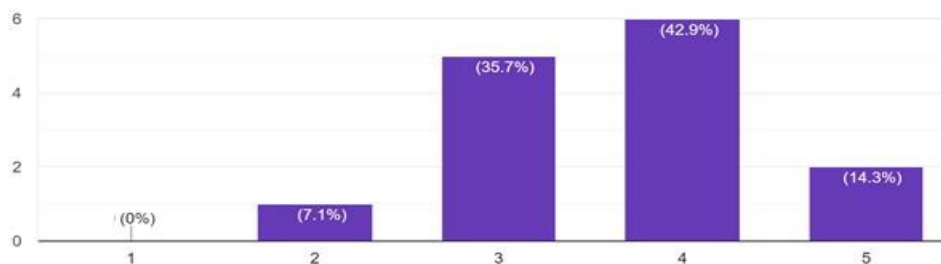


Figure 2. Improvement of Success

Regarding the evaluation on What is the Impact of Mobile Educational Games on Improving Student Success? The results show that the higher level in total 57.2% consider as very relevant and out of them 14.3% of Professors that are using gamification consider it is very high, then 42.9% of them consider the impact as high, while 35.7% of the Professors participants in the study are neutral and finally 7.1% are of an opinion that the impact is not so relevant.

3- What are the aspect of game adaptation by students and teachers? (1 Very Low - 5 Very High)

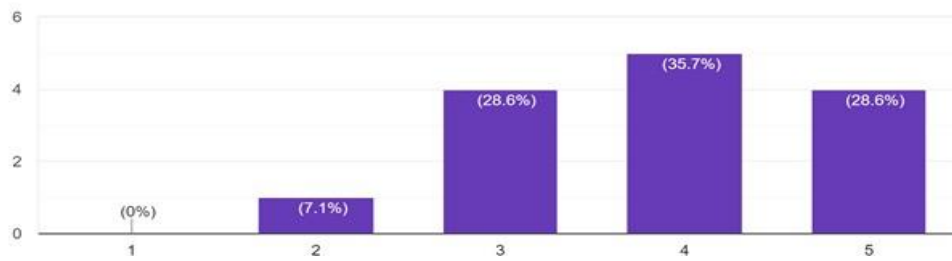


Figure 3. Game Adaption

Regarding the evaluation on What are the aspect of game adaptation by students and teachers? The results show that the higher level in total 64.3% consider as very relevant and out of them 28.6% of Professors that are using gamification consider it is very high, then 35.7% of them consider the impact as high, while 28.6% of the Professors participants in the study are neutral and finally 7.1% are of an opinion that the impact is not so relevant.

4 - How Mobile Educational Games affect students' motivation and willingness to learn?

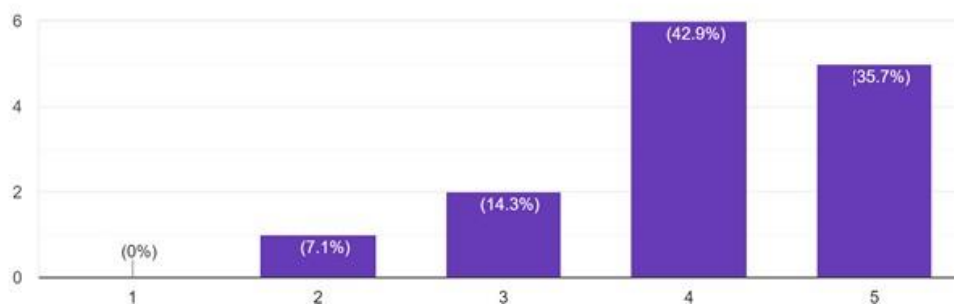


Figure 4. How Mobile Educational Games affect students' motivation and willingness to learn?

Regarding the evaluation on How Mobile Educational Games affect students' motivation and willingness to learn? The results show that the higher level in total 78.6% consider as very relevant and out of them 35.7% of Professors that are using gamification consider it is very high, then 42.9% of them consider the impact as high, while 14.3% of the Professors participants in the study are neutral and finally 7.1% are of an opinion that the impact is not so relevant.

5- Does Mobile Educational Games promote competition among students?

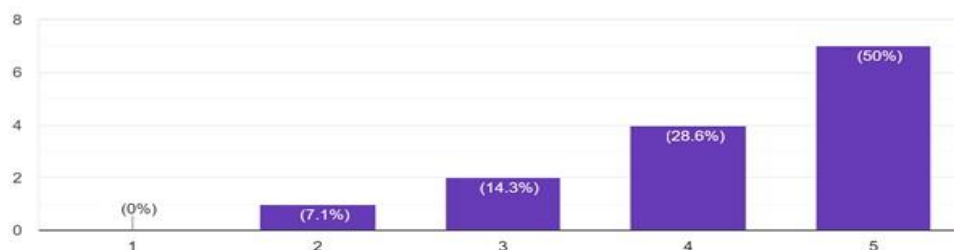


Figure 5. Whether Mobile Educational Games promote competition among students?

Regarding the evaluation on Whether Mobile Educational Games promote competition among students? The results show that the higher level in total 78.6% consider as very relevant and out of them 50% of Professors that are using gamification consider it is very high, then 28.6% of them consider the impact as high, while 14.3% of the Professors participants in the study are neutral and finally 7.1% are of an opinion that the impact is not so relevant.

6- Which are the main drivers' teachers serving in higher education institutions find to use gamification in their courses?

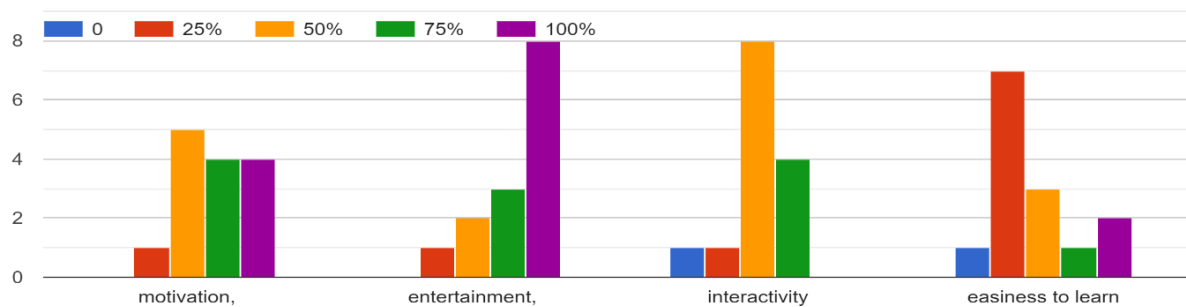


Figure 6. Main challenges for teachers in online education

Regarding the evaluation on the Main drivers for teachers in using gamification online education? The results show that the higher number of them 31,4% are considering student motivation to gamification followed by entertainment 33,1%, then followed by 19,8% interactivity of gamification and with 15,7% assessing easiness to learn. In general entertainment followed by motivation are considered as the most important drivers to use of gamification.

7 - Which are the main barriers teachers in higher education institutions find in using gamification in their courses?

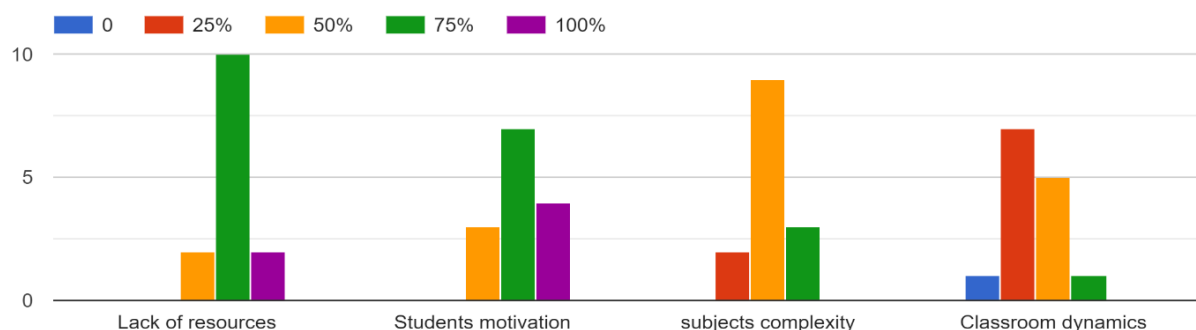


Figure 7. Which are the main barriers teachers in higher education institutions find in using gamification in their courses?

Regarding the evaluation on analyses Which are the main barriers teachers in higher education institutions find in using gamification in their courses? The results show that the higher number of them 34,4% find the lack of resources, followed by 26,2% Student motivation, then 29,7% subject complexity, 9,7% Classroom dynamics. In general barriers can be overcome by using webinars and more tools and other resources.

5 Conclusion and Recommendations

The research study provides a review of the published literature as well as an analyses of the emerging trends as well as the educational game and its impact on the education process. Conclusion is that competencies are

needed to properly drive the digital change and gamification has been showing as useful tool in achieving proper digital skills in the form of entertainment and increasing motivation for leaning at the same time.

Based on the literature review, as the most significant steps toward implementing and developing a successful educational game are the student's involvement and acceptance of the educational game, deciding which of the multiple features should be implemented, in order to assist specific groups and maintain their satisfaction. Also, identifying the optimal requirements and definitions is considered as a major step in order application to be powerful and reliable.

Nowadays students use mobile devices for entertainment purpose, so the main aim of the study is to use this interest and motivation and implement it into the learning process. The study tries to contribute practically by increasing the student motivation and interest of learning, and not wasting their time playing other games, but learning and playing at the same time. This research tries to make a sublime contribution in the field of mobile learning in the education process.

While there are difficulties for instructors and students getting to content on the web, there are likewise openings for intuition past the shows of how classes are commonly encouraged to make course content more available. These procedures can be valuable for learning, particularly in huge study halls. Be that as it may, they don't advance availability and don't really instruct students propensities outfitted towards drawing in with course content through thought, connection and conversation. The kind of evaluation being recommended here requires the collection of different kinds of evidence that can be used to determine whether faculty and departments are indeed promoting student learning.

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Testing Statistical Hypothesis on Learning Effectiveness: pre-and post-COVID 19

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Abstract

This paper raises the question: “Is there a statistically significant relationship between traditional teaching and online teaching related to learning effectiveness?” In this aspect, the purpose of this study is to compare students’ achievements in the same subject before and during the health crisis and to draw conclusions if there is any statistically significant relationship between the two methods of teaching and learning effectiveness. Furthermore, if any relationship was found, the aim is to assess how the opportunities provided by the Internet can develop and improve the terms of learning and teaching in the future.

The statistical analysis of data is done after more than a year of online teaching and learning which means that it is the right time to assess the opportunities and threats of Covid -19 in the sphere of education.

This paper investigates and compares the performance records of students in the subject of Monetary Policy in the academic year 2019-2020 and 2020-2021. At the Mediterranean University of Albania, the course is developed in the first semester of the second year in Bachelor Cycle in Economic Science. During the academic year 2019-2020, the teaching was done in a classic method and took place in the auditorium while in 2020-2021 the teaching was developed on the Google Classroom platform.

This paper analyzes through descriptive statistics and by testing hypothesis (Chi-Square) the impact of each method in learning effectiveness. The study does not include in analysis psychological and social factors that influence the way of teaching and learning. As a conclusion, we found a statistically significant relationship between the teaching method and students' grades.

Keywords: education, Covid-19, learning effectiveness, “new Normal”, testing hypothesis, statistics

1. Introduction

During the Covid-19 pandemic, education was one of the most researched areas with the purpose to investigate further the specific impact that health crisis had on the methods of teaching and learning on students' performance. Education all over the world faced an unexpected and unprecedented change in modes of teaching and learning. During the closure of educational institutions, several platforms, and educational resources have been launched to support and facilitate the process of study.

This paper is derived from the idea to critically compare students' achievements in the same subject in two different periods, before and during Covid-19. The goal is to assess the learning effectiveness of the online and traditional classes by comparing students' results and to analyze through statistical methods their performance in the subject of Monetary Policy in the academic year 2019/2020 and 2020/2021, at Mediterranean University of Albania. In this study students' academic performance is treated with high confidentiality.

The study conducted by Fadol et al. (2018) compared students' performance in three different scenarios of teaching and learning, namely physical class attendance, web-based and combined method. The results derived from the study showed higher performance of students in web-based and combined methods than in the traditional one. Another empirical study by Ni (2013) found no significant relationship between teaching-learning methods and students' performance. In the same way, studies conducted by Hannay and Newvine (2006) and Khorsandi et al. (2012) revealed that students achieved higher results in online teaching and learning environments because of the flexibility of balancing daily activities. Poirier and Feldman (2004) have also revealed that the online environment seems to be more effective. Online education has the potential to transform the academic environment by removing barriers in learning opportunities, increasing flexibility, decreasing stress, increasing the quality of participation, introducing interactive materials, integrate multimedia and other new opportunities that the online offers. etc. In other words, it expands educational opportunities and develops new pedagogical methods (Arkorful, V.; Abaidoo, N., 2014 and Healy, S.; Block, M.; Judge, J., 2014).

On the other hand, several studies (Figlio et al., 2010; Parsons-Pollard et al., 2008; Brown and Leidholm, 2002) reported higher results in traditional classes. An essential element of the traditional learning environment is the communicative and social interactions among students and their teachers. It motivates the students to ask questions and to share their opinions concerning a point of view.

From another point of view, we are still skeptical about how reliable are the results obtained during Covid -19 since it was quite difficult for professors to monitor, control, and evaluate appropriately the knowledge of each student. However, in a study including 156 students, Fortune, Spielman, and Pangelinan (2011) concluded that there was no statistically significant

difference in learning preferences between students attending online courses and students attending courses in person.

This paper is structured in the following sections: introduction and literature review, data description and statistical analysis, testing hypothesis, results, discussions, and conclusions.

2. Data description and statistical analysis

Due to the COVID-19 pandemic, the Mediterranean University of Albania switched immediately in March 2020 from learning - teaching in a classic method in the auditorium to online learning - teaching on Google Classroom (G-Suite) platform from home. The course of Monetary Policy is developed in the first semester (October-March) of the second year in Bachelor in Economic Science with profiles: Business Administration, Finance Banking and Accounting and Business - Law. The students of years 2019/2020 and 2020/2021 that followed this subject are the targeted populations. The collected data underwent a quantitative analysis conducted using descriptive statistics and inferential statistics (Chi-square: χ^2 test) facilitated by Microsoft Excel software. The subject is mandatory and the form of knowledge control is as it is presented in the table below.

Table 1: Forms of knowledge control, in (%)

Course attendance and active participation	10%
Completion of obligations (laboratory, course assignments)	20%
Midterm	30%
Final exam	40%
Total	100%

Source: Author

The data consist of the total results (final grade) which means include all the components mentioned above. The maximum of points a student can have is 100 points (100%) and the minimum of points to be considered “passed” is 41 points (41%). Less than 41 points mean that the student failed the exam and must repeat it.

The table below shows the grade distribution for two methods for the total participants in this study, 147 and 151 students. As far as we can observe the frequency of the minimum and maximum grades are higher in online classes but the gap is deeper for the lower grades. Moreover, the table of frequency distribution presents cumulative data that are often used to determine the number of observations that lie below or above a particular data set. For example, 85.7% of students’ learning in the traditional way have got a result not higher than 8. Regarding the students learning online, this percentage was 86.7%.

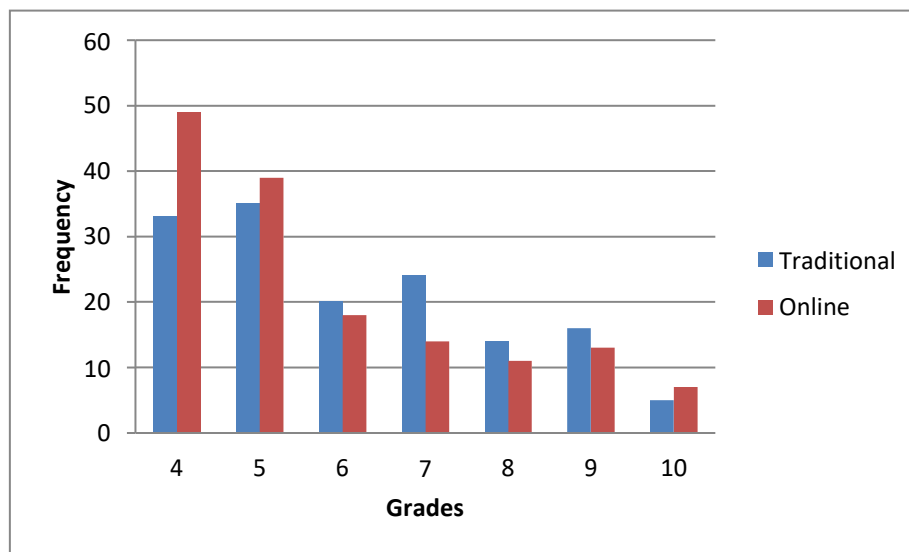
Table 2: Traditional and web-based classrooms grades comparisons

Grade Distribution	Subject: Monetary Policy			
	Traditional	Online	Traditional Cumulative distribution	Online Cumulative distribution
4	33	49	33	49
5	35	39	68	88
6	20	18	88	106
7	24	14	112	120
8	14	11	126	131
9	16	13	142	144
10	5	7	147	151
Total	147	151		

Source: Author calculations

Regarding the average grade, we can conclude that the mean in traditional classes is 6.13 and in online classes 5.77. We find the difference 0.36 significant. Referring to the data, more students passed successfully the subject while being in the auditorium 78% concerning 68% in the online classes. Surprisingly, students tend to perform better in traditional classes. There is a higher failure rate in online classes compared to traditional classes. This result concurred with findings from earlier studies that there are higher failure rates in online classes than in traditional teaching and learning (Ni, 2013; McLaren, 2004; Carr, 2000). The grades distribution is presented also in the chart below:

Figure 1. Grades achieved by students in both modes of teaching



Source: Author

Table 3 presents central tendency measure statistics like mean, median, mode, and variation measures like variance and standard deviation. The median is another way of judging the students' performance since the arithmetic mean can be skewed slightly by having several very high or very low scores. The median is a better measure of class performance than the mean

because represents the middle of the data set and is not sensitive to extreme values. In our case, in calculating the median, we have got a higher value for the traditional group which seems to have better performance even in this indicator. Mode refers to the value that is repeated mostly among our data. For the students learning in the auditorium, we can observe that the most common value is 5 and for online students, the highest frequency has grade 4. Variance and standard deviation are two other important indicators calculated to understand how far from the mean are the observed values referring to Freeman, J., Anderson, D., Sweeney, D., Williams, T., & Shoesmith, E. (2017). Table 3 concludes that the observed values tend to spread around the mean in both cases more or less having the same value with no significant differences.

Table 3: Descriptive Statistics for Traditional Students vs. Online Students

Descriptive Statistics	Traditional (2019-2020)	Online (2020-2021)
Mean	6.13	5.77
Median	6	5
Mode	5	4
Variance	3.3	3.4
Standard Deviation	1.81	1.84

Source: Author calculations

3. Chi-square χ^2 test

We want to answer the question if the grades of the students are completely independent of the way of teaching or that the way of teaching does not have an impact on students' grades? Until now we have derived the conclusion that the traditional way of teaching and learning gave better results for the students.

We used the Chi-Square Test, one of the most commonly used non-parametric test, in which the sampling distribution of the test statistic is a chi-square distribution when the null hypothesis is true. This test was firstly introduced by Karl Pearson in 1990 and the Greek Letter χ^2 is used to denote this test. There are two main kinds of chi-square test:

the test of independence, which asks a question of relationship such as: “Is there a relationship between students grades and way of teaching?”

the goodness-of-fit test, which asks something like “How well does a coin in my hand match a theoretically fair coin?”

This study proposes to test the following null hypothesis H_0 and alternative hypothesis H_a :

H_0 : There is no statistically significant relationship between the two methods of teaching with to learning effectiveness.

H_a : Online classes differ significantly from traditional classes to learning effectiveness.

In other words, the test is used to determine whether there is a significant difference between the expected frequencies and the observed frequencies in one or more categories. This is a test of independence where the students' grades are the dependent variable and the learning effectiveness the independent variable.

The value of χ^2 is calculated as:

$$\chi^2 = \sum (O_i - E_i)^2 / E_i \quad (1)$$

Where: O_i - Observed frequencies

E_i - Expected frequencies

4. Results

Before introducing the final results we followed these steps:

1. Chose a level of significance ($\alpha = 0.05$). It decides the rejection or acceptance of H_0 and derives the conclusion.
2. Found critical values (Table Chi Square)
3. Found test statistics

Regarding the third step we have to find the critical value in the Chi-Square table. Degrees of freedom $df = (Col-1)*(Row-1) = 6$, $\alpha = 95\%$ which corresponds to 12.592.

Table 4: The students' grades Chi-square test

Traditional			Online			Chi- Square Test for Traditional	Chi- Square Test for Online
Expected value (Ei)	Oi-Ei	(Oi-Ei) ²	Expected value (Ei)	Oi-Ei	(Oi-Ei) ²	(Oi-Ei) ² /Ei	(Oi-Ei) ² /Ei
40.45	-7.4	55.5	41.55	7.4	55	1.37	1.34
36.50	-1.5	2.3	37.50	1.5	2	0.06	0.06
18.74	1.3	1.6	19.26	-1.3	2	0.08	0.08
18.74	5.3	27.6	19.26	-5.3	28	1.47	1.43
12.33	1.7	2.8	12.67	-1.7	3	0.23	0.22
14.31	1.7	2.9	14.69	-1.7	3	0.20	0.20
2.47	2.5	6.4	3.55	3.5	12	2.60	3.36

Source: Author calculations

After making all the calculations as shown in Table 4, the value that we obtained was 12.71. We reject the null hypothesis “Ho: There is no statistically significant relationship between the two methods of teaching with respect to learning effectiveness” because the Chi-Square calculated value is higher than the critical value from the Chi-Square Distribution Table.

5. Discussion and conclusions

This study indicated a significant difference between modalities. The findings reveal that online classes are less effective compared to traditional ones. We recommend some future research to explore different elements of learning effectiveness that can influence both methods of teaching and learning. Today students are internet-oriented and one idea for the future is that the traditional classes could be improved by introducing virtual spaces by increasing the quality of participation. Traditional classes should integrate this avenue to accommodate students who face difficulties in class participation by designing supplementary web-based discussion modules through the blackboard discussion platform. This will offer such students opportunities to fully participate in the traditional classrooms and subsequently increase participation quality. Some subjects, like Macroeconomics, Statistics, Accounting etc, that have exercises to solve and graphs to draw found difficulties in the teaching process even using technical devices and visualization. In this case, the Internet can help only to introduce interactive materials and integrate multimedia in the process of teaching but cannot substitute the role of the whiteboard.

The study found a statistically significant relationship between the teaching method and students' grades when applying the Chi-Square test.

The study may need in the future further investigation on how to improve curriculum design, course development, learning environment and other factors that affect learning effectiveness.

The study may develop additional calculations to get other important conclusions for example by gender: male and female or by including in the model psychological and social factors.

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Strategy for Resolving Conflicts in Family Businesses

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Abstract

The transition process in the Republic of Macedonia caused a number of changes, acknowledging that the new market economy system inspired and intensified the process of establishing a family business (BF). Despite the fact that family businesses are one of the oldest forms of business, they have a very low survival rate. It has been proven that only 13% of FBs manage to be inherited in the third generation. (Ward: 1987) Indeed, family and business are so intertwined in BF that the potential for disagreement is greater than in formal firms others. (Lee & Rogoff, 1996). As a family firm grows in age and number of employees and family owners, as well as in wealth, conflict increases due to differences in goals and strategy. Usually, interpersonal conflict is caused by rivalry between family members (Keanon Alderson, 2015; 140). This process will necessarily be introduced in the business transition phase.

To measure how successful a BF is, business and family well-being scores are taken as criteria. A business that has positive outcomes for the business as well as for the family will be considered successful BF. ((Ritch L. Sorenson; 1999)

The purpose of this paper is to detect which are the strategies that should be used to give better results for the business but also for the family, ie what is the correlation between strategies and outcomes of business and family. A survey was conducted at 104 BF in Northern Macedonia to confirm the following hypotheses: Hypothesis 1: The use of the cooperation and compromise strategy will result in positive output in business and family results. Hypothesis 2: The use of the strategy for competition and avoidance during resolving conflicts in family business result in negative outcomes in business and family. 3 Hypothesis: Good communication in FB will result in positive output in business and family results. Hypothesis 4: Well formalization FB will result in positive output in business and family results Hypothesis 5: Strategic planning in FB will result in positive output in business and family results.

From the results of the field research, it was confirmed that cooperation and compromise like the management of conflict strategies in terms of family businesses are in direct correlation with business and family outcomes, while the strategy of competition and avoidance give an opposite effect.

Good communication has a positive correlation with business and family outcomes. So, the last hypothesis was confirmed that BF's who have a satisfactory level of communication have better business and family outcomes.

Keywords: *Communication, Conflict, Family Business, Conflict Resolution, Strategic Planning*

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1. Introduction

The analysis and definition of family businesses (FB) has recently emerged as a distinct area of expert interest. Although BF is one of the oldest and most widespread forms yet, there is no definition accepted for it. We can find different perspectives: Pros and cons of family businesses. Involving the family in the business creates some advantages, but also brings some weaknesses which cannot be ignored. The findings show that compared to other businesses, family businesses have a more complex set of issues to consider when managing conflict (Sorenson, R. L 1999: 1) This is why keeping a FB alive is probably the most difficult task to manage, because only 13% of family businesses succeed in transferring to the third generation (Ward, J. L 1984: 6). But, there are those who suggest that BF's image and reputation represent competitive advantages for BFs that are difficult to imitate by other companies (Craig, Dibrell and Davis 2008; Micelotta and Raynard 2011; Zellweger et al., 2012).

In our study we will define FB as an enterprise / company in which the core capital is owned and / or managed by two or more family members and has a clear tendency to be passed on to its descendants. future (Ademi Bedri; 2005; 23). Since there is a higher level of conflict in BF, an attempt will be made to investigate where and how conflicts occur. Conflict is inevitable on FB, but the right question is: Will we manage the conflict or will the conflict manage us?

Conflicts in BF, at the stage of business creation may not be obvious. At this stage, everyone is preoccupied with work, the results of success why not even profit. As a family firm increases in age and the number of family employees and owners, as well as in wealth, conflict increases due to differences in goals and strategy. Commonly, interpersonal conflict is caused by rivalry among family members (Keanon Alderson, 2015; 140). Conflicts in most cases occur when situations are unclear, unpredictable and when there is not enough mutual understanding between the two parties but also when the parties have opposite positions on it. Conflicts occur because there may be opportunities to change roles within the family and business, and the transfer of family emotions into family business relationships is often a result. Differences in mindset may result in a greater need for auditing the business plan and the business in general. Conflicts, when is not under control, are always and in most cases followed by stress, loss of control at work, decreased productivity and many other undesirable effects?

2 Purpose of Study

The paper will try to find strategies for better manage conflicts on FB. Following the practice with similar works of this kind in developed countries, the need arises for further research in this field, as well as research on other forms of business in order to create space for comparative analysis. This can create perceptions which refer to the impact that conflict management styles, communication and strategic planning have on business results in other forms of ownership structure in the organization. English language literature has been used for this paper because in the Republic of Northern Macedonia there is almost no literature analyzing conflicts in family businesses, so any contribution in this regard is very welcome.

So, the purpose of this paper is to detect which are the strategies that should be used to give better results for the business but also for the family, ie what is the correlation between strategies and outcomes of business and family. In addition to the strategies, the role of communication and formalization of relations will be analyzed in order to have a successful FB.

3 Review of Literature

In the past, many researchers have engaged in conflict research ranging from Blake & Mouton, 1964, Kilman (1974), Rahim (1983), Sorenson (2004), Thompson, 1990; Tjosvold, 1991; Wall & Callister, 1995) etc. There is therefore a consolidated theory for conflict resolution and the behavior of individuals and groups assigned to certain situations. The strategy for conflict resolution also has a big influence in the process of managing conflicts. According to the author Ritch L. Sorenson the strategies for managing conflicts are:

Competition is based on the concerns of competitor; it does not take account others' concerns. If the conflict involves the owner, it will be resolved to the owner's satisfaction and blocks others from achieving their goals, negative emotions such as anger stress, and distrust are generated. Competitors misunderstand one another, develop negative attitudes, and harm relationships.

Accommodation is based on height concern for others and low concern for self. It ascertains other's desires and resolves them while neglecting personal desires. Assuming that all parties accommodate in FB, conflicts may be resolved to everyone's satisfaction, but height accommodative owner may sacrifice business success to satisfy family or employees.

Collaboration attempts to fully satisfy the concerns of involved parties and requires time and effort on the part of participants. It requires good interpersonal skills including open communication, trust, and mutual support. In this way it will contribute to desirable family outcomes, including positive relationships and cohesion.

Compromise involves each party giving in to the other to find an acceptable solution. It is a „fixed-pie“ approach. Because something is given up, no one feels fully satisfied. In some way is similar to collaboration and should produce similar outcomes.

Avoidance is the failure to address conflicts, individuals may deny that conflicts exist or simply avoid directly discussing them. Although it prevents direct face-to-face confrontations, avoidance may result in escalated frustrations that spill over in other way. It is not relationship building strategy and should contribute neither to positive business nor positive family outcomes. (Ritch L. Sorenson; 1999)

Communication in BF is of particular importance and should be taken into consideration. FBs have specific communication values that renew their longevity and reliability, which can be a strategic advantage and influence buyer decisions and customer loyalty. (Dyer & Whetten, 2006). Empirically it will be analyzed what is the correlation between communication and FB success, measured through the output outcomes of family and business. Communication has no dilemma that it should be at the level even outside the business. The family business brand identity includes what the company wants to design and communicate with stakeholders (Sageder et al., 2016).

Formalization is the extent to which clear rules, regulations, policies, and procedures govern the activities of an organization. Formalizing employment relationships on FB should be considered as input-output in business for family members. This indicates the conditions for a family member to be able to participate in the business. The Reward System must be precisely defined and must be written on paper. There should be a job description for each job, without exception for family members. Every family member should have a certain role, especially those who are in the management of the company.

From the above model originates the thesis of this paper and it is open communication between employees in FB, strategic planning and formalization of relationships using the strategy of cooperation and compromise in resolving conflicts, and if these strategies are implemented then conflicts will be managed and FB members will become functional, so there are more opportunities to have positive results from business and family, as a condition for a successful business.

3. Methodology

Based on the theory explained earlier, but also on previous studies, the basis for research has been built. It is based on the main data for this study that have been collected from family firms operating in the Republic of Northern Macedonia which are declared as such. So only those companies are considered which in the question of whether they consider the business as a family have stated positively.

Research was conducted on 104, but only 100 met the BF requirement in Northern Macedonia to validate the following hypotheses: Hypothesis 1: The use of cooperation and compromise strategy will result in positive output in business and family results. Hypothesis 2: The use of strategy for competition and avoidance during resolving conflicts in family business result in negative outcomes in

business and family. Hypothesis 3: Good communication in FB will result in positive output in business and family results. Hypothesis 4: Well formalization FB will result in positive output in business and family results. Hypothesis 5: Strategic planning in FB will result in positive output in business and family results.

To prove these hypotheses, thesis research instruments have been developed to measure dependent variables: business and family outcomes, and independent variables such as conflict resolution strategies, communication, strategic planning, and relationship formalization. A standard instrument, the Thomas Kilmann Questionnaire, is used to identify conflict resolution strategies, and research instruments based on the scale of attitudes are designed to measure formalization and strategic planning. Structured interviews were used for qualitative analysis but only for 12 cases, only for a double check. The sample is random without specific predefined sample characteristics. The Welch and Brown-Forsythe tests are applied to validate the hypothesis along with Pearson correlation.

4 Results

The correlation matrix and descriptive statistics along with the composite reliability are presented in Table 1 below.

The first hypothesis use of the cooperation and compromise strategy will result in positive output in business and family results. positive and accepted value. The collaboration strategy is integrative, it motivates members for teamwork, creating synergy effect and sets organizational learning. On the other hand, the family loves to compromise on different situations.

Tab 1. Correlations Among Conflicts Strategies, Communication, Formalization, Strategic Planning, and Family-Business Outcomes

	Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10
1	Collaboration	4.174	0.658	1									
2	Accommodation	3.196	0.716	0.296	1								
3	Compromise	3.719	0.793	0.613	0.378	1							
4	Competition	3.257	0.815	0.056	0.247	0.074	1						
5	Avoidance	2.972	0.848	0.191	0.511	0.223	0.201	1					
6	Communication	3.553	0.521	0.426	0.349	0.317	0.109	0.361	1				
7	Formalization	3.503	0.854	0.161	0.043	0.451	0.109	-0.005	0.348	1			
8	Strategic Planning	3.833	0.659	0.409	0.131	0.317	-0.029	-0.005	0.251	0.615	1		
9	Family Outcomes	3.652	0.536	0.257***	0.135	0.252**	-0.001	0.071	0.399***	0.213**	0.174*	1	
10	Business Outcomes	3.699	0.634	0.371***	-0.033	0.200**	0.019	0.102	0.284***	0.301***	0.271***	0.299***	1

N=100

*Correlation is significant at the 0.1 level (2-tailed)

**Correlation is significant at the 0.05 level (2-tailed)

***Correlation is significant at the 0.01 level (2-tailed)

Hypothesis 2: The use of strategy for competition and avoidance during resolving conflicts in family business result in negative outcomes in business and family is not proven because the value of coefficient r is not sufficient. The results show that the correlation cannot be established with certainty. However, it can be said with certainty that the use of competition strategy and avoidance strategy do not give good results either in business or in the family. Competition is individual and subjective and directly affects outages in communication channels. Avoidance, on the other hand, involves only problems, so when they come to the surface, they will come back like a boomerang making them difficult to control. To prove this hypothesis, perhaps deeper research is needed, i.e. qualitative analysis, which remains a task for future researchers.

1 Hypothesis: Good communication in FB will result in positive output in business and family results. It is fully verified, taking into account the value of the coefficient $r = 0.399$ and $r = 0.284$ with the explanation that once again it is proved how much the success of family outcomes depends when you have good communication. Communication as a method of resolving conflicts is openly shown by research, it is highly related to the outcomes of family and business, because it contributes to increasing trust and respect among all participants in FB.

2 Hypothesis: Formalization of relations in FB will result in positive output in business and family results Confirmed in full, taking into account the value of the coefficient $r = 0.213$ and $r = 0.301$ with the explanation that once again it is proved that the family does not want formalization. does not like the rules, while the opposite applies to business relationships. From the random interview with members of FB, it is concluded that in our country the rate of formalization is low, especially in FB in the early stage of development.

3 Hypothesis: strategic planning in FB will result in positive output in business and family results is not fully confirmed. That is, strategic planning gives good business results, but does not give good family results. Field research showed that in the Republic of Macedonia there is no large scale of strategic planning, it is necessary to have external assistance.

5. Conclusions

The realistic goal of conflict management is not only to design conflict resolution, but also to change the organizational culture of the organization, in terms of conflict resolution. Effective communication between FB members can be a good foundation on which long term trust can be built. It is also necessary to formalize the relationship. This is often achieved with outside help. In fig. 1 shows how a model for overall conflict resolution is suggested. A new organizational culture will be created which will reflect the mission and vision of FB and will "guarantee" good business and family results. Using an adequate strategy at the moment of conflict resolution is one of the most important components in this process. The competition strategy will not satisfy the rest of the participants on FB and will produce negative effects because the owner will block the wishes and suggestions of others participants.

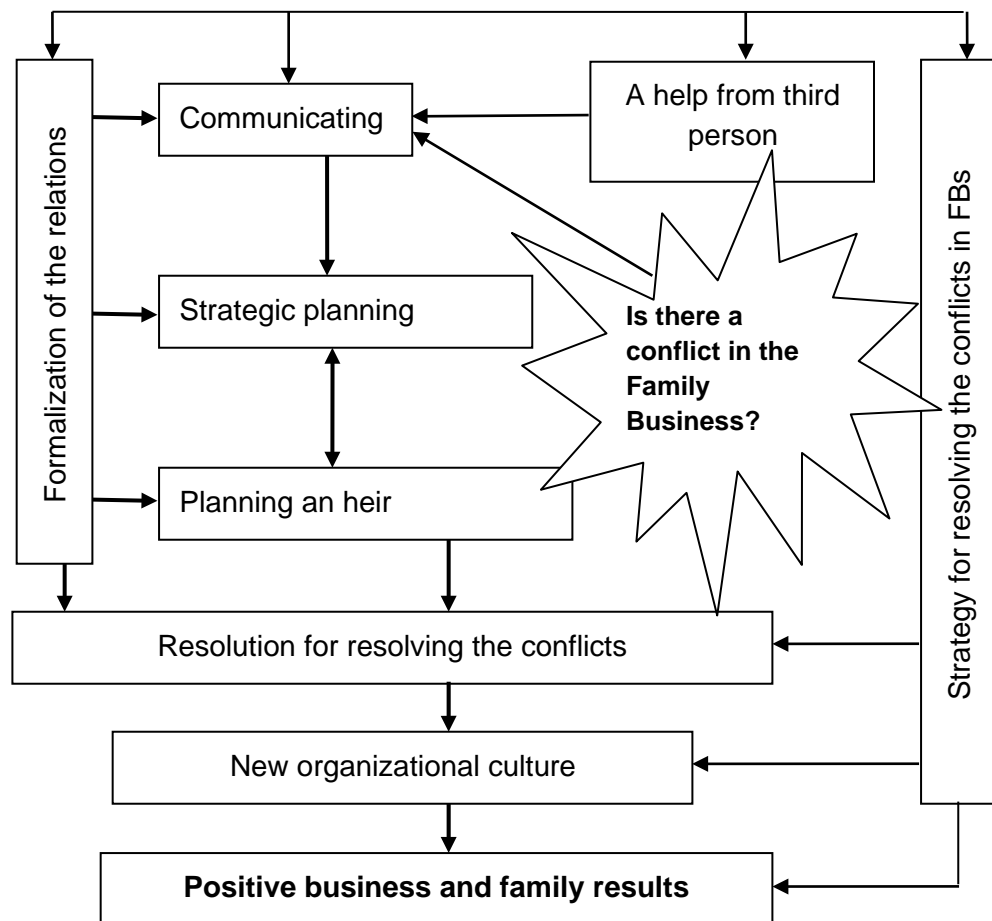


Fig. 1: Model for successful handling conflicts

Accommodation strategy suppresses personal desires and fulfills the desires of others; as a result good results are achieved. The results show the maintenance of cohesion of members in FB and the establishment of good relations between them. This type of strategy can maintain good relationships but only in the family not in business.

The cooperation strategy exists to the maximum to the satisfaction of all parties involved. This requires time and effort on both sides in order to reach a mutually acceptable solution. This requires good personal honor skills, open communication, trust and support. Because this strategy requires reciprocity in sharing information and knowledge among all participants, it will foster organizational learning and adaptation that will improve company performance and create a new organizational culture.

The compromise strategy is similar to the cooperation strategy. This strategy pushes all parties to find a mutual solution where both parties will have to give up something. It turns out that neither party is completely satisfied.

Compared to the cooperation strategy, where the integration component is promoted, this strategy is distributive. This strategy can contribute to good business / family results, but not as much as the collaboration strategy.

The avoidance strategy lacks opportunities for identifying conflicts. Individuals may deny that there is a conflict or simply avoid talking directly about the conflict. This means that there is a fear of a direct face-to-face confrontation, but later the conflict will escalate and move from business to home. This is a typical example of Spillover's theory. An example of this happens when family members avoid conflict at work but then transfer it home. But when both parties have a chance to "cool down" or the problem is not so acute, this strategy can be helpful. Excessive use of this strategy can leave unresolved issues, which can later further complicate the situation and thus reduce the chances of compromise between the parties to the conflict.

Communication contributes to increasing trust and respect, realizing reciprocal links in a form of dialogue through which destructive conflicts are reduced. The business leader, who makes day-to-day decisions, needs to learn how to communicate well in order to inspire family dialogue. One of the research lines that explores the effects of family involvement in the firm is family business brand management (Krappe et al., 2011; Beck, 2016). Family business brand management analyzes the differences between family business brand identity and perceptions and stakeholder perceptions of the family business brand (Beck, 2016). On the other hand, the family business brand reflects the associations and expectations that go along with involving a family in a firm (Krappe et al., 2011). Beck (2016) argues that to better understand brand management, it is necessary to acknowledge and explore how stakeholders value a brand and the decision-making involved in determining what should be included as part of a brand. However, conceptual and empirical research on family firm branding has focused primarily on understanding the perceptions that different stakeholders have about family firms (Beck, 2016).

Strategic FB planning is good conflict prevention. When the company is strategically planning, then the company is trying to use the change to make its profit. In FB the strategic planning process should exist in both the family and business dimension. Strategic planning reduces the integration of family needs into business in the sense of: What are the long-term and professional goals of family members? What is the mission of FB? What is the vision of the future? (Ward, J. L 1987) Will family members be active members in management or will they be passive members? What is the way to enter and exit the business?

When we consider these components, we can move on from past opportunities (growth, new markets, rule change) and threats (increased competition, shortage of raw materials and lower prices) for the business itself to establish and direct strategy.

A strategic business transfer plan is a must to ensure that the family business continues to thrive even after the change of generations.

Nancy suggests that the process should be in the following stages:

The beginning of the problem is a stage when children start learning about FB and this is also the moment when they start learning about themselves. It is not always wise to say that children should decide solely on their career. Parents should explain to them that the door to enter the business will always be open to them. This can also be a motivation for kids to get into business.

The selection of the candidate is the moment when heir of the company is elected. Identifying the potential heir is an important stage in conflict prevention. Usually, the owners choose the heirs according to their age, gender, qualification and ability.

Training the candidate is not an easy task because the founder not only can train his child for some business skills. This is why other people from the company or from outside can train the candidate. A very good opportunity to assess how well the skills are taught is when you let the candidate give his or her opinion on a specific situation.

Transition is a process that shows the moment when the founder retires. If we want the transition to be successful, we need to do the following:

- The transition must be done at a certain time;
- Must be complete;
- The entrepreneur must follow the plan. (Nancy Bowman-Upton; 2000)

Formalizing relationships to reduce conflicts is a process of establishing work rules in business. It is a key factor of integration, coordination as a starting point for control. When FBs have sufficient formalization of relationships, then employees will not focus on unnecessary mutual misunderstandings. They will compete with external competition this way conflicts will be reduced and greater commitment to work will be realized. This is a key value for business and authentic method of doing business and a set of rules about what is allowed and what is not. Formalization will be standard for all employees. The structure of the relationship between employees will be visible and clear, not mechanical.

4 Recommendations

Successful resolution of conflicts implies a specific change in the behavior of all parties involved in the conflict. Conflicts should be seen as everyday phenomena. FB members need to be "familiar" with the differences if they want to come up with a successful strategic plan. An important component when reacting to a conflict situation is to make a clear distinction between business and family interest and to look at both systems holistically, not just to look at the current situation. No more attention should be paid to just one of the systems. The skill of successful management lies in using the right strategy at a given moment. All the mentioned strategies should be considered as options, but implement what is most appropriate for the situation that will give the desired results at a given moment. Cooperation and compromise should always be a priority. All FBs that will successfully predict and resolve conflict will show positive family and business outcomes. These trauma-free businesses will go through the process of generational change and that means they will exist longer. In that case FBs will represent in symbiosis between family and business that will bring satisfaction to both systems.

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Occupational health and Safety and Infection Control among Dentists in the University Dental
Clinical Center and Private Dental Clinics in Skopje, North Macedonia

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ABSTRACT

Aim: assessment and comparison of knowledge, attitude, and practice (KAP) on dental infection control (IC) and occupational safety among dentists in private dental clinics and the University Dental Clinic Center, in Skopje, North Macedonia.

Methods: Data were collected cross-sectionally with a self-administered questionnaire consisting of 97 variables. The study population comprised all dentists/faculty who worked at the University Dental Clinic Centre “St. Pantelejmon” (UDCC) and a convenience sample of dentists who worked in private dental clinics (PDCs).

Results: The Questionnaire was completed by 188 subjects, 45.7% worked in UDCC and 54.3% in PDCs. More than 90% of all dentists were aware of the risk of transmission of bloodborne pathogens in dental settings and recognized the need for mandatory training on IC. Marely 20%

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attended continuing education on the subject, a higher percentage did not have written programs

for IC in their workplace, were not vaccinated against Hepatitis B virus, and did not feel

comfortable treating patients with infectious diseases (IDs). Around 40% answered correctly that

critical and semi-critical instruments must be sterilized and only around 20% always sterilized

handpieces between patients. Dentists in UDCC showed a significantly higher level of

knowledge about potential transmission of infections in dental clinics. Whereas, dentists in PDCs

wore more likely to use eyewear and face masks, and to refuse care for patients with IDs.

Conclusion: There is a great need to improve dental IC in North Macedonia. Development of national standards, continuing education and training on IC and safety for dentists is highly recommended.

Keywords: Infection control, dental clinics, dental school, knowledge, attitudes, practices, North Macedonia

INTRODUCTION

In recent years, Health Care Associated Infections (HAI's) in dental health care settings have drawn considerable professional and public attention (Kohn et al., 2003). Dental interventions are among the most common minor surgical interventions mostly conducted ambulatory (Whitener & Hamory, 2004). Patients and dental healthcare workers can be exposed to a number of upper respiratory and bloodborne pathogens through exposure to blood and saliva. Hence, the cross-transmission of infections in the dental office is a constant threat (Bartlett, 2004; Harrel & Molinari, 2004; Kohn et al., 2003).

Globally, the frequency of occupational exposure to bloodborne diseases (HBV, HCV, HIV) and the HIV/AIDS pandemic has led towards major advancements in prevention and control of dental infections mainly through published guidelines, education and research (Kohn et al., 2003;

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Kravitz, Bullock, & Cowpe, 2014). Many developed (Harte & Charlton, 2005; McCarthy, 2000; Van Wijk et al., 2012) and developing countries (Raghunath Puttaiah et al., 2009; Saquib et al., 2019; Sofola & Savage, 2003) have investigated compliance with infection control measures in dental health care settings (Volgenant & de Soet, 2018). Studies have suggested that compared to dentists in private clinics, dentists working in hospitals and dental schools may adhere more to infection control and occupational safety programs (Mandourh et al., 2017). Moreover, in outpatients facilities it may be difficult to obtain data about IC and safety status (Whitener & Hamory, 2004).

In North Macedonia, about 90% of primary and secondary dental health care is provided in private dental clinics (PDCs). These are small sized self-employed practices subsidized partially

by the government. On the other hand, the University Dental Clinic Centre “St. Pantelejmon” (UDCC) is the oldest and biggest public dental school in the country and offers primary, secondary and tertiary dental health care. The UDCC also engages in training of undergraduate dentists, dental interns and dental specialties. However, to the best of the researchers’ knowledge, to date, there are no published studies about IC and safety among dentists in North Macedonia. Moreover, studies that have compared KAP on IC safety between dentists in private clinics and dental schools elsewhere are scarce.

The aim of this study was to investigate the knowledge, attitudes, and practice (KAP) on IC and safety among dentists in private clinics in capital city of Skopje, North Macedonia and dentists in the Public University Dental Clinic Center. The specific aim was to compare KAP between dentists in private clinics and in Public University Dental Clinic Center.

METHODS AND MATERIALS

The study population of this cross-sectional study comprised dentists/faculty who worked at the Public University Dental Clinic Centre “St. Pantelejmon” (UDCC) ($n=86$) and a convenience sample of dentists who worked in private dental clinics (PDCs) in city of Skopje ($n=102$). The self-administered “*Questionnaire on Dental Infection Control and Occupational Safety*” with 97 variables were distributed and collected personally by this study author. The questionnaire was translated from English to Macedonian. The first part of the questionnaire contained general information about the participants including demographic characteristics, level of education, place of work, number of years in practice, and the second part contained an extended set of variables on IC and safety. The approximate time for the filling out the questionnaire was around 30 minutes. Participation was voluntary and confident. The Research and Ethics Committees of

the Faculty of Medicine “Ss. Cyril and Methodius University” and the Dean of Faculty of Dentistry gave permission for the present study. The study was carried out from January to March 2012. The modified version of this questionnaire was used in several other countries (Miller, Budnyak, Gurevich, Fabrikant, & Puttaiah, 2012; R Puttaiah, Shetty, Bedi, & Verma, 2010; Raghunath Puttaiah et al., 2009).

Statistical processing of the obtained data was analyzed using SPSS for Windows, version 13.0. Analyses included descriptive statistics for demographic variables, Chi – square tests, Mann-Whitney U test. The significance level was set at 0.05. The means and standard deviation were determined for quantitative variables.

RESULTS

A total of 220 questioners were distributed ($n=120$ in UDCC and $n=120$ in PDCs) and 188 were returned completed. The response rates among the surveyed dentists who worked in UDCC and in PDCs were 71.6% ($n=86$) and 85% ($n=102$), respectively. Overall 37% were general dentists and 63% were specialists. 64.7% and 35.3% of dentists in PDCs were general dentists and specialists, respectively, whereas, 95.4% and 4.7% of dentists at UDCC were specialists and general dentists, respectively. The mean age of all respondents was (40.6,SD=9.4), and the majority were female 115(61.2%). 61% of all respondents were in practice for less than 15 years, and 39% were in practice for more than 15 years. Around 43 % of all respondents reported exposure to percutaneous injuries in the last three months, 11.8% to 18.6% reported one exposure, and around 10% to 12.8 % reported two exposures. 73.5% to 75.6% of all respondents were exposed 1 to 100 times to splash/spatter of water over the last three months and most of

them (14% to 14.7%) were exposed 10 times to splash/spatter. Results on the KAP with work place differences are shown in Tables 1, 2 and 3.

The percent affirmative response on knowledge and perception of needs regarding IC and safety according to place of work (UDCC versus PDCs) are shown in Table 1. Table 2 shows percent affirmative response on knowledge and Attitudes regarding IC according to place of work (UDCC versus PDCs). Table 3 shows the percent affirmative response to practice measures being implemented in UDCCC and PDCs.

DISCUSSION

The aim of this study was to assess knowledge, attitude and practice of dental IC measures and safety in University Dental Clinic and private clinics of Skopje, North Macedonia. The first set of questions were related to knowledge and perception of needs regarding Infection Control in North Macedonia. It was found that among all the respondents only about 17% had recommendations / protocols for IC in their practice, and only 22% and 35% of participants at UDCC and UPCs, respectively, reported receiving safety training in dental school. Most dentists recognized the need for mandatory continuing education on dental IC and safety, but only around 20% reported attending IC and safety training, and 30% to 40 % were independently educated from books, magazines, or internet. The occupational risk created by lack of training in IC and safety was amplified by the high exposure rate among participants, lack of Post Exposure Protocol (PEP) in their workplace, and low immunization rate against Hepatitis B Virus. After occupational exposure to blood and other potentially infectious body fluids every health care worker should follow PEP and conduct the HIV test (Miller et al., 2012). In the current study, only a minority of all respondents stated that they have PEP in the workplace and only about half

reported that in case of exposure they would follow a prescribed PEP (Table 1) which is much lower than rates reported elsewhere (Miller et al., 2012). Moreover, only about 20% to 30% of respondents were tested for HIV sero-status. Possible reasons as to why dentists do not follow PEP may be explained by the fact that in North Macedonia there is no national infection controll program and HAIs survelliance system in place (Organization, 2020). Moreover, there are no regulations on reporting and recording injuries at work, as well as no national guidelines for dental IC and safety. In year 2003, the CDC published guidelines for dental Infection Control in USA, which proved very effective in increasing the use of protective measures among USA dentists safety (Kohn et al., 2003). Guidelines on dental IC and safety have been developed and published recently in the Russia Federation (Miller et al., 2012) and India (R Puttaiah et al., 2010).

Furthermore, large percentage of respondents were immunized against diseases for which there is a vaccine. However fewer dentists (17% and 29%) were immunized against HBV, which is in accordance to a study conducted in Romania (Duffy, Cleveland, Hutin, & Cardo, 2004) and lower compared to studies conducted in Lebanon (Sofola & Savage, 2003) and India (R Puttaiah et al., 2010). This situation could result in outbreaks of HIV, HBV, and corona-virus disease 2019 epidemics (Cuny & Collins, 2008; Hartshorne, 2010; Meng, Hua, & Bian, 2020), and therefore requires urgent development of infection control recommendations for dental professionals including mandatory seroprophylaxis for HBV for all DHCW, as well as mandatory continuing education on dental IC and safety (Kohn et al., 2003). Compulsory vaccination against HBV for the dental profession and the use of other standard precautions have proved very successful in drastic dropping of HBV cases in the U.S.A. (Kohn et al., 2003).

In the present study, it was found that 75 % of dentists in PDCs and only 21% dentists in UDCC have had preventive exam in the past year ($p<0.001$), a significant larger percentage of dentists at UDCC stated that they do not have sufficient number of set of instruments ($p<0.001$) and formal training on IC and safety ($p=0.04$) (Table 1). According to the North Macedonian legislation on Occupational health and safety, the employee is obligated to carry out annual preventive health examinations for employers carried out by an authorized health institution in the field of labor medicine. It is believed that the discrepancy with regards to the preventive exams between respondents at UDCC and UPCs may exists because public employers are not inspected by federal authorities as rigidly as are private practices. This finding is in accordance with another study and shows that safety and health standards in federal agencies almost universally are not held to as high an accountability level as are the private employers (Heath, 1982). Moreover, similar to these study findings, a study conducted in Romania showed that dentists in private clinics had better equipment than dentist in public health facilities and lower level of knowledge on IC and safety, suggesting that equipment itself without proper education may not be enough to practice safe dentistry (Duffy et al., 2004). On the other hand, a study in India showed that dentists who worked in private practice had better instruments and equipment, in addition to more knowledge on IC and safety compared to dentists who worked in dental schools (Shetty et al., 2011).

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Table 1. Percent affirmative response on knowledge and perception of needs regarding infection control – comparison by place of work (UDCC versus PDCs)

Total cases = 188(N) 100% University Clinic n=86(45.7%) Private Practice n=102(54%)			
Variables	University Clinic (%)	Private Clinics (%)	p-value ^a
Obtained a copy of N. Macedonian Dental Safety Recommendations	16.3	16.7	0.94
Read and understood N. Macedonian Dental Safety Recommendations	30.2	35.3	0.46
Trained adequately in Dental Safety to practice Safe Dentistry	52.3	52.9	0.93
No formal training in IC and safety	37.2	23.5	0.04
Trained in IC and Safety at didactic program at school	22.1	35.3	0.05
Attended CDE programs addressing UP recommendations	19.8	21.6	0.76
Self-trained using books/journals	32.6	40.2	0.28
Self-trained using internet	18.6	31.4	0.05
Dental Safety CDE should be mandatory for dentists in Macedonia	90.7	90.2	0.91
Do not have adequate sets of instruments	64	20.6	<0.001
Participants reporting occupational health measures			
Immunized against the following:			
HBV	17.4	29.4	0.06
Influenza	13.9	16.7	0.02
Polio	75.6	64.7	0.17
Diphtheria	52.3	5.8	0.3
Tetanus	72.1	67.7	0.51
Rubella	32.6	39.2	0.34
Measles	58.1	71.56	0.05
Rubeola	45.3	53.9	0.24
Mumps	60.5	67.7	0.31
Chicken Pox	47.7	64.7	0.02
Follow a prescribed protocol when exposed	56.9	48	0.22
Use sharps container to dispose sharps	83.7	89.2	0.27
Use of rubber dam regularly	8.1	9.8	0.69
Use of high volume evacuator regularly	61.6	83.3	0.001
Had a preventive exam within the past year from an	20.9	75.5	<0.001

Occupational Health Specialist			
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^a Chi - square test for independence; (UDCC) University Dental Clinic Center; (PDCs) Private Dental Clinics; (UP) Universal Precautions, (HBV) Hepatitis B Virus; (HCV) Hepatitis C Virus, (STD) Sexually Transmitted Diseases; (HIV); (CDE) Continuing Dental Education; (IC) Infection Control.

Questions regarding the knowledge on IC and safety (Table 2) showed that while the majority of all respondents understood that blood borne pathogens could be transmitted in dental office, the majority demonstrated a lack of understanding of “universal or standard precautions”; merely one third of all respondents felt that PPE were required only while anticipating splash/spatter; only 37% and 62% of respondents at PDCs and UDCC, respectively, thought that infectious disease could be transmitted through splash / spatter and 67% and 72 % at PDCs and UDCC respectively, acknowledged percutaneous route as a plausible route of infectious transmission. In addition, participants in the current study showed poor knowledge about the potential risk of biofilm in dental water systems to patients and employees.

Understanding the mode of infection transmission, sterilization of instruments, and maintenance of the dental water system is an important factor related to spread of infections (Kohn et al., 2003). Compared to dentist in PDCs, dentists at UDCC showed a significantly higher level of knowledge about the possibility of HBV and HIV transmission in dental health facilities ($p=0.005$), and the transmission of infections through splash /spatter ($p<0.001$). In addition to this, they recognized more often that microbes in dental water can be a health risk to patients and employees ($p=0.03$), and that dental water system can be a potential reservoir of pathogenic microorganisms ($p=0.017$). Splash and spatter counts for the second most common exposure

after percutaneous injuries (Manfredi, 2010) and eye conjunctiva has been recognized as a portal of entry for viral infections including HBV, influenza, and herpes simplex (Sofola & Savage, 2003; Volgenant & de Soet, 2018). These findings suggest stronger focus on formal and continuing IC education for all dentists.

Furthermore, responses to questions on attitude revealed that only a minority of all study participants felt comfortable in treating patients with blood-borne diseases. The majority scheduled treatment of ID patients on separate time or day, 5.8% and 16.7% of respondents in UDCC and PDCs, respectively, refused treatment of infectious patients, 14% and 33% at UDCC and PDCs, respectively, believed they have a right to refuse care for patients with infectious diseases. Compared to UDCC, dentists in PDCs were more likely to think that they had the right to refuse care for patients with infectious diseases ($p=0.01$), and had refused care for ID patients more often than UDCC dentists ($p=0.02$).

Refusing dental care to patients with blood borne infections is considered unethical. However, literature indicates that the stigma towards treating patients with infectious diseases is common among dentists in both developed and developing countries

(McCarthy, Koval, John, & MacDonald, 1999; Mulligan, Seirawan, Galligan, & Lemme, 2006; Park et al., 2011; Scully & Greenspan, 2006). It has been reported elsewhere that dentists use extra IC measures for patients with known HIV and HBV status due to a fear of personal safety or losing patients as a result of treating patients with ID (McCarthy, Koval, & MacDonald, 1999). These findings are worrying and suggest that dentists should be educated on the issues of stigmatization of infectious patients, in addition to consistent use of the same IC procedures for all patients (McCarthy, Koval, & MacDonald, 1999).

Practice of standard precautions of IC and safety showed that the majority of all respondents used gloves and face masks routinely, however, use of googles and face-shields was limited. Dentists in private clinics used more protective eyewear ($p=0.009$), face mask ($p=0.04$) and protective gowns ($p=0.03$) than dentists at UDCC. One reason for low compliance with wearing googles in the current study may be related to respondents not understanding the danger of spatter and splash as a possible rout of infection transmission. Googles are part of standard precautions and can protect during expected exposure (Dagher, Sfeir, Abdallah, & Majzoub, 2017; Ebrahimi, Ajami, & Rezaeian, 2012; R Puttaiah et al., 2010). In addition, the majority of all respondents reported that they would use extra IC measures while treating IDs patients, and that they would double-glove for persons with known status of Bloodeborne diseases and STDs. Ideally, it is expected that all patients be treated as potentially infectious with application of same infection control measures (Kohn et al., 2003).

Disinfection and sterilization of instruments are critical components of infection control. Based on the potential for disease transmission, instruments in dentistry are divided in critical, semicritical and noncritical; critical instruments need to be sterilized. Moreover, ultrasonic cleaning of instruments before sterilization is preferable to manual cleaning (Kohn et al., 2003). In the current study only around 40% of all respondents expressed understanding that the critical and semicritical instruments should be sterilized. Furthermore, most respondents demonstrated inadequate practices regarding the use of autoclavable handpieces, rubber dam, ultrasonic instrument cleaners, the sterilization of critical instruments such as diamond burs, use of autoclaves and bagged instruments for sterilization and storage. The majority of study participants manually cleaned their instruments, only around 20% sterilized handpieces between

patients, and the majority (80%) only cleaned up handpieces with surface disinfectants. This practice is inadequate, in order to kill the bacteria in the inner part, the handpieces need to be autoclaved (Volgenant & de Soet, 2018). Autoclaving allows for the fastest and most effective sterilization of critical and semicritical instruments (Kohn et al., 2003). However, only around half of all respondents reported using autoclaves. This could be due to high cost of handpieces, as well as the dentists' fear of causing damage by autoclaving.

In the present study, dentists in private clinics were more likely to sterilize critical instruments, to disinfect impressions and to monitor sterilizers monthly. Additionally, they were more likely to use dry heat for instruments sterilization, to only clean handpieces with surface disinfectants, wash instruments manually before sterilization and to store sterile instruments un-bagged. Studies conducted among dentists USA (Harte & Charlton, 2005) and dentists in private clinics in Makkah, Saudi Arabia (Mandourh et al., 2017) reported a regular use of autoclaves and autoclavable handpieces (Raghunath Puttaiah et al., 2009). However, consistent with the present study's findings, failure to proper sterilization due to the non-availability of instruments was reported in Lebanon, in some Asian Countries and Nigeria (Dagher et al., 2017; R Puttaiah et al., 2010; Raghunath Puttaiah et al., 2009; Sofola & Savage, 2003).

Rubber –dam and high volume suction are highly recommended for aerosol control and infection prevention (Kohn et al., 2003). However, in the present study only around 10% of all respondents used rubber – dam during restorative procedures. Compared to dentist in UDCC, dentists who worked in UDCs used significantly more often high volume evacuator ($p<0.001$).

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Infection Control is a team work and same preventive measures apply to all dental personnel.

This study assessed KAP among dentists. Therefore, results cannot be generalized for dental nurses.

Table 2. Percent affirmative response on knowledge and attitudes regarding infection control - comparison by place of work (UDCC versus PDCs)

Total cases = 188(N) 100% University Clinic n=86(45.7%) Private Practice n=102(54%)			
Variables	University Clinic (%)	Private Clinics (%)	p-value ^a
Infectious disease status is always known	4.7	8.8	0.26
Infection Control is a waste of time	5.8	2	0.16
HBV. HIV. HCV and STDs can be transmitted in a dental office	100	91.2	0.005
Potential for BBP transmission through splash/spatter	61.6	37.3	0.001
Potential for BBP transmission through percutaneous route	72.1	66.7	0.42
Full PPE is required only while anticipating splash/spatter	34.9	24.5	0.12
Universal / Standard Precautions means “not to use the same precautions for all patients ” but only for “patients with IDs”	26.7	20.6	0.32
Critical and semicritical instruments must be sterilized	39.5	41.18	0.82
Dental water systems contain biofilms (greater than 1 million cfu/mL)	43	26.5	0.02
Microbes in dental water are a health risk to patients and employees	60.5	44.1	0.03
Do not know proper procedures for safe removal of clinical waste	9.3	5.9	0.37
Attitudes			
Comfortable treating patients with bloodborne diseases	11.6	13.7	0.67
Schedule infectious disease patients on a separate time or day for general dental care	79.1	72.5	0.3
Have the right to refuse care for patients with IDs	14	33.3	0.01
Have refused care for patients with bloodborne diseases/STDs	5.8	16.7	0.02
HIV patients should be treated in all clinics and dental schools	69.8	55.9	0.05
Refused care for ID patients--other patients feel uncomfortable	8.1	22.5	0.01
Everyone should know their HIV sero-status	88.4	83.3	0.33
Respondent has been tested for HIV sero-status	27.9	18.6	0.13
Feel that Bloodborne Infectious Diseases/ STDs are on the rise in North Macedonia	86	92.2	0.18
Feel that Tuberculosis is on the rise in North Macedonia	77.9	65.7	0.02

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^a Chi - square test for independence; (UDCC) University Dental Clinic Center; (PDCs) Private Dental Clinics; (IDs) Patients with Infectious Diseases; (HBV) Hepatitis B Virus; (HCV) Hepatitis C Virus, (STD) Sexually Transmitted Diseases; (HIV); (IC) Infection Control.

Table 3. Percent affirmative response to practice measures being implemented - comparison by place of work (UDCC versus PDCs)

Total cases = 188(N) 100% University Clinic n=86(45.7%) Private Practice n=102(54%)			
Variables	University Clinic (%)	Private Clinics (%)	p-value ^a
Indiscriminate use of gloves	90	94	0.25
Indiscriminate use of protective eyewear	48	67	0.009
Indiscriminate use of face masks	78	89	0.04
Indiscriminate use of gown	61	76	0.03
Double glove for persons with a known bloodborne disease or STDs	77.9	65.7	0.07
Regularly use additional safety precautions while treating IDs patients	77.9	85.3	0.19
Respondents who treated patients of known HIV seropositive status	15.1	0	<0.001
Respondents who treated patients of known HBV seropositive status	31.4	14.7	0.01
Respondents who treated patients of known HCV seropositive status	25.7	4.9	<0.001
Respondents who see patients with TB (those who are not yet deemed non-infectious)	61.6	34.3	<0.001
Always sterilize all critical instruments between patients	79.1	88.2	0.09
Regularly sonicate all instruments before sterilization	18.6	26.5	0.2
Regularly hand wash instruments before sterilization	81.4	97.1	<0.001
Always sterilize high speed handpieces between patients	20.9	25.5	0.46
Only wipe-down high-speed handpieces between patients	61.6	80.4	0.004
Use autoclave to sterilize instruments	58.1	53.9	0.56
Use dry heat to sterilize instruments	69.8	82.4	0.04
Sterilize steel burs regularly	68.6	94.1	<0.001
Sterilize diamante burs regularly	50	83.3	<0.001
Monitor sterilizer with spores on a monthly bases	59.3	78.4	0.005
Store sterile instruments un-begged	53.5	63.7	0.183
Change surface barriers between patients	57	75.5	0.007
Practice disinfection of impressions	31.4	62.7	<0.001
I flush the waterline with tap water to control contamination	40	33	0.38
Use tap water as an irrigant /coolant while cutting teeth	73.3	73.5	0.97

Use bottle system as coolant/irrigant on my dental unit	23.5	27.5	0.051
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^a Chi - square test for independence; (UDCC) University Dental Clinic Center; (PDCs) Private Dental Clinics; (IDs) Patients with Infectious Diseases; (HBV) Hepatitis B Virus; (HCV) Hepatitis C Virus, (STD) Sexually Transmitted Diseases; (HIV); (IC) Infection Control.

CONCLUSIONS

Results of the present study showed that the KAP on IC and safety of all study respondents were below standard levels. Working at UDCC or PDCs did not affect significantly the overall level of KAP on IC. Most study participants demonstrated a lack of understanding of “universal or standard precautions”, had not received training on dental ID and safety and did not utilize the key elements of infection control. However, compared to dentist in PDCs, dentists at UDCC showed higher level of knowledge about the possibility of HBV and HIV transmission in dental clinics, the transmission of infections through splash /spatter, and potential risk from pathogenic microorganisms in the dental water system. Dentists who worked in PDCs, on the other hand, were more likely to think that they had the right to refuse and/or had refused care for ID patients, used significantly more personal protective equipment, and showed better practices with regards to sterilization and disinfection of instruments.

Future efforts should be directed towards:

- Development of national standards and protocols on dental IC and safety.
- Establishment of HAIs surveillance programs, mandatory trainings for dental practitioners.
- Education of DHCW to reduce stigma towards treatment of patients with infectious disease.

- Development of IC and occupational safety content into dental school curricula.
- Assessment of KAP on IC and safety among dental nurses.

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Assessment of Occupational Exposure Frequency to Chemicals and the Awareness among Automobile Technicians in Debar, North Macedonia

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Abstract:

The occupational environment and work procedures of automobile technicians are closely tied with chemicals, which often have fundamental roles in many procedures during daily activities. Automobile technicians can be exposed to different chemicals on a daily basis, which can lead to health deterioration and a lower quality of life with prolonged long-term exposure. The key challenge that health and safety now faces are to engage and influence the huge variety of businesses, particularly small businesses, and to help them manage health and safety more effectively. As a result of insufficient implementation of appropriate safety rules or management procedures, as well as lack of training for the employees to carry out these practices, the majority of exposure occurred especially on projects undertaken by small companies. The main objective of this paper is to assess the occupational exposure frequency to chemicals as well as the level of the awareness among the employees in order to build a more insightful database of issues related to Occupational Health and Safety.

Keywords—*automobile technician, chemicals, occupational exposure, assessment, health, awareness.*

1. Introduction

Occupational diseases and disorders are associated with a particular occupation or industry. Factors such as those physical, chemical, biological, mechanical and psychological, which are encountered daily, promote the occurrence of occupational diseases and disorders.^[1]



Figure 1: Factors that lead to occupational diseases and disorders

During the daily work that automobile technicians perform, they can be exposed to a wide variety of chemicals.^[2] The exposure to chemicals can be short term and / or long-term exposure, which on most occasions goes unnoticed by the technicians.^[3] Automobile technicians often complain or have symptoms of exposure to chemicals ^[4] but on most cases it's the lack of awareness to the dangers of their daily work activities that prevents them from connecting the dots and realizing that it's their daily work that is contributing to the deterioration of their health.^[5,6,7]

The issue is present mostly in small businesses (workshops) ^[8] where low awareness to the chemicals that the technicians are exposed to,^[9] contributes negatively to the overall occupational safety and health levels of the workshops.^{[10][11]} This is the first time that research of this nature and about this issue has been conducted on the region of Debar, North Macedonia.

2. Purpose of Study

The purpose of this study is to assess how frequently automobile technicians are exposed to chemicals and how aware are the technicians about their exposure to chemicals and the dangers they face on their daily work. It is important to obtain results that can show us if there is a correlation among employees of certain backgrounds and the frequency they are exposed to chemicals and their awareness levels. Obtaining results means that we can be more focused in targeting those certain groups and increasing the attention to the underlying issues that contribute to the low overall safety and health in the workshops.

3. Research Methods

This research was conducted on a certain number of workshops and technicians in the region of Debar, North Macedonia. The study population consisted of 59 automotive technicians.

Automotive technicians were divided into 3 groups: mechanics, electricians, and auto-body technicians (including painters). All subjects were males aged 10 to 40+ years old. Furthermore, the data was analyzed and divided in different subgroups of age, occupation, exposure and level of OSH awareness.

This study was conducted in a period of 30 days, during the months of July and August 2021, between employees and apprentices working as automotive technicians.

The research methods used in this study include questionnaires addressed to automotive technicians and field evaluations of the work performed in the workshop. The questionnaire was divided into four parts to collect information related to socio-demographic profile, job profile, chemical hazards encountered during work and awareness about the exposures to chemicals and the use of personal protective equipment.

These two methods provide us with data that can be used to gain knowledge on the level of awareness that technicians have regarding their exposure to chemicals and their awareness.

4. Findings and Results

Based on the data obtained from the questionnaires and interviews, 59 employees participated in the survey, from the answers obtained that are shown in Figure 1. from 59 automotive technicians, 32 of them or 54 % worked as mechanics, 15 of them or 26% worked as auto-body technicians (including painters) and 12 of them or 20% worked as electricians.

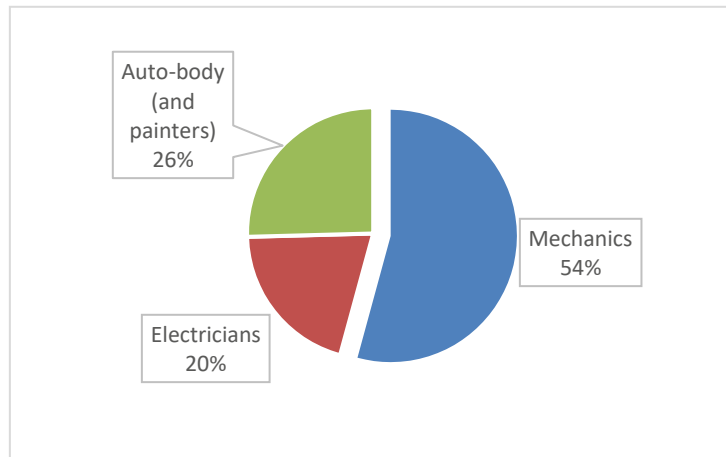


Figure 2 Technician types

Through this survey study, the socio-demographic characteristics of automobile technicians in the city of Debar were recorded, according to the data presented in Table 1. all 59 participants of the study were male.

The technicians interviewed ranged from the youngest, aged 10 to the oldest, aged 67, and the predominant age group was 20 to 24 years and the 40+ years, followed by the age group 25-29 (9%), and age group 35-39 years old made up 8% while with the lowest participation were the age group 30-34 years old with 5% and the smallest group with 2% was the age group 10-14 years old.

Although the literacy rate was 100%, 35.5% of the technicians had completed only primary education, while the majority (59.3%) belonged to the secondary education group, unfortunately only a minority (5%) of the technicians had tertiary education. Based on the answers received from automotive technicians show that the majority of them (83.0%) have received professional training through work experience and that 16.9% have not received the necessary professional training.

Evaluating the answers given, most of the automotive technicians (33.8%) had 5-9 years of work experience, followed by 23.7% those with 15-19 years of work experience, while with a lower percentage of 18.6% were those who had less than 4 years of work experience.

Most employees (80%) worked their profession full time, while only 20% employees worked part time. As for how many working hours per day 59.3% of respondents answered 6-11 hours per day while fewer hours (<4 - <6) per day, only 6 respondents.

Table 1 Characteristics of the respondents

Parameters	Frequency	Percentage %
Gender		
Male	59	100%
Female	0	0%
Age		
10-14 years	2	3.3%
15-19 years	5	8.4%
20-24 years	16	27.11%
25-29 years	9	15.2%
30-34 years	5	8.4%
35-39 years	8	13.5%
40+ years	14	23.7%
Education Level		
Primary	21	36%
Secondary	35	59%
Tertiary	3	5%
Working experience (years)		
<4	11	18.6%
5-9	20	33.8%
10-14	6	10.1%
15-19	14	23.7%
>20	8	13.5%
Hour variance per day		
<4	1	1.6%
<6	5	8.4%
5-9	3	5.0%
6-11	35	59.3%
12-18	15	25.4%
Work Pattern		
Full-time	47	80%
Part-time	12	20.3%
Training type		
Apprenticeship	49	83.0%
none	10	16.9%

Automotive technicians are constantly exposed to various chemicals in the workplace. Evaluating the answers in Figure 2. to the question of whether they had knowledge of any health risks from chemicals? We have significant proportions of cases that had no knowledge of any health risk from chemicals and petroleum products, where out of a total of 32 mechanics, 21 answered that they have no knowledge and 11 answered that they have knowledge about the risks. Out of 15 auto-body technicians, 9 of them said they had knowledge and 5 had no knowledge, and out of a total of 12 electricians who were part of the study 8 of them had no knowledge and that 4 had any knowledge of the health risks that come as a result of working with chemicals and petroleum products.

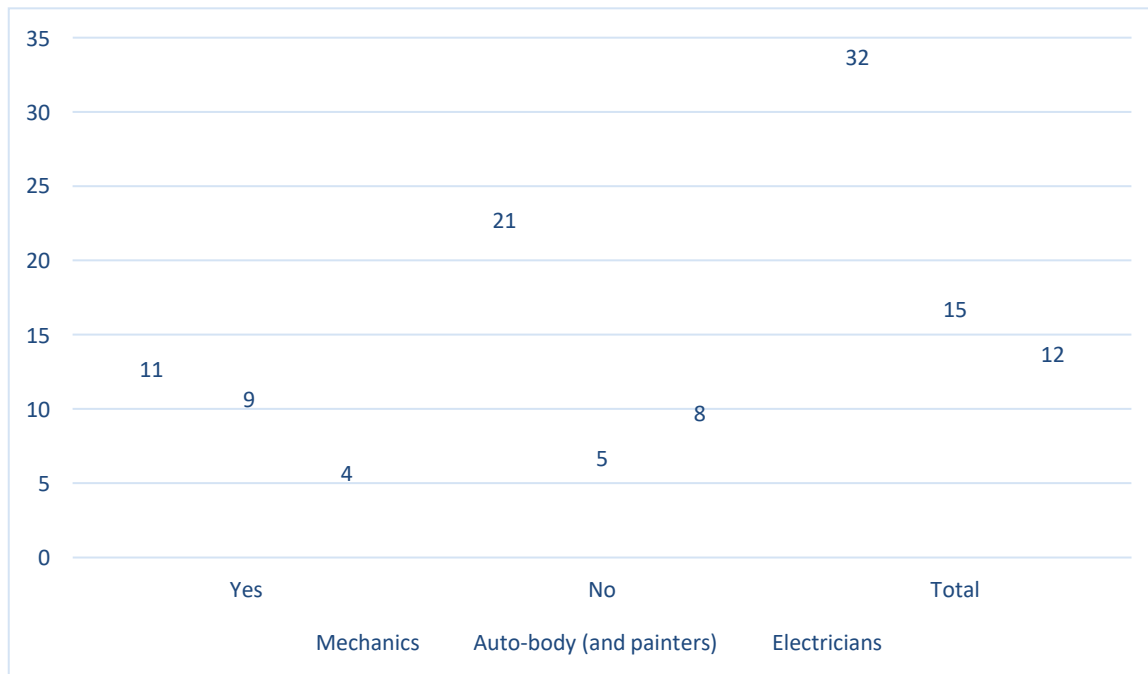


Figure 3 Knowledge on health risks associated with chemicals

The observation process was carried out on the basis that during the research period, each Technician was observed twice during the work. Observations show that auto-body technicians (including painters) are more exposed (100%) to chemicals during their work, but also have the highest level (50%) of awareness compared to other technicians. Further are the mechanics who have a lower exposure rate (51%) than auto-body technicians, but also the level of awareness was lower (15.6%). Compared to the two groups mentioned above electricians resulted in a lower exposure rate (37%), but unfortunately the level of awareness of exposure to chemicals was 0%.

Table 2 Technician's Awareness level and Exposure rate

Technician type	Observations	Awareness level	Exposure rate
Mechanics	64	15.6%	51%
Auto-body (including painters)	30	50%	100%
Electricians	24	0%	37%

According to the employee responses presented in Figure 3. Almost the majority (95%) of the employees did not have appropriate training for occupational safety and health and only 5% of the employees had received training for occupational safety and health. Of those who had OSH training, 2 belonged to the group of mechanics and 1 worker from the group of electricians.

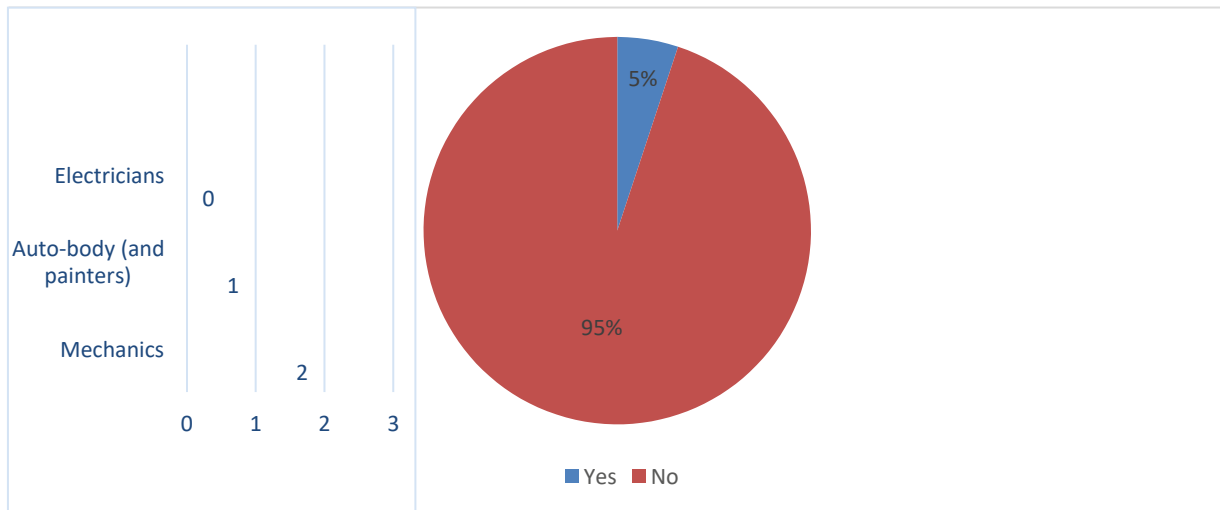


Figure 4 OSH training

The use of PPE among automotive technicians in the city of Debar is shown in Figure 4. where it shows that the use of PPE was also low. Protective clothing was most commonly used (40 employees) among automotive technicians followed by safety boots (35 employees) and gloves (25 employees) while equipment such as welding masks and hard hats were not used at all.

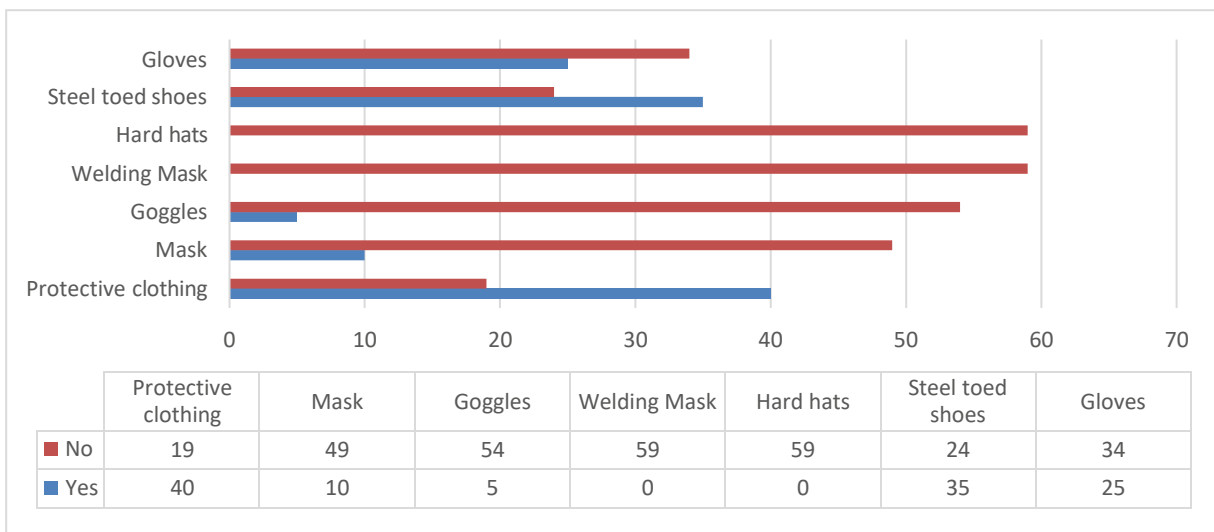


Figure 5 PPE Usage

The findings show that the level of educational status, having years of work experience and the type of training they received before starting work, were factors that did not play any role associating with the awareness of occupational hazards and use of personal protective equipment among automotive technicians. This may be as a result of the poor quality of the education and / or training that the participants have completed, also it is worth mentioning, the factor of mentality where most of the workers (85%) had an “I know it” or “it’s nothing” attitude towards the topic.

The study is the first of its kind, examining awareness of occupational hazards and the use of PPE among automotive technicians in the city of Debar.

5. Conclusion

It should be concluded that from this survey the frequency of exposure to chemicals has a high rate among automobile technicians, and the lack of adequate training shows that the technicians are not even aware of the exposures they had to the chemicals and the dangers they pose to their health and wellbeing.

The absence of female workers shows that this job is predominantly a masculine job. The majority of these technicians are either young (20-24 years old) or older than 40 years, which possibly is the result of the fact that these young technicians once were or still are apprentices of the 40+ year old category. It should be noted that even though the literacy rate is high, the situation has not changed much since most of the technicians are not educated and trained properly for the activities that they conduct. This can be an indicator of poor Occupational Safety and Health Policy implementation on a regional and maybe country wide level, which is not an isolated issue, but is one that connects all the dots, where the State Work Inspectorate may not be functioning properly and poor OSH advertising campaign, which has failed to develop an OSH culture between the employers and employees of this sector.

In conclusion, the major determinants of hazards among automobile technicians in Debar region, North Macedonia, are training type, educational level, years of experience, use of PPE, and the level of awareness to exposure to chemicals. Unfortunately, there was a generally low level of awareness but low usage of PPE among the technicians. Therefore, there is need for emphasis on Occupational Safety and Health programs, which promote workplace safety among automobile technicians. In addition, the development of OSH education programs, the intensification of OSH inspections, the increased use of PPE and different risk management techniques will go a long way into reducing occupational hazards and lowering the technician's exposure rates.

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Assessment of Occupational Safety and Health Awareness, Education and Training on the Woodworking Industry Workers in Debar, North Macedonia

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Abstract: The goal of this study was to find the link between workplace accidents and the lack of Occupational Safety and Health education and training on the woodworking industry workforce. The focus of research was to determine the level of the understanding of the importance of personal protective equipment in preventing injuries as well as the amount of information the employees have received about the hazards they can and will face on their workplace and the ways they can prevent or minimize the risks before and during their employment. The research aims to give a clearer insight about how much the alertness of workers needs to be adjusted along with the changes necessary in the degree and type of education needed.

Keywords— *assessment, awareness, health, education, training, woodworking.*

1. Introduction

The wood processing industry is one of the industries where workers are constantly exposed to various risks.^[1] According to reports from various safety and health studies in the woodworking industry, workers are exposed to varying degrees of risk which range from bacteria, viruses, chemicals and various physical injuries.^[2,3,4] There is a high risk of accident from the use of woodworking machinery.^[5,6] The facts show that injuries from these accidents are more serious than those caused by ordinary machinery^[7,8] and a large proportion of victims suffer from permanent disability.^[9,10] In the city of Debar there are a considerable number of workshops that deal with wood processing and so it is important to establish whether the employees have the necessary awareness as well as the appropriate education and training about preventing work related injuries and diseases. This is the first time that research of this nature and about this issue has been conducted on the region of Debar, North Macedonia.

2. Purpose of Study

The purpose of this study is to establish a connection between workplace accidents and the lack of OSH education and training on the woodworking industry workforce as well as create a clear picture of the conditions and awareness of the workers in the wood processing industries in the city of Debar in which case it will contribute to increase the awareness of employers and employees about the working conditions, risks and personal protective equipment.

3. Research Methods

The study methodology is based upon questionnaires and interviews with a certain number of employees working in the wood processing workshops in the city of Debar where they are constantly exposed to various risks. The data was analyzed and divided across different categories such as: age, occupation, formal education and work experience, in order to assess the awareness, education and training regarding OSH.

The research begins with observing the work process in the wood processing industry. In these facilities the identification of work, processes, and work materials is conducted, as well as a risk report is performed of the working conditions.

In this study all of the woodworking workshops are located in the city of Debar and the surrounding area in a period of time from May to June 2021. The study population was all workers participating in the processing as well as their students (apprentices). From this study was repeated each worker who at the time of the study had a life-threatening illness.

The returned questionnaires were checked for errors, cleaned, manually verified, and analyzed; descriptive statistics were created.

4. Findings and Results

The purpose of the research was to understand the level of education and training of workers in the wood processing industry as well as the assessment of OSH awareness.

Based on the data obtained from the questionnaires and interviews, the survey included 63 workers aged 14 years to 40+ years old, with a literacy rate of 100%. Most workers worked full time and were trained as apprentices. None of the workers had ever received training in Occupational Safety and Health. Their answers were used in this study to understand the level of education and training of workers in the wood processing industry in the city of Debar.

Workers' responses were sought to easily understand and interpret the results. The results in this study are presented in tables, graphs which are based on the objectives of the study.

All respondents belong to the wood processing industry. Their age distribution from the findings presented in Table 1. shows that the workforce in the wood processing industries is relatively young. This is based on the facts where the majority of respondents (25.3%) belonged to the age of 30-34 years and (22.2%) belonged to the age of 40+ followed by (15.8%) belonged to the age of 35-39 years and (14.2%) aged 25-29 years, while with a lower percentage of age belonged to the age group 20-24 years with (9.5%), 15-19 years with (9.5%) and with (3.17%) the age group 10-14 years old.

Table 1. Age Category of the Respondents

Age Categories	Frequency	Percent (%)
10-14	2	3.17
15-19	6	9.5
20-24	6	9.5
25-29	9	14.2
30-34	16	25.3
35-39	10	15.8
40+	14	22.2
Total	63	100

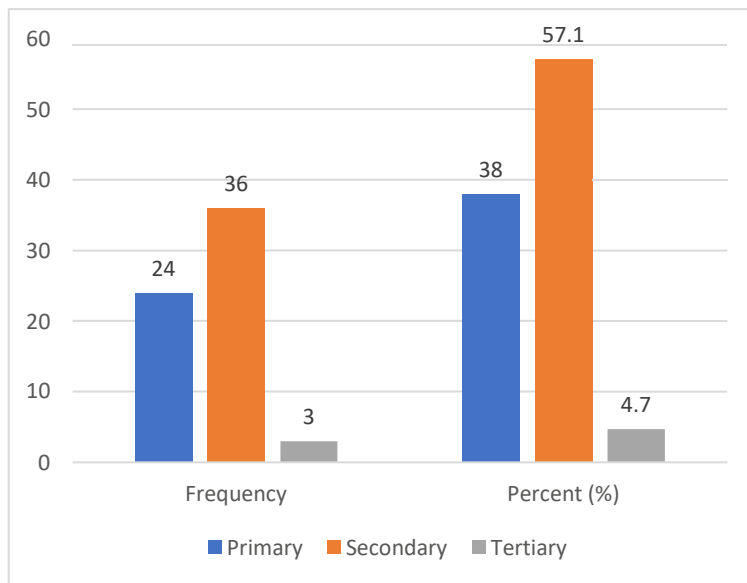


Figure 1. Education level

The research aims to determine the educational level of the respondents. The results in Figure 2. show that the majority (57.1%) of the respondents had completed secondary education, then with (38%) of the respondents had completed primary education and a small number (4.7%) of the respondents had completed tertiary education.

Table 2. Working Experience

No. of Years	Frequency	Percent (%)
<4 years	14	22.2
5-9 years	20	31.7
10-14years	7	11.1
15-19 years	15	23.8
>20years	7	11.1
Total	63	100

Based on the responses of the respondents in Table 2. the results are presented, which show that 31.7% have work experience from 5-9 years, followed by those with 15-19 years of work experience with 23.8%, and 22.2% of participants with less than 4 years of work experience, and with a lower percentage of 11.1% are those with 10-14 years and those with more than 20 years of work experience.

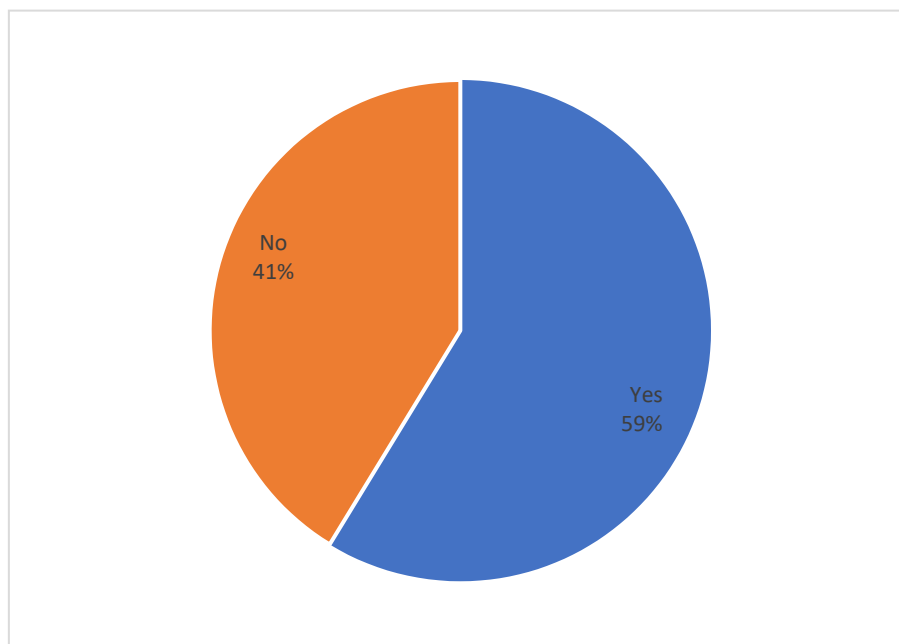
Table 3. Training type

Training type	Frequency	Percent (%)
Apprenticeship	53	84.1
None	10	15.8
Total	63	100

Respondents were asked about training in this industry were based on the answers given in Table 3. the employees show that the majority of them (84.1%) participating in the study have been trained or have learned the job in the workplace through work experience as a student in that workplace, and a proportion of employees (15.8%) had no training whatsoever.

Understanding the individual characteristics of workers in the woodworking industry, such as age, gender, level of education and work experience help to place the study in context. Assessment of these characteristics was key to this study as they are factors that may influence workers' decision whether or not to use personal protective equipment while performing their activities.

The study also sought to determine whether respondents were aware of any health risks posed to them in the workplace. The findings were almost more than half of all workers, 37 (58.7%) had knowledge of any health risks associated with wood working, while 26 (41.2%) had no knowledge.

**Figure 2. Are you aware of any health hazards associated with woodworking?**

By reading the assessment if any OSH training has been conducted and if they are aware of the risks in the workplace? The result in Figure 3. shows that a high percentage of employees (83%) had not completed OSH training and were unaware of the risks associated with the workplace while 17% had OSH training.

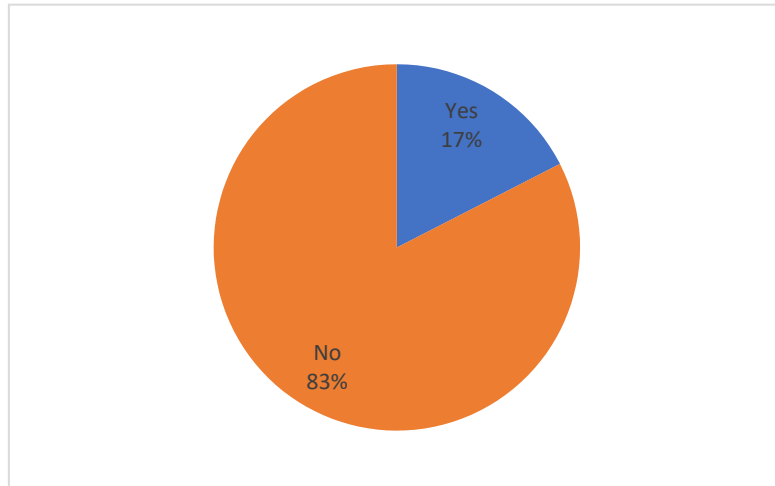


Figure 3. OSH Knowledge and Training

The findings showed that none of the workers had all the necessary personal protective equipment needed to protect them from occupational hazards to which they may be exposed while performing various woodworking activities.

The results presented in Table 4. showed that the majority of workers (74.6%) did not use PPE while the rest (25.3) use PPE.

Do you use PPE?	Frequency	Percent (%)
Yes	16	25.3
No	47	74.6
total	63	100

Table 4. Do you use PPE?

The reason for not having PPE was either personal or industry level. For example, one of the main reasons for not having the necessary PPEs during tasks was discomfort. The discomfort experienced while using PPE (as some workers involved in wood processing stated that it was difficult to perform certain processes with gloves) made the workers to not use them or use them in a way that is irregular.

5. Conclusions and Recommendations

Workers in the wood processing industry in Debar face illnesses and accidents that come as a result of workplaces, as well as the lack of occupational safety and health programs. They need to have accurate knowledge and proper training on safety and health and different levels of exposure must be measured and monitored. Managers and supervisors need to be continuously trained in risk assessment to identify risks. This will help them to be able to take precautionary measures to avoid or minimize the risks associated with the workplace and reduce the number of accidents.

Risk identification, risk assessment and risk control are ongoing processes that must be followed by wood processing industries.

In conclusion, the lack of female workers shows that this job is predominantly a masculine one. The main determinants of hazards at work that are among the woodworking workers in the region of Debar, Northern Macedonia, are the type of training, educational level, years of training, PPE usage and the level of awareness of exposure to chemicals. Unfortunately, there was a low level of awareness and a low usage of PPE among the workers.

The Labor Inspectorate needs to increase its capacity. In one, to increase the number of inspectors employed in the Debar region, as well as to provide guidance for professional training on occupational safety and health, and raise awareness of the workplace hazards that the workers face daily.

To summarize, we can say that the OSH system in our region, according to the poor performance is not functioning properly and there is a great need to develop the OSH system in the region, which includes intensification of inspections, OSH education and training, and creating a safety culture / mentality among the workers from the woodworking industry in the region.

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