



PROSPERITAS VESTRA FINIS NOSTRA!

MEDICAL UNIVERSITY

" Prof. Dr. Paraskev Stoyanov" - Varna

Sliven Branch

Department of Health Care

Pavlina Penkova Teneva

**THE PRACTICAL TRAINING OF MEDICAL LABORATORY
ASSISTANTS FOR THE FORMATION OF PROFESSIONAL
SKILLS AND COMPETENCES**

A B S T R A C T

on

Dissertation work for awarding the educational and scientific degree

"Doctor"

Professional field: 7.4 Public Health

Research Major: Health Care Management

Supervisor

Associate Professor Emilia Georgieva, PhD

Sliven, 2022

The dissertation contains 122 pages, including 17 tables, 28 figures and 5 appendices. 158 literary sources are cited, of which 70 are in Cyrillic and 88 are in Latin. The dissertation work was discussed and proposed for defense to the Departmental Council of the Department of Health Care at the Sliven Branch of the University of Varna on December 14, 2022.

Scientific jury:

1. Prof. Elena Grozeva Zheleva, PhD - reviewer
2. Prof. Galina Stamova Chaneva, PhD - reviewer
3. Assoc. Prof. Silvia Ivanova Filkova, PhD
4. Assoc. Prof. Maria Ivanova Dimitrova, MD
5. Assoc. Prof. Kristina Petrova Zaharieva, PhD

The public defense of the dissertation work will take place on 28.02.2022 at in the auditorium of the Sliven Branch at the Medical University - Varna during an open meeting of the Scientific Jury.

The defense materials are available in the Scientific Department of the MU - Varna and are published on the website of the MU - Varna.

Note: In the abstract, the numbers of the figures and tables do not correspond to their numbers in the dissertation work.

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I INTRODUCTION

Clinical laboratory tests form the scientific basis on which the medical diagnosis and treatment of patients is established . The medical laboratory assistant profession has undergone significant changes in recent decades , and both scientific and technological advances will lead to further evolution. Therefore, adaptability to a rapidly evolving environment and willingness to continuously update knowledge as well as skills are the most important requirements facing laboratory assistants.

The preparation of students must be in line with European and national standards, the latest achievements in science and information technology, as well as with the needs of business. Advances in technological development pose the question of the competence of the medical laboratory assistant in modern healthcare.

An essential factor for the formation of professional competences in the training of medical laboratory assistants is the practical training, which constitutes a little more than half of the total horary hours in the curriculum of the specialty. The improvement of the professional qualities and competencies of the students takes place in a real working environment in the bases for clinical practice. The awareness that medical laboratory assistants are active participants in the process of diagnostic and treatment activities motivates students to develop independence and creative thinking in modern conditions. Forms and builds a new professional model of the health care specialist to be competitive on the national and international market. The elements in practical training are related to the knowledge of the theoretical foundations of basic clinical disciplines, as well as automation and modernization in laboratory research. Application of new approaches in performing laboratory

analyzes and their interpretation in the light of pathological changes occurring in a number of diseases.

Training in the "Medical Laboratory Assistant" specialty in Bulgaria is regulated by the United State Requirements for acquiring higher education in the "Health Care" professional field of the "Professional Bachelor" educational qualification.

The training of medical laboratory assistants and the acquisition of professional competences in Bulgaria has not been the subject of special studies so far.

II METHODOLOGY AND RESEARCH METHODS

1. Purpose, tasks, working hypotheses

1.1 Purpose:

To study the formed professional skills and competencies of students a medical laboratory assistant with a view to optimizing their practical training.

1.2 Tasks:

To achieve this goal, we set ourselves the following **tasks**:

- 2.1.2 To study and analyze the literature and legislation on the researched problem.
- 2.1.3 To conduct a study to establish the status and trends in the training of medical laboratory assistants.
- 2.1.4 To investigate the opinion of working medical laboratory assistants regarding the level of practical training and professional skills and competencies of students.
- 2.1.5 To develop a theoretical model for optimal organization and implementation of the practical training of medical laboratory assistants.

1.3 Working hypotheses.

In the process of the work, the following working hypotheses were built:

- 1.3.1 It is assumed that the formed professional skills and competencies of medical laboratory assistant students meet the modern requirements of laboratory practice for successful professional realization.
- 1.3.2 It is assumed that there is a need for additional knowledge directed at the errors made in the three stages of the laboratory process.
- 1.3.3 The need to use innovative methods and technologies in the practical training of medical laboratory assistants is allowed, as a condition and factor for the formation of professional competencies of future specialists.

2. Organization, time and place of the dissertation study

2.1 The subject of the study is the process and conditions under which the practical training in the Medical College forms professional skills and competencies in the future medical laboratory assistants, necessary for modern laboratory activity.

2.2 Object of the study:

- *Students* - studying in the specialty - "medical laboratory assistant";
- *Medical laboratory assistants* practicing the profession
- *Experts*

2.3 The scope of the survey is 184 respondents, divided into three groups:

First group - students from the "Medical Laboratory Assistant" specialty (61.96%, $n=114$) in MK Stara Zagora ($n =63$) and MK Varna ($n =51$) ;

Second group - medical laboratory technicians practicing the profession in the cities of Stara Zagora, Sliven, Yambol, Haskovo and Kardjali (26.63%, $n=49$) ;

Third group - laboratory doctors with the specialty "Clinical Laboratory" and senior laboratory assistants in the medical-diagnostic laboratory of Stara Zagora, Sliven, Yambol, Haskovo and Kardjali (11.41%, $n=21$) .

2.5. Research bodies

In its main part, the research was carried out personally by the doctoral student in order to achieve greater accuracy. The study was conducted in several stages, with the tools, place and period of implementation determined (Table 1).

Table 1 . Stages of the study

stages	Activity	Toolkit	Location	Time
1.	Research the relevance of the problem. Formulation of a topic, determination of the goal, tasks, object and subject of the study, development of hypotheses Toolkit development. Preparation of the literature review	Literary sources on the subject, articles, study documentation, publications (including international ones), normative documents	Stara Zagora	June 2020 December 2021
2.	After permission from KENY of MU-Varna, conducting research. A study was conducted with female students, practicing medical laboratory assistants and experts (Clinical laboratory doctors and senior laboratory technicians).	An informed consent Survey card #1 for students; Survey card #2 for practicing medical laboratory assistants Questionnaire #3 for experts	MK-Stara Zagora MK - Varna Stara Zagora, Haskovo, Sliven, Kardjali, Yambol	m. November - December 2021 November 2021 February 2022
3.	Processing, analysis and description of the received data	SPSS - SPSS for Windows 13.0.	Stara Zagora	m. May August 2022

3. CHAPTER THREE. OWN STUDIES

3.1. Results of own research and discussion

Our study included **184 respondents**, divided into three groups - students of the "Medical Laboratory Assistant" specialty (**61.96%**, $n=114$), working medical laboratory assistants (**26.63%**, $n=49$) and users of health professionals (**11.41%**, $n=21$) (Fig.1).

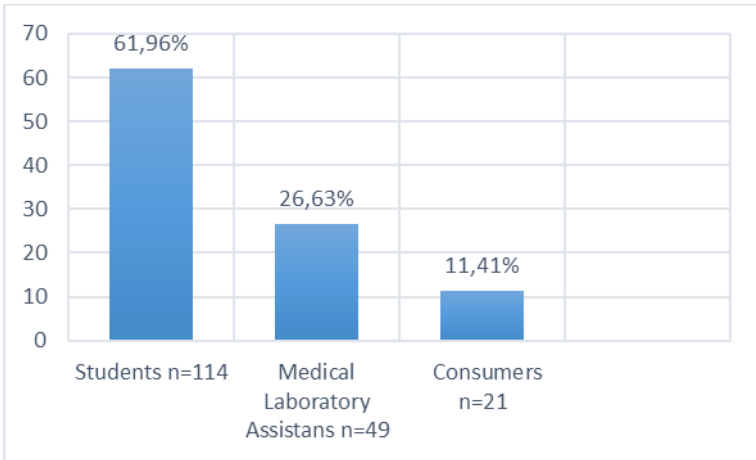


Fig.1. Distribution of survey respondents

3.1.1. Analysis of the data from the survey among students of the specialty "Medical Laboratory Assistant"

In our survey, we have included 114 respondents studying in the specialty "Medical Laboratory Assistant". The gender distribution shows a higher relative proportion (**92.98%**, $n=106$) of female respondents compared to male respondents (**7.02%**, $n=8$).

Statistical analysis shows that the null hypothesis can be rejected and we can conclude that there is a statistically significant

difference in the relative shares of respondents of both sexes ($\chi^2 = 84.246, p < 0.01$). This is explained by the fact that the profession of the medical laboratory assistants is preferred as a profession by women, and also by the set low quotas for the admission and training of men in the specialty in medical colleges.

The distribution of students depending on the Medical College in which they are studying shows a higher relative share (55.26%, $n=63$) of students studying in Medical College - Stara Zagora compared to students studying in Medical College – Varna (44.74%, $n=51$).

No statistically significant difference was found in the relative shares of respondents studying at Medical College - Stara Zagora and Medical College - Varna ($\chi^2 = 1.263, p = 0.261$), which is an indication of equal coverage of respondents from both educational institutions. The conclusions made in the dissertation work could not be explained by specifics of the educational process depending on the college where the students are educated.

The average age of the surveyed students in our study was 22.06 years ($SD \pm 4.155$) with a minimum age of 18 years and a maximum age of 38 years. The age of male students was 21.87 years ($SD \pm 1.727$) with a minimum age of 21 years and a maximum age of 26 years. In the group of female students, the mean age was 22.08 ($SD \pm 4.287$) years with a minimum age of 18 years and a maximum of 38 years (Table 2).

Table 2. Age of surveyed students by gender

gender	N	Min	Max	Mean	Std. Dev
Men	8	21	26	21.87	± 1.727
Women	106	18	38	22.08	± 4.287
Total	114	18	38	22.06	± 4.155

In order to test the hypothesis that the arithmetic mean of age for the two groups of respondents: male and female is equal, a t-test (for independent Student's sample) was conducted, which found that there was no difference between the arithmetic mean of age of men ($M=21.87$, $SD=1.727$) and women ($M=22.08$, $SD=4.287$): $t(113)=-0.131$, $p=0.90$.

A good material and technical base is necessary for quality training and acquisition of professional competences, periodic renewal of the equipment available in the classrooms for educational practical classes in accordance with the latest developments in laboratory sciences and practice, and provision of the necessary consumables and reagents for the practical classes.

According to data from more than 2/3 of the respondents in our survey (71.05%, $n=81$), the material and technical equipment of the medical college where they study corresponds to their idea of a **modern educational process**. In part, this notion is satisfied for nearly 1/4 of the surveyed students (24.56%, $n=28$). One student indicated that the material and technical base does not correspond to his idea of a modern learning process, and 3.51% ($n=4$) of the surveyed respondents could not give a definite answer (fig. 2).

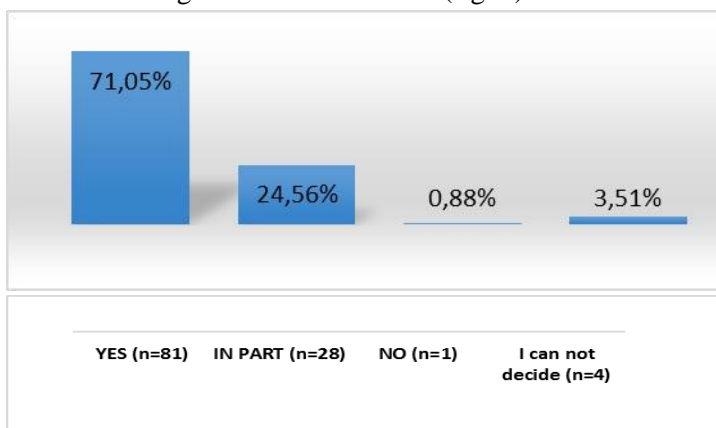




Fig.2. Satisfaction with material and technical support for a modern learning process in the medical college

The specificity of the training of medical laboratory assistants requires that such conditions be created that correspond to the technologies in modern medical laboratories in order to achieve synchronization in the training of students. The opinion of the students is overwhelmingly positive that the medical college in which they study has the material and technical base responsible for the implementation of a modern educational process.

In terms of awareness of the legal framework in the Republic of Bulgaria, which regulates the professional competence of medical laboratory assistants, a high relative share (66.67%, $n=76$) has students who report that they are familiar, followed by those who are familiar with parts (24.56%, $n=28$). Unfamiliar students are 5.26% ($n=6$) of the respondents, and those who cannot judge represent 3.51% ($n=4$) of the total number of respondents (fig.3).

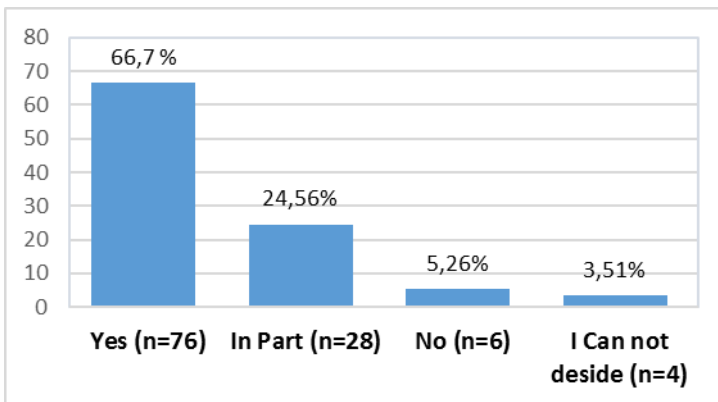


Fig.3. Familiarity with the regulations in the Republic of Bulgaria, regulating the professional competence of medical laboratory assistants

Student assessment of the quality of teaching and the organization of the learning process is a complex pedagogical phenomenon and a useful feedback in the learning process.

The next important point in the questionnaire was to capture the students' opinion about their satisfaction with the organization of the educational process at the Medical College.

The data analysis shows that slightly more than half of the respondents (54.39%, n=62) **highly** value the organization of the educational process in the "Medical Laboratory Technician" specialty, supporting the mastery of competencies necessary for work in a real environment. A very high rating was given by 1/3 of the respondents (29.82%, n=34), the rating was **average** for 12.28% (n=14) of the respondents, and **satisfactory** for 2.63% (n=3) of them. One of the surveyed students (0.88%, n=1) **could not judge** (Fig.4).

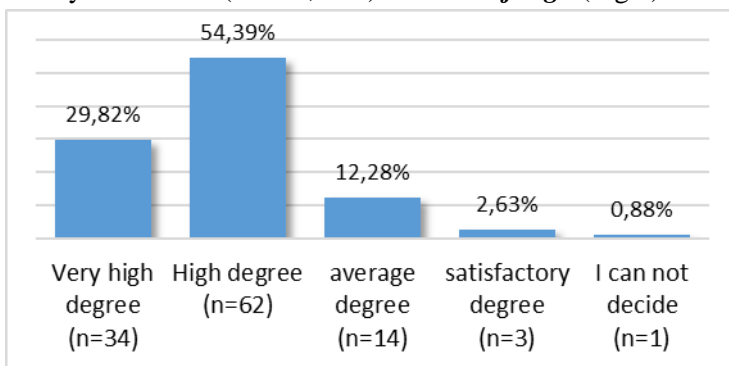


Fig.4. Degree to which the organization of the learning process supports the mastery of the competencies necessary for the real work environment

The statistical analysis of the data did not show a difference ($\chi^2 = 5.314$, $p=0.257$) in the degree of evaluation of the organization of

the learning process depending on the medical college where the training in the specialty "Medical Laboratory Assistant " is carried out. This means that the training in both medical colleges is at the same level, with close evaluations by the students studying in the respective structures (Table 2).

Table 2. Degree to which the organization of the learning process supports the mastery of the competencies necessary for the real working environment of a medical college

Degree	N	%	Medical College Varna		Medical College Stara Zagora		p-value
			N	%	N	%	
Very high	34	29.82%	11	23.91	23	33.82%	p>0.05
High	62	54.39%	25	54.35	36	52.94%	
Average	14	12.28%	8	17.39	6	8.82%	
Satisfactory	3	2.63%	1	2.17	2	2.94%	
I can not decide	1	0.88%	1	2.17	1	1.47%	
TOTAL	114	100.00%	46	100.00	68	100.00%	-

For the purpose of our research, we selected six competencies and asked the survey participants to indicate which are of key importance for their professional preparation. The highest relative share (35.09%, n=40) falls on "**creative application of acquired knowledge**" followed by "**teamwork**" competencies (23.68%, n=27) , "**communication**" (13.16%, n =15), "**orientation in extreme situations**" (11.40%, n =13) and "**making independent decisions**" (10.53%, n=12). The respondents who indicated the competence "**dealing in conflict situations**" have the smallest relative share (6.14%, n=7) (Fig. 5).

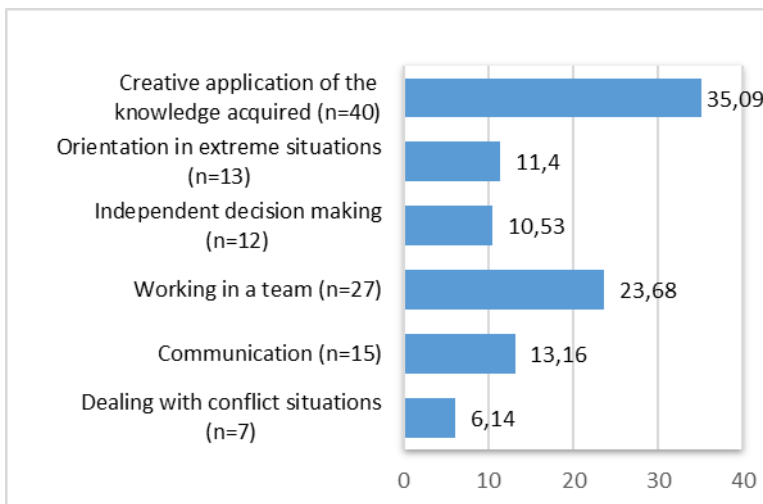


Fig.5. Competence of key importance for the professional training of students

Based on the analysis, we could conclude that the most important competence for the surveyed students is the creative application of the acquired knowledge, and the least important is coping in a conflict situation ($\chi^2=39.474$, $p<0.05$). The opinion is confirmed that it is of high importance for students to acquire knowledge, which they can then apply in the real work environment.

Student satisfaction with professional training is an important indicator of the quality of the educational process in this specialty. When asked to what extent the professional competences of medical laboratory assistants are adequate to the needs and requirements of modern healthcare, the data show a high proportion of respondents (82.46%, $n=94$) who indicated the answer **"to a very high degree"** (32.46 %, $n=37$) and **"to a high degree"** (50.00%, $n=57$) . However, 17.54% ($n=20$) of the students have certain doubts regarding the adequacy of the professional competences received at the College of

Medicine and indicated as an answer **"in an average degree"** 8.77 % ($n=10$) and the same relative those who cannot decide what answer to give to this question from the survey card also have a share. This means that it is necessary to look for the reasons and make timely corrections, both in the teaching staff and in providing the necessary conditions for professional training of the students (fig. 6).

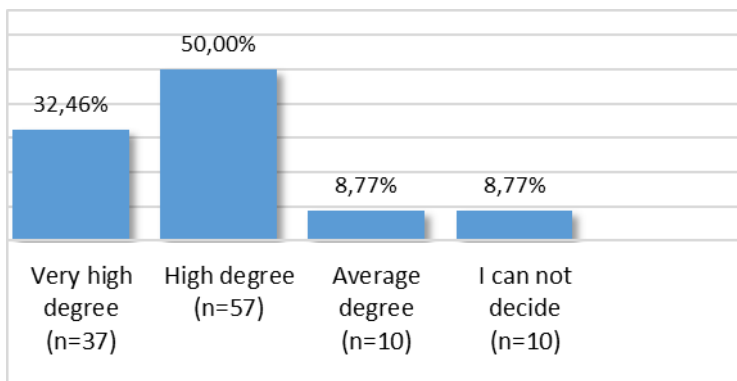


Fig. 6. Evaluation of the degree of adequacy of the professional competences of the medical laboratory assistants

The relative shares of respondents whether high and very high assessment of the degree of adequacy of the professional competences of medical laboratory assistants in relation to modern health care are statistically significant ($p<0.05$), which means that the students' assessment is rather positive.

In the group of students majoring in "Medical Laboratory Assistant", it is statistically impossible to prove which competence is mastered to a very good, high, medium or low degree ($p>0.05$). No competencies were found that the respondents did not master according to their self-assessment, which indicates a high self-esteem and self-confidence among the students (Table 3).

Table 3. *Self-assessment of mastery of some competencies by students.*

Rate assessment of Competence	Very high degree	High degree	Intermediate degree	Low grade	I'm not in control	χ^2	p-value
Independence and responsibility	51.75% (n=59)	35.96% (n=41)	11.40% (n=13)	0.88% (n=1)	0.00% (n=0)	73,088	p<0.05
Competencies for learning	36.84% (n=42)	42.98% (n=49)	19.30% (n=22)	0.88% (n=1)	0.00% (n=0)	49,158	p<0.05
Communicative and social competences	40.35% (n=46)	35.09% (n=40)	22.81% (n=26)	1.75% (n=2)	0.00% (n=0)	40,246	p<0.05
Professional competences	40.35% (n=46)	35.09% (n=40)	20.18% (n=23)	4.39% (n=5)	0.00% (n=0)	35,825	p<0.05
p-value	p>0.05	p>0.05	p>0.05	p>0.05	p>0.05	-	

The competence "Independence and responsibility" is mastered to a very high degree by the respondents, and the competencies "Communicative and social skills", "Professional competencies" and "Learning competencies" are also mastered to the same degree (p<0.05).

Student satisfaction with professional training is an important indicator of the quality of the educational process in this specialty.

In our study, the highest relative share (41.23%, n=47) is the respondents who answered that they feel prepared for independent work in a real environment. 29.82% (n=34) of the respondents feel partly prepared, and 14.04% (n=16) of the respondents in our study define themselves as unprepared. 14.91% (n=17) of the surveyed students cannot assess their preparation for independent work in a real environment (fig.7).

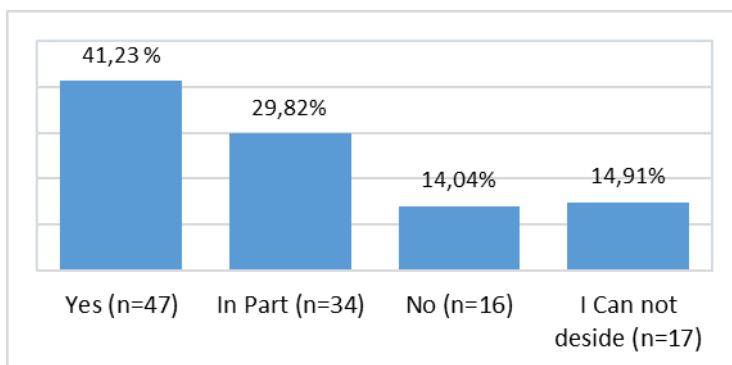


Fig. 7. Willingness to work independently in a real-world environment

The training of the surveyed students from the two medical colleges on the territory of the country is evaluated by them as high, as a result of which the students feel prepared to work independently in a real environment ($p < 0.05$).

In recent decades, the "Medical Laboratory Assistants" specialty has established itself as traditional and in demand for the needs of regional and national healthcare. The perspective for development is very good, in view of the ever-increasing shortage of health professionals, including and medical laboratory assistants. Building a successful professional career depends on motivation and the right choice of profession, on the internal need for self-improvement as a specialist, as well as on the satisfaction of the work performed.

Almost half of the respondents define the level of their internal motivation for acquiring professional competence as "**very high**" (49.12%, $n=56$), and "**high**" is defined as "high" by 42.98% ($n=49$) of the respondents students. 7.02% ($n=8$) of the surveyed students cannot assess their level of internal motivation, and for one of them (0.88%, $n=1$) this level is self-defined as "**low**" (Fig. 8).

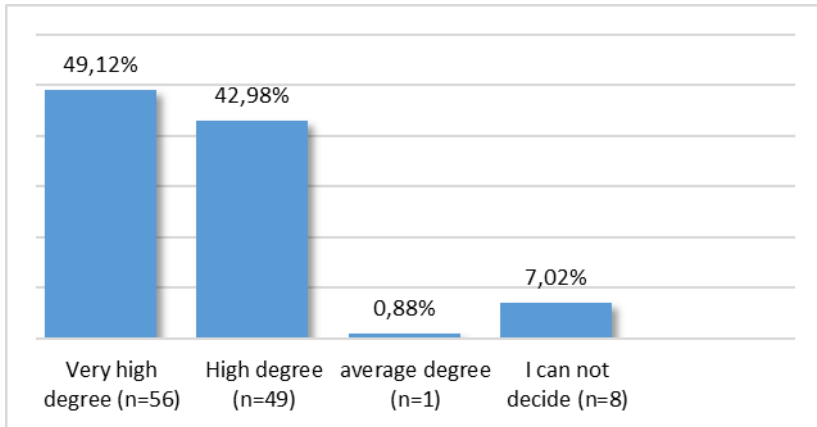


Fig. 8. Level of internal motivation to acquire professional competence

The very high assessment of the level of internal motivation of students from the "Medical Laboratory Assistant" speciality to acquire professional competence is statistically significant ($p < 0.05$). This means that the students who are currently studying and participated in our survey are highly motivated to acquire new knowledge and skills to apply in their future professional activities as graduate medical laboratory assistants, finding their fulfillment in our country and abroad .

Students' creative activity can be encouraged and developed through participation in scientific forums, projects, publication and research activities. This is a way for students to feel the real challenge of researching real processes and phenomena, and for teachers to pass on their experience and arouse their interest in higher degrees of study. In the next question , we asked the students to evaluate the opportunities provided for creative activity (including participation in scientific forums, projects, publication and research activities). The highest relative share (36.84%, $n=42$) has respondents who define them as "**good**" , followed by those whose assessment is "**very good**" (24.56%, $n=28$). These opportunities were rated as "**excellent**" by

22.81% ($n=26$) of the surveyed students. 15.79% ($n=18$) of the respondents in our survey cannot judge (Fig.9).

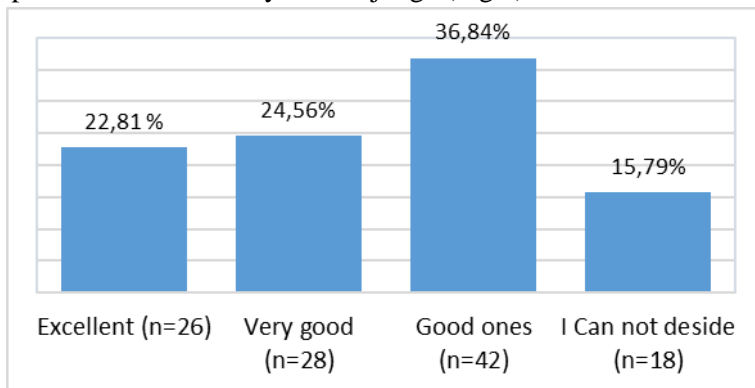


Fig. 9. Evaluation of the provided opportunities for creative activity

The difference in answers is statistically significant ($p<0.05$) and the data analysis shows that despite the available opportunities for creative activity during their university education, students still do not rate them as excellent in the majority of cases. This makes it necessary to think in the direction of these activities being further developed in a volume that satisfies the needs of the students, which will further develop their competencies in addition to those they receive within the framework of the compulsory curriculum.

Internships conducted in a real working environment are a direct organizational link between training and practice. Through their practical activities during their studies, students gradually, consistently and easily form professional skills and habits, commitment to the profession, and responsibility to human health.

According to the majority of surveyed respondents, the highest contribution to mastering professional competences is "**practical training in a real work environment**" (63.16%, $n=72$). For the rest of the surveyed students, these are "**opportunities to use modern information technologies**" (19.30%, $n=22$) and

"involvement of students in scientific research" (17.54%, n=20)
(Fig. 10).

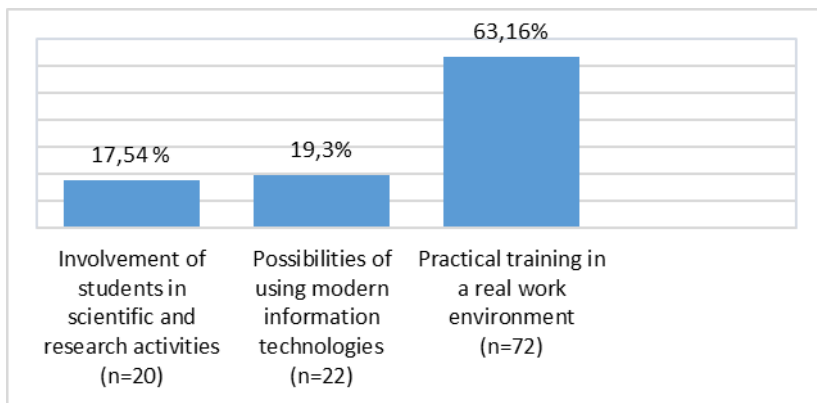


Fig. 10. Contribution to the learning process for mastering professional competencies

Internships are one of the unique benefits of attending medical school. Their holding has rich traditions. The fact is that practical training in a real work environment has the largest relative share. It has been assessed as contributing to the greatest extent in the mastery of professional competence. It is necessary to think in the direction of its being upgraded, expanded, in order to maximally satisfy the needs, knowledge and skills of the students. It would be good to further investigate the attitudes of students regarding the quality of practical training in a real work environment and, if necessary, to make changes or innovations in line with the changing requirements of students in the "Medical Laboratory Assistants " specialty.

With the competent performance of all duties, the medical laboratory assistants actively participates in all stages of laboratory research - pre-analytical, analytical and post-analytical stages. The study programs at the Medical College of Thrace University - Stara Zagora have been updated and brought into line with the medical standards in the relevant disciplines. The training of medical

laboratory assistants is tailored to their participation in all stages of the laboratory process and the high requirements for the work of the laboratories.

It was important for the study to establish the level of knowledge gained regarding errors in the stages of the laboratory process. Almost 2/3 of the respondents (64.91%, $n=74$) believe that they need more in-depth knowledge related to errors in the stages of laboratory research. 16.67% ($n=19$) of the surveyed participants have a partial need, and 7.02% ($n=8$) of them do not have a need. The need could not be assessed by 11.40% ($n=13$) of the survey respondents (Fig.11).

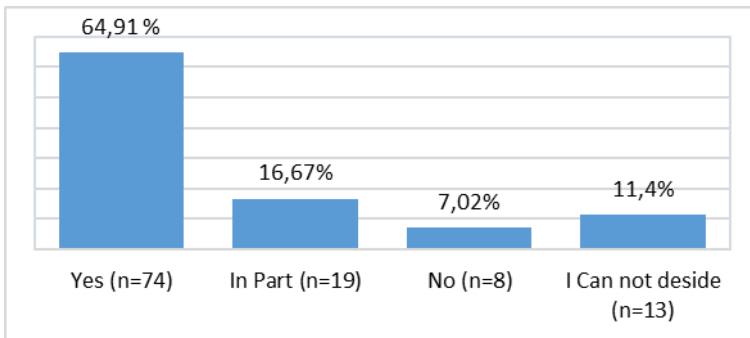


Fig.11. Need for more in-depth knowledge related to errors in the stages of laboratory research

From the answers of the surveyed students, their need for more in-depth knowledge related to errors in the analytical and pre-analytical stage of conducting clinical-laboratory research is clearly outlined. The lack of formal and sufficient training and knowledge of trainees involved in the three stages of laboratory activity leads to erroneous laboratory results. Inadequate knowledge in this area will create conditions for test design errors and misinterpretation by students a medical laboratory assistants as future healthcare providers.

The difference in the relative shares of respondents who indicated different answers is statistically significant ($p < 0.05$). The overwhelming share of absolutely positive answers directs our reasoning to the fact that the included amount of material related to errors in the curriculum does not fully satisfy the needs of the students and they need additional training on the problem.

3.1.2. Analysis of survey data among working medical laboratory assistants

Our study included 49 practicing medical laboratory assistants, all of whom (100%, $n=49$) were female and are presented in Table 3.

Table 3. General characteristics of the survey participants

Workplace	Total number
MBAL "St. Ivan Rilski" - Stara Zagora branch	7
UMBAL "Prof. Dr. St. Kirkovich" - JSC Stara Zagora	5
SAGBAL "Eva" EOOD - Sliven	1
MBAL "St. Ioan Rilski" Ltd. Yambol	1
MBAL "St. Panteleimon" - Yambol AD	1
"MBAL Haskovo" JSC	3
MBAL "Trakia" EOOD, Stara Zagora	4
"DKC 1 Stara Zagora" EOOD	2
"SMDL CLINILAB EOOD" - Kardzhali	10
"SMDL KLINILAB EOOD" - town of Haskovo	1
MDL Bodimed, Stara Zagora	7
GBSMDL Zinvest - K- Branch Stara Zagora OOD	3
SMDL Biocom - 98 EOOD - Stara Zagora	3
KOTC - Stara Zagora	1
Total number	49

The mean age of the medical laboratory assistants surveyed in our study was 27.29 ($SD \pm 4.505$) years with a minimum age of 22 years and a maximum age of 43 years.

Based on the data indicated by the conducted survey, we found that the average duration of work experience in the specialty of the surveyed working medical laboratory technicians was 3.76 ($SD\pm 4.505$) years with a minimum duration of 1 year and a maximum duration of 9 years.

All of the interviewed medical laboratory assistants (100%, $n=49$) at the time of conducting the survey work on an employment contract in the specialty "Medical Laboratory Assistants" on the territory of Stara Zagora and the region.

We asked the respondents to first determine to what extent the organization of the educational process in the specialty "Medical Laboratory Assistants" helped mastering the competencies necessary to practice the profession.

Half of the surveyed medical laboratory assistants 51.02% ($n=25$) define it as "high" and "very high" for a little over 1/4 of them (26.53%, $n=13$). It is defined as average by 16.33% ($n=8$) of the respondents and the lowest rating - "satisfactory" is indicated by 6.12% ($n=3$) of the surveyed medical laboratory workers (fig. 12).

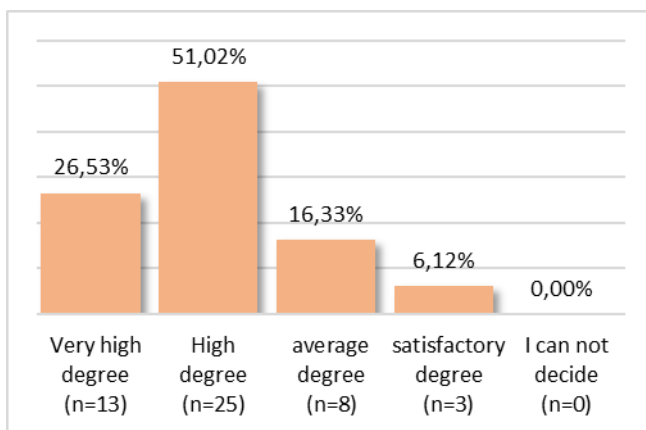


Fig. 12. Mastering the competencies necessary for practicing the profession as a result of the organization of the educational process

The data show that, in the majority of cases, the opinion of the respondents regarding the role of the organization of the educational process in the "Medical Laboratory Assistants " specialty for mastering competencies applicable to the practice of the profession is high. This means that the learning process is headed in the right direction, but there is still work to be done in order for it to be very high.

As a key competence in their professional training, the medical laboratory assistants indicate in the highest relative share (32.65%, n=16) "**creative application of the acquired knowledge**" and "**making independent decisions** " (32.65%, n=16) followed by the competencies "**teamwork**" (18.37%, n=9) , "**communication**" (10.20%, n =5), and "**orientation in extreme situations**" (6.12%, n =3). None of the respondents indicated the competence "dealing in conflict situations" (Fig. 13).

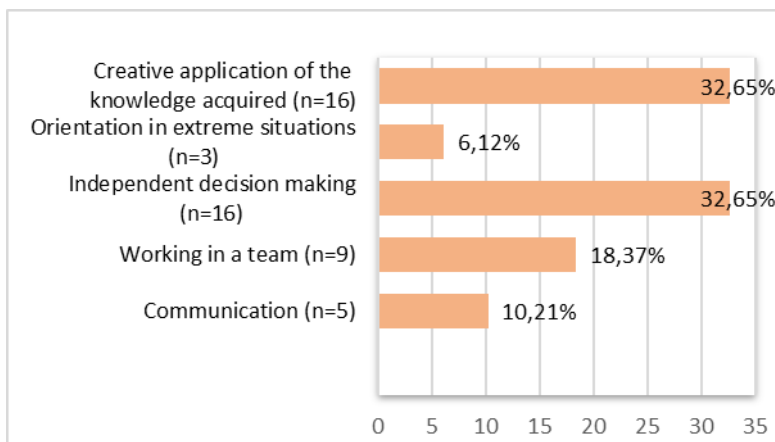


Fig. 13. Competence of key importance for the professional training of medical laboratory assistants

In the group of medical laboratory assistants, the self-assessment shows that the competence "Professional competences" is

mastered to the highest degree, which is positively self-assessed by 57.14% ($n=28$) of the respondents ($p<0.05$). Competences that are mastered to a high and medium degree ($p>0.05$) cannot be separated according to the self-assessment of the surveyed participants in our study. No competencies were found that the respondents did not master according to their self-assessment or those that were mastered to a low degree ($p>0.05$), and none of the surveyed participants shared that they did not master or mastered to a low degree any of the listed competencies for self-assessment (Table 4).

Table 4. Self-assessment of the degree of mastered competencies by medical laboratory assistants

Rate of assessment Competence	Very good degree	High degree	Intermediate degree	Low grade	I'm not in control	χ^2	p-value
Independence and responsibility	51.02% ($n=25$)	32.65% ($n=16$)	16.33% ($n=8$)	0.00% ($n=0$)	0.00% ($n=0$)	8,857	$p<0.05$
Competencies for learning	48.98% ($n=24$)	26.53% ($n=13$)	24.49% ($n=12$)	0.00% ($n=0$)	0.00% ($n=0$)	5,429	$p>0.05$
Communicative and social competences	38.78% ($n=19$)	34.69% ($n=17$)	26.53% ($n=13$)	0.00% ($n=0$)	0.00% ($n=0$)	15,898	$p<0.05$
Professional competences	57.14% ($n=28$)	32.65% ($n=16$)	10.21% ($n=5$)	0.00% ($n=0$)	0.00% ($n=0$)	16,204	$p<0.05$
p-value	$p<0.05$	$p>0.05$	$p>0.05$	$p>0.05$	$p>0.05$	-	-

The competence "Independence and responsibility" is mastered to a very high degree by the respondents, and the competencies "Communication and social skills" and "professional competences" are also mastered to the same degree ($p<0.05$). Based

on the statistical data, we cannot assess to what extent the respondents' learning competencies are mastered ($p>0.05$).

Readiness to work is an important aspect of practice in the health care system. Given the changes and trends within healthcare, current and professionally oriented curricula and programs play a key role in the professional preparation of students for practice.

The evaluation of the medical laboratory assistants who have graduated and have found realization in practice, regarding the competences acquired during their studies, is positive. Almost half of the respondents (40.82%, $n=20$) rate the degree to which they possess professional competences as high. A little over 1/3 of the respondents (34.69%, $n=17$) give a high assessment of their competences related to their profession, and the self-assessment is average for 22.45% ($n=11$) of the respondents. One participant (2.04%, $n=1$) in the conducted survey could not assess the level of his professional competences (fig. 14).

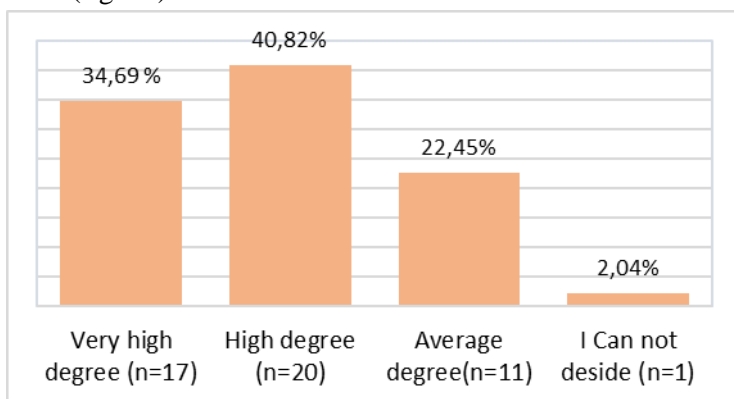


Fig. 14. Self-assessment of the level of professional competences possessed

The data analysis shows that the difference in the relative shares of the different degree of self-assessment at the level of professional competences is statistically significant ($\chi^2 = 28.959$,

$p < 0.05$). Despite the presence of a high degree of evaluation of the level of professional competences of the majority of the respondents in the survey, it was found that among them there are persons who do not feel sufficiently well professionally prepared. This, in turn, calls for thinking in the direction of creating an environment for increasing competence that starts from university education and continues after graduation through the introduction of training courses and in-service programmes, and the creation of key professional competencies.

The competitiveness of education occupies an important place and acquires special importance in the modern dimensions of the educational process. Apart from the labor market, this process corresponds directly to the integration processes related to the mutual recognition of diplomas and the mobility of medical laboratory assistants.

All surveyed medical laboratory assistants are of the opinion that the professional competences they possess make them **competitive and mobile in** the labor market, and slightly more than half (55.10%, $n=27$) are firmly convinced of this. This opinion is partially shared by 44.90% ($n=22$) of the respondents, and there are no negative answers (fig. 15).

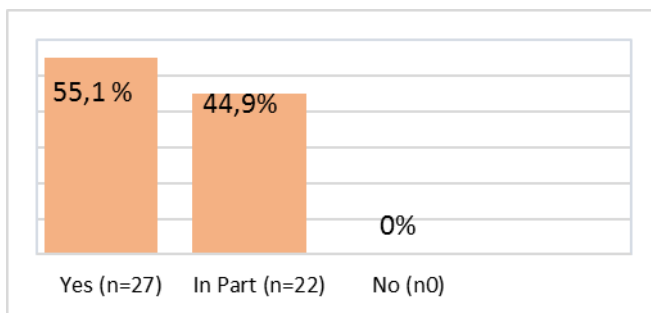


Fig. 15. Competitiveness and mobility in the labor market according to the professional competences possessed

The positive assessment of the fact that medical laboratory assistants consider that the professional competences they possess make them competitive and mobile in the labor market necessitates working in the direction of developing these competences. Both during their professional formation in the university environment and after completing their education and entering the labor market, either by the employer and the professional organizations to which this group of medical specialists belong, or by searching for individual opportunities for increasing professional competences through involvement in various projects and trainings.

practical training in a real working environment contributed to the highest degree to the formation of their professional competences in the process of university education (79.59%, $n=39$). The possibilities of **using modern information technologies** was defined as leading by 20.41% ($n =10$) of the respondents. **Involvement in research activity** is not assessed by anyone as leading in the formation of professional competence since university education (fig. 16).

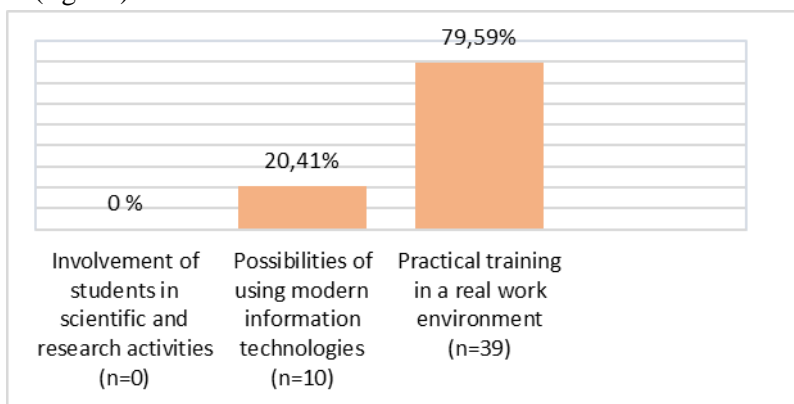


Fig. 16. A factor contributing to the formation of professional competence

The data show that practical training in a real working environment during university education is a key factor in the formation of the professional competences of future medical laboratory assistants. This prepares them for work in the rapidly developing and dynamic field of laboratory practice and builds them as professionals with knowledge and skills.

The integrated components in the curriculum of the "Medical Laboratory Technician" specialty - *clinical practice* and *pre-diploma* internship are aimed at building medical laboratory assistants' skills for independent work, responsibility and teamwork. The responsibility for forming these characteristics is shared between the HE system, in particular the medical college and the bases for conducting practical training.

A large part of the interviewed practicing medical laboratory assistants (59.18%, $n=29$) answered that the educational practice and pre-diploma internship provide opportunities to acquire skills for independence and responsibility in the performance of professional tasks. Slightly more than 1/3 of the respondents (36.73%, $n=18$) partially agree with this statement, and 4.08% ($n=2$) of the surveyed medical laboratory workers disagree (Fig. 17).

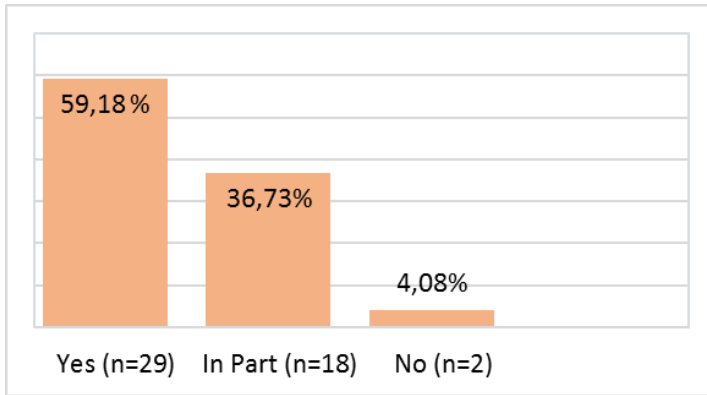


Fig. 17.

Formation of skills for independence and responsibility during the educational practice and the pre-diploma internship

For the purposes of our study, no statistical significance ($p > 0.05$) was found for the persons who gave a negative answer to this question, which means that the pre-diploma internship and learning practices have their role in forming the students' skills for their good professional realization in consequence and affirms them as knowledgeable and capable professionals.

For the purposes of the dissertation, we analyzed the opinion of practicing medical laboratory assistants regarding the introduction of a free-choice discipline "Sources of error in the stages of clinical laboratory research" as a factor that would contribute to increasing the knowledge and skills of medical laboratory assistants and increasing their professional competence when starting work in a real work environment.

As positive, we could consider the fact that more than 80% of the respondents gave a positive assessment of the introduction of this optional discipline, as absolute conviction that it would be useful was expressed by 61.22% ($n=30$) of the surveyed participants in our study. and partial agreement is expressed by slightly less than $\frac{1}{4}$ of the respondents 24.49% ($n=12$) . 14.29% ($n=7$) of the surveyed medical

laboratory assistants in the current study have a categorically negative opinion on this proposal (Fig. 18).

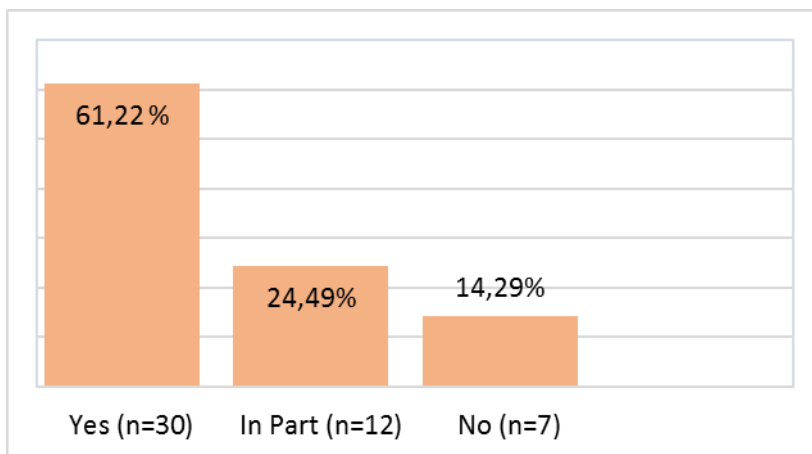


Fig. 18. Introduction of the ID "Sources of errors in the stages of clinical laboratory research" as a factor for increasing the knowledge and skills of medical laboratory assistants

The categorically expressed positive opinion regarding the proposal to introduce a freely selectable discipline related to the errors in the analytical and pre-analytical stages of conducting clinical-laboratory research confirms the opinion that in the curriculum of the specialty "Medical Laboratory Assistants " this is not represented in a sufficient volume, ensuring full preparation of students on this problem.

We approached the analysis of the data from the two groups of respondents – medical laboratory assistants and students with the tasks of answering the following questions:

- 1) Is there a difference in the opinion of the two groups of respondents in the evaluation of the organization of the educational process in a medical college;

- 2) For each group, which competence is most significant for professional training, and to determine whether there is a difference in the professional competences possessed according to the EQF;
- 3) Which factors in the learning process have the greatest contribution to the formation of professional competences;
- 4) To find out if there is a difference in the self-assessment of the possessed professional competences between students and medical laboratory assistants;

The organization of the educational process in the specialty "Medical Laboratory Assistants " and its role in mastering the competencies necessary for work in a real environment was evaluated to different degrees by the respondents in the two groups whose opinion was examined - laboratory technicians and students.

The analysis does not show conformity with the expressed opinion ($p < 0.05$), and in both groups of respondents this assessment is high for more than half of the students 54.39% ($n=62$) and 51.02% ($n=25$) of working laboratory assistants ($p < 0.05$) (Table 5).

Table 5. Evaluation of students and medical laboratory assistants on the importance of the organization of the learning process for the acquisition of professional competences

Degree	Students majoring in "Medical Laboratory Assistants "		Medical Laboratory Assistants		p-value	p-value
	n	%	n	%		
Very high degree	34	29.82%	13	26.53	p<0.05	p<0.05
High degree	62	54.39%	25	51.02	p<0.05	
Intermediate degree	14	12.28%	8	16.33	p<0.05	
Satisfactory degree	3	2.63%	3	6.12	p>0.05	
I can not decide	1	0.88%	0	0.00%	p>0.05	

Regarding the key competences, a statistically significant difference was found in the key competence, determined by the two groups of respondents ($p<0.05$), and only for the competence "Making independent decisions" no difference was found in the two studied subgroups of the general population of respondents , took part in our survey ($p>0.05$). (Table 6).

Table 6. Number and relative share of respondents identifying core competencies as important

Competence	Students majoring in "Medical Laboratory Assistants"		Medical Laboratory Assistants		p-value	p-value
	n	%	n	%		
Coping in conflict situations	7	6.14%	0	0.00%	p<0.05	p<0.05
Communication	15	13.16%	5	10.20%	p<0.05	
Teamwork	27	23.68%	9	18.37%	p<0.05	
Making independent decisions	12	10.53%	16	32.65%	p>0.05	
Orientation in extreme situations	13	11.40%	3	6.12%	p<0.05	
Creative application of acquired knowledge	40	35.09%	16	32.65%	p < 0.05	

With regard to the competences specified in the European Qualification Framework, it was found that the surveyed students and laboratory assistants mastered the listed competencies to varying degrees, and no statistically significant difference was found in the mastery of the competence "Independence and responsibility" ($p>0.05$), i.e. it is a competence that, in terms of degree of mastery, is rated the same by both groups of respondents at the different levels of assessment.

For the second proposed competency "Learning Competencies" when rated "Very Good" and "High" a difference was found in the two groups of respondents, with the group of students having a better command of the competency to a very good degree and laboratory technicians to a high degree. There is no difference in the mastery of the competence "Communication and social skills" in the two groups of respondents, and the last proposed competence "Professional competences" shows a difference in the degree of mastery in the two groups, with the assessment of "very good level" and "average level" not found a statistically significant difference. All proposed competences are mastered by the respondents to a very good, high or medium degree, and no competencies were found that were statistically significantly not mastered or mastered to a low degree in one of the two surveyed groups (Table 7).

Table 7. Degree of mastery of individual groups of competences in the training process of medical laboratory assistants

Rate of assessment Competence	Very good degree	High degree	Intermediate degree	Low grade	I'm not in control
Independence and responsibility	$p>0.05$	$p>0.05$	$p>0.05$	$p>0.05$	$p>0.05$
Competencies for learning	$p<0.05$	$p<0.05$	$p>0.05$	$p>0.05$	$p>0.05$
Communicative and social competences	$p>0.05$	$p>0.05$	$p>0.05$	$p>0.05$	$p>0.05$
Professional competences	$p<0.05$	$p>0.05$	$P<0.05$	$p>0.05$	$p>0.05$

No statistically significant effect was found in both groups regarding the opportunities provided in the training process, which contributed to the greatest extent to the formation of their professional competence. Two of the three analyzed factors - *"Ability to use modern information technologies"* and *"Practical training in a real working environment"* was equally evaluated by both groups of respondents ($p>0.05$). The possibility of *"We involve students in research activities"* is significant only for the group of students ($p<0.05$), (Table 8.).

Table 8. *Factors that contribute to the formation of professional competence in students and medical laboratory assistants*

Factor	Students		Laboratory workers		p-value
	n	%	n	%	
Involvement of students in research activities	20	17.54%	0	0.00%	$P<0.05$
Ability to use modern information technologies	22	19.30%	10	20.41%	$p>0.05$
Hands-on training in a real work environment	72	63.16%	39	79.59%	$p>0.05$

From the data presented in Table No. 8, it can be seen that both students and practicing medical laboratory assistants attach the greatest importance to "Practical training in a real working environment" as a factor for building professional competences. Both groups of respondents consider that the possibility of involvement in scientific research activity has the least importance for the formation of these competences.

A statistically significant difference was found in the self-assessment of the professional competences possessed by the two groups of

respondents ($p < 0.05$). Both groups of respondents self-assess their competences to the same extent, and the differences are negligible from a statistical point of view. This means that the training of medical laboratory assistants is adequate to the needs and requirements of modern health care in a "very high" and "high" degree (Table 9).

Table 9. Self-assessment of the level of professional competences according to the needs of modern healthcare .

Degree	Students majoring in "Medical Laboratory Assistants"		Medical Laboratory Assistants		p-value	p-value
	n	%	n	%		
Very high degree	37	29.82	17	34.69	$p < 0.05$	$p < 0.05$
High degree	57	54.39	20	40.82	$p < 0.05$	
Intermediate degree	10	12.28	11	22.45	$p < 0.05$	
Satisfactory degree	10	2.63	1	2.04	$p < 0.05$	

3.1.3 Analysis of data from medical laboratory users

To discover themselves components of the curriculum, it is very useful to determine the needs and expectations of stakeholders regarding the competencies of the graduating student.

We gathered information about standard professional practice requirements upon entry into employment and future expectations through surveys of medical laboratory users.

21 medical laboratory users were included in our study. In this group of respondents, the relative share of women (90.48%, n=19) prevailed over the relative share of men (9.52%, n=2).

The difference in the relative shares of male and female respondents is statistically significant ($\chi^2=13.762, p<0.01$), which is explained by the fact that the persons practicing professions related to the clinical laboratory as a medical specialty are mostly female .

The breakdown by profession of the surveyed respondents shows a higher relative share of clinical laboratory doctors (71.43%, n=15) compared to senior medical laboratory assistants (28.57%, n=6).

Medical professional users had to determine the degree of theoretical knowledge possessed by medical laboratory assistants. According to slightly more than half (52.38%, n=11) of the interviewed participants, the medical laboratory assistants who work in their structures possess "to a very high degree" the necessary theoretical knowledge for free practice of the profession. To a high degree, this knowledge is possessed by medical laboratory assistants according to 1/3 of the interviewed persons (33.33%, n=7), and to a low degree - according to 14.29% (n=3) of doctors and senior medical laboratory assistants (fig. .19).

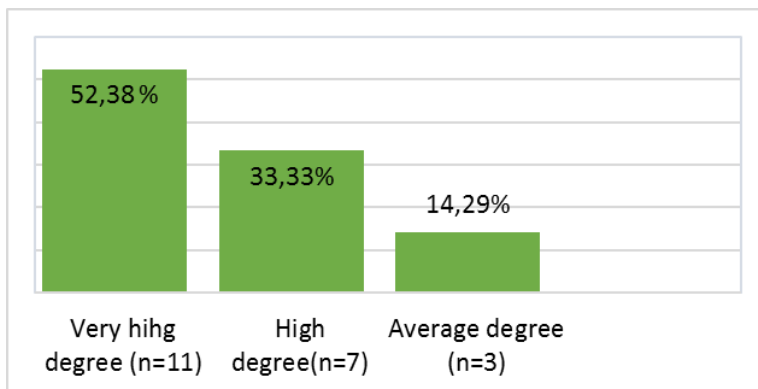


Fig. 19. Possession of theoretical knowledge for free practice of the profession by medical laboratory assistants

The experts' assessment of the practical skills possessed is also positive. According to the opinion of 2/3 of the interviewed persons (66.67%, $n=14$) the medical laboratory assistants who work in their structures possess a very high degree of practical skills, and 1/3 are of the opinion that the possessed skills are to a high degree (33.33%, $n=7$). The practical skills of the laboratory assistants were not evaluated in an average or lower degree by the interviewed persons (fig. 20).

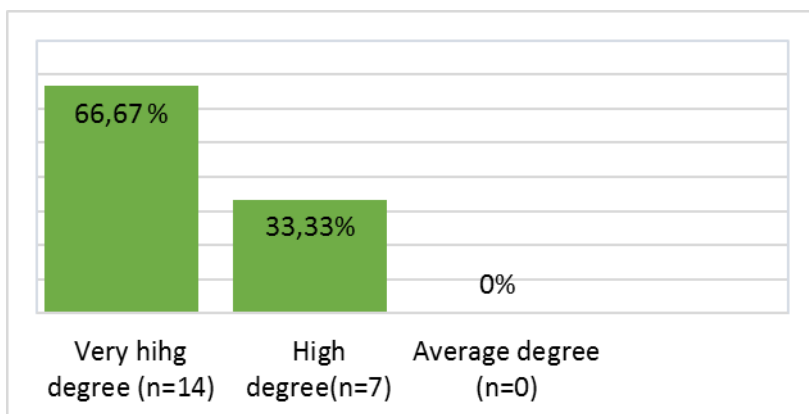


Fig. 20. Possession of practical skills by medical laboratory assistants

The opinions of almost all experts were united that, at the present moment, the possessed theoretical knowledge and practical skills of the medical laboratory assistants who graduated from the Stara Zagora Medical College are at a very high level. For us teachers, this is important, since the introduction of new technologies into

laboratory activity requires continuous synchronization and updating of theoretical and practical training.

According to 57.14% (n=12) of the respondents, the medical laboratory assistants working for them partially show creativity in non-standard situations, and according to 28.57% (n=6) the laboratory workers show creativity completely. 14.29% (n =3) of the interviewed users are of the opinion "rather not" (fig. 21).

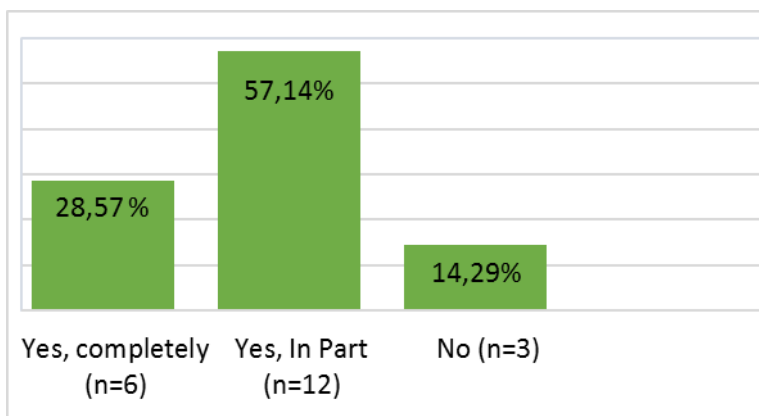


Fig. 21. Showing creativity in non-standard situations

The rapid adaptation of the new staff members in the work environment is a factor that also affects the processes of delegation of independence in the implementation of the work procedures of the newly arrived persons in the laboratories. According to all interviewed users of medical laboratory assistants (80.95%, n=17), medical laboratory assistants who work in the respective structure show a very high degree of independence and responsibility; to a high degree this was assessed by 14.29% (n=3) of the interviewed persons and to an average degree by one of them – 4.76% (n=1) (fig. 22).

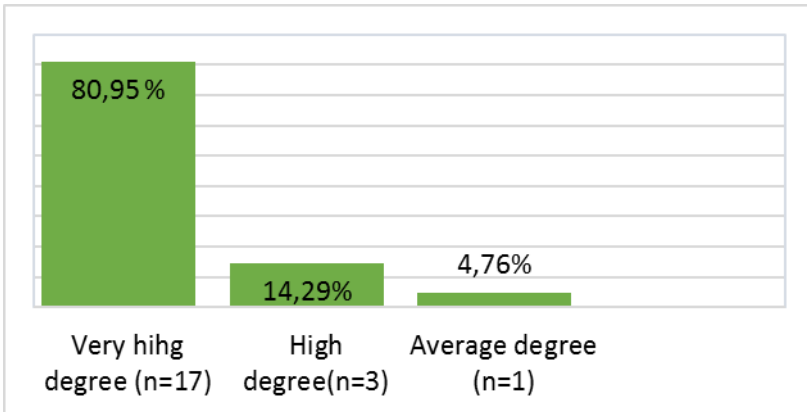


Fig. 22. Degree of independence and assumption of responsibility by working medical laboratory assistants

The high rating given by users is an indication that medical laboratory assistants possess competences related to independence and taking responsibility, which contributes to improving the work process, facilitating the assigned tasks and their quick implementation according to the employer's requirements.

According to the interviewed users of medical laboratory assistants, their teamwork skills were assessed as "excellent" (57.14%, n=12), and with regard to communication skills and foreign language competence, it is statistically impossible to determine to what extent they are proficient in the medical laboratory assistants ($p > 0.05$) (Table 10).

Table 10. Evaluation of some competencies possessed by medical laboratory assistants

Skill(Competency)	Skills to work in vkip		Communication skills		Foreign language competence		p-value
	N	%	N	%	N	%	
Olicny	12	57.14%	3	14.29%	0	0.00%	p<0.05
Very good	6	28.57%	7	33.33%	9	42.86%	p>0.05
Good ones	0	0.00%	8	38.10%	10	47.62%	p<0.05
Satisfactory	3	14.29%	3	14.29%	2	9.52%	p>0.05
Bad	0	0.00%	0	0.00%	0	0.00%	p>0.05
p-value	p<0.05		p>0.05		p>0.05		

The data prove that the most strongly mastered competence by medical laboratory assistants is the ability to work in a team ($p<0.05$), and foreign language competence is well mastered ($p<0.05$). Statistically, no conclusion can be drawn as to which competence is mastered to a very good and satisfactory degree ($p>0.05$). No competencies were identified that were poorly mastered by medical laboratory assistants according to the interviewees.

Quick entry into the work environment and adaptation to the work environment is of utmost importance for employers and even more so for direct supervisors and colleagues. Although these processes are bilateral and highly dependent on the environment, it can be thought that good practical training of students can support their cooperation in teams.

According to slightly more than half of the respondents (52.38%, n=11), the students majoring in "Medical Laboratory Assistants " possess the necessary knowledge and skills for successful implementation. In part, these skills are possessed according to the opinion of 1/3 of the respondents (33.33%, n =7), and not possessed according to 14.29% (n=3) of the interviewed users of medical laboratory specialists. There are no respondents who cannot estimate their answer (Fig. 23).

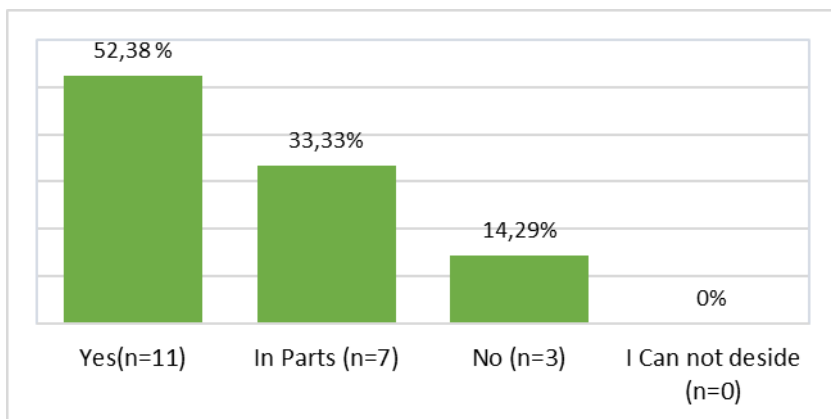


Fig. 23. Possession of knowledge and skills by the students for a successful professional start

Several main conclusions can be drawn from the conducted survey among employers:

- The employers' assessment of the possession of knowledge and skills for work according to the professional qualification is very good;
- A little over half of the employers gave an excellent assessment of teamwork skills;
- Slightly lower scores for communication skills and foreign language competences stand out;

- Half of the employers are of the opinion that the students have the necessary amount of knowledge and practical skills for successful professional realization.
- During training, it is good for students to be stimulated to be more independent, as well as to look for ways to increase their skills for a short adaptation period to work in different laboratories.

3.4 Approval of a model for the introduction into practice of the optional academic subject "Sources of errors in the stages of the laboratory process" in the training of the specialty "Medical laboratory assistant".

The modern approach to total quality in the laboratory is focused on the needs and satisfaction of patients, the risk of errors and mistakes in the analysis steps must be minimized to ensure the full quality of laboratory services.

The laboratory result is a quantity that sums up the influence of a large number of factors. Distinguishing the three stages has a theoretical importance - for grouping and systematic study of the factors that influence the final result, as well as a didactic importance - for forming an idea about the overall process of laboratory research. Each of these stages is burdened with characteristic sources of variation that can affect the final result.

Based on the literature review and the results obtained from our study, a need for in-depth knowledge of students to apply in practice rules and procedures to reduce errors in the pre-analytical, analytical and post-analytical stages in the clinical laboratory is outlined.

It is necessary to develop and implement measures already during the training of medical laboratory assistants in the college. For this purpose, we propose a model of the elective course "**Sources of errors in the stages of the laboratory process**" to be used in the curriculum of the "Medical Laboratory Assistant " specialty, because

by definition *"the elective courses provide specific knowledge and competences in the field of the specialty and are studied by the students trained in the relevant specialty."*

The introduction of new and up-to-date disciplines and topics contributes to better awareness and the acquisition of objective knowledge. The curriculum is aimed at increasing specific professional competencies of future medical laboratory assistants. The opportunity to offer students up-to-date and modern knowledge stimulates their interest in the specialty, their motivation and their pursuit of self-improvement.

The purpose of the activities within the optional discipline is for the learners to add to the acquired theoretical knowledge and practical skills information on performing quality laboratory tests, in biological fluids and tissues, in accordance with the requirements for obtaining reliable laboratory results. The program focuses primarily on preanalytical and analytical quality as key areas for improving clinical laboratory practice from the perspective of the medical laboratory assistant.

The tasks of the discipline are aimed at building students' theoretical knowledge and practical skills to comply with the requirements for the conditions and technique for performing all procedures, from the patient to the result.

The main thematic units of the curriculum are placed on:

1. Familiarity with biological factors determining the biological variation of the laboratory result.
2. Pathological factors that determine the deviation of laboratory results outside the reference limits.
3. Diagnostic and treatment factors.
4. Preanalytical factors.
5. Analytical factors.
6. Post-analytical factors.

In order for students to acquire additional knowledge and skills according to their individual interests, and a professional development plan, the training will take place in the fifth semester. It is related to their level of preparation and will expand their knowledge of the profiling discipline Clinical Laboratory.

The content of the elective course "Sources of errors in the stages of the laboratory process" is structured in relatively separate parts, including 30 academic hours of classroom work, of which 20 hours are lectures and 10 hours are practical classes. For conducting the practical classes in a separate clinical laboratory in MK Stara Zagora. The laboratory has 14 workplaces, specialized measuring equipment and models.

The following methods will be used to obtain the feedback and assess the degree of mastery of the required minimum of knowledge and skills by each student: solving a test with questions, solving a case study and written development on a question from the course outline.

The expected results at the end of the training course are that the students know all the procedures and have the necessary skills to perform independent work at each stage of the laboratory process.

Be aware of potential sources of variation from laboratory order to laboratory result receipt. Be aware of their role in the reliability of the laboratory result in the pre-analytical, analytical and post-analytical stages, and strictly implement all algorithms, steps in technical sheets and standard operating procedures to perform each task in the laboratory.

The curriculum will be proposed for voting and included in the curriculum of the "Medical Laboratory Assistants" specialty in MK Stara Zagora from the academic year 2022/23.

CONCLUSION

The Medical Laboratory Assistants profession is one of the largest groups of health professionals in the health care system, they are key performers in laboratory work, and their duties and responsibilities continue to evolve. The role of the clinical laboratory is to provide fast, timely and useful medical information for the diagnosis, treatment and prevention of diseases. The number, type and complexity of laboratory tests have increased over the past 50 years. Medical laboratory assistants in the future must be able to flexibly adapt to these situations to provide quality service through their scientific, technical and practical skills and competencies.

The development of the specialty is closely related to the advancement of technology, the current and professionally oriented curriculum. It plays a key role in preparing students for practice. Medical laboratory educators have an important role in continually monitoring curriculum content and making decisions about preparing students for an ever-changing field.

The dissertation provides information on the training and interrelationship between students, medical laboratory assistants and staff users.

The results of the research confirmed the hypotheses that there is a need for additional knowledge aimed at the mistakes made in the three stages of the laboratory process, that the formed professional skills and competencies of medical laboratory students meet the modern requirements of laboratory practice for successful professional realization. A new look at education, training, and the application of new educational techniques is needed to prepare a workforce of people who will advance laboratory medicine in the 21st century.

OUTCOMES

- The majority of the two groups of respondents (students and working laboratory workers) rated the organization of the educational process at the medical college as **"very good"** , **helping them to master professional competencies.**
- Practical training in MK for both groups of respondents – practicing medical laboratory assistants and students is a leading factor in the formation and construction of professional competencies for a successful professional start;
- *in scientific and research activity* in the formation of professional competence already during college studies was rated the lowest ;
- The competence *"creative application of acquired knowledge"* is the most significant for the practical activity for both medical laboratory assistants and students;
- From the answers of the surveyed students, their need for more in-depth knowledge related to the errors in the pre-analytical, analytical and post-analytical stages of clinical laboratory research is clearly outlined;
- The opinion of working laboratory technicians is categorically positive regarding the proposal to introduce an optional discipline related to errors in the stages of the laboratory process. In the curricula of the "Medical Laboratory Assistant" specialty, this is not represented in a sufficient volume, providing full training of students on this issue.
- According to the experts, the acquired professional qualification "Medical laboratory assistant" in Medical College meets to a high degree the needs and requirements for the performance of the tasks in the structures that they lead.

RECOMMENDATIONS

To the Ministry of Education:

1. To update the United State Requirements Ordinance for the acquisition of higher education in the specialties of the professional field "Health care" for the educational qualification degree "professional bachelor in..." for the specialty "Medical laboratory assistant", by adding mandatory disciplines "Errors in the stages of clinical laboratory research' and 'Quality control in laboratory practice'.

To the manuals of the specialty "Medical laboratory assistant" in the Medical Colleges

1. To optimize the curriculum for the "Medical Laboratory Assistant" specialty, by increasing the part of practical training.

2. To optimize the educational content of the disciplines "Clinical Laboratory" and "Clinical Practice", by expanding the scope of topics and new indicators from the clinical laboratory and medical practice, aimed at increasing the specific professional competences of future medical laboratory assistants.

CONTRIBUTIONS

With a theoretical-cognitive nature:

1. An in-depth analysis of the medical laboratory assistant training in Bulgaria was made, the conformity of the knowledge, skills and competences for modern health care and the need for change was established;

2. The opinion of students and practicing medical laboratory technicians about the level of their professional competence mastered in the conditions of a Medical College was studied.

3. The opinion of experts in the field of the Clinical Laboratory was studied about the adequacy of the training of the medical laboratory assistants and their readiness for independent work.

Of a practical-applied nature:

1. Optimization of the educational process in the Medical College, through the educational aid "**Rules for taking biological material for clinical-laboratory research**" for the formation of professional skills and competencies of the medical laboratory assistant in the conditions of practical training, as well as for all specialties of the professional field "Health Care".

2. It proposes the development of "**Clinical laboratory constellations in patients with Sars-Cov-2**" and their inclusion in the Clinical Laboratory and Clinical Practice programs of the medical laboratory assistant specialty.

3. Offers the study of an optional course "**Sources of errors in the stages of the laboratory process**" for students of the medical laboratory assistant specialty.

4. It suggests holding regular meetings and seminars between laboratory doctors and senior medical laboratory assistants with the teachers of the medical colleges, to update the curricula according to the new models and technologies suitable for the future laboratory practice.

**List of publications related to the dissertation work
of Pavlina Penkova Teneva**

1. **Teneva, P.** EDUCATIONAL STANDARDS AND FORMATION OF KEY COMPETENCES IN THE EDUCATION OF MEDICAL LABORATORY ASSISTANTS *Knowledge International Journal* , 47 (4), 765–770, 2021-08-16

2. **Pavlina Teneva** The role of practical training in a medical college for the formation of professional abilities and habits in students of the specialty "Medical Laboratory Assistant"
<http://dx.doi.org/10.14748/vmf.v10i2.7874> Varna Medical Forum, 2021, app. 1 Ninth scientific session of Varna Medical College, March 26, 2021

3. **Teneva, P.,** Kichukova, K., & Todorova, G. (2020). PRE-ANALYTICAL ERRORS IN LABORATORY RESEARCH FROM THE POINT OF VIEW OF MEDICAL LABORATORY STUDENTS. *KNOWLEDGE - International Journal* , 43 (4), 871–876. Retrieved from <https://ikm.mk/ojs/index.php/kij/article/view/463>

ACKNOWLEDGMENTS

I express my sincere thanks to my scientific supervisor Assoc. Emilia Georgieva, Ph.D. for the joint work, valuable advice and guidance on the way of developing the scientific work. I am extremely grateful to Prof. Elena Zheleva, Ph.D. from the Sliven Branch of the University of Varna for the unconditional support, trust, patience and faith in me.

I thank the Academic Management of Trakia University and Medical College for the provided institutional support. I also thank my family, especially my husband - for their patience, support and love.