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# Medical Students' Experiences and Factors Related to Their Motivation for Undergraduate Courses Involving Scientific Research

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## ABSTRACT

**Introduction:** The aims of this study were to investigate the perceptions of faculty of medicine students about conducting scientific research and to identify the factors influencing their motivation to conduct scientific research.

**Methods:** This cross-sectional study involved 543 students from the second to fifth grades at the faculty of medicine. The questionnaire included questions about career plans, experiences with research courses, and factors affecting students' motivation to conduct research.

**Results:** Clinical semester students are more likely to present their research at congresses (p=0.001) and to publish their work nationally (p=0.001) and internationally (p=0.014) compared with preclinical semester students. Preclinical period students showed greater agreement than clinical period students in their belief that their motivation for conducting research would be higher by involving them in the decision-making process for selecting research topics (p=0.013) and by streamlining the ethics committee approval process (p=0.004). Students in the clinical group were more motivated when their opinions were considered in research design courses (p=0.043), when ample time was dedicated in the curriculum for research completion (p=0.001), and when time was allocated for interaction with advisors and peers (p=0.001).

**Conclusion:** This study suggests that incorporating compulsory, well-supported research activities that integrate evidence-based medicine and scientific research into pre-graduate medical education may encourage students to consider research careers. Student willingness to participate in research may be enhanced when their research subject preferences and original ideas are considered, adequate time for research is provided, group work is encouraged, and effective counseling is available.

**Keywords:** Medical education, program development, research, medical students, curriculum

## Introduction

Within the scope of evidence-based medicine practices, the necessity for medical school graduates to know scientific research methods and to perform effective practices is widely accepted (1-4). It is necessary to strengthen students' interest in research during their medical school education. Considering that the number of physician-scientists is decreasing (5-7) and that measures should be taken in this regard (6,7), it is important to understand the perceptions of medical students toward conducting scientific research, their experiences related to the education they received on this subject, and especially their motivation.

An individual's motivation can be related to many personal and environmental factors, such as autonomy in the sense of feeling that one has a choice and willingly approves of one's behavior, competence in the sense of feeling mastery and being effective in one's activities, and relatedness in the sense of feeling connected to others and belonging, as proposed in self-determination theory (1,2,8,9). It is important to understand how much the education program enables the acquisition of scientific method and research competence, how students perceive their experiences in the program, and how they evaluate the motivating and non-motivating situations related to the program to revise the education programs in line with student needs. It should be understood what changes occur in students' motivation in different educational periods and which types of motivation come to the fore in which periods (1,2). With this evidence, educational programs can be shaped to be more effective (4,5,7-9).

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This study investigates, define, and explain the factors that motivate medical students to conduct scientific research. Accordingly, the research problems of this study are as follows:

1. What are the students' views on the factors that may affect their motivation for research in relation to the educational program?

- In which ways do opinions on factors that may affect research motivation differ between clinical and preclinical period students?

2. What are the students' course experiences in designing and managing scientific research?

- How do students' course experiences in designing and managing scientific research differ between clinical and preclinical students?

## Methods

### Participants and the Data Collection Instrument

The study was a cross-sectional study conducted with 543 students in the 2nd on 5th grades of our faculty of medicine using a face-to-face questionnaire collection method. The participation rate was 67%, and the students were selected using a convenient sampling method. After the purpose of the study was announced to them face-to-face and consent was obtained, the volunteer students filled out the forms themselves in their learning environments. The questionnaire used in the study was created by the researchers and includes the following headings: demographic data, academic plans to conduct scientific research, research experiences at the faculty of medicine, opinions on the part of the curriculum related to scientific research, and factors that may be related to motivation to conduct scientific research. Exclusion criteria were not volunteering to participate in the study, transferring from another university to the fourth and/or fifth year, and incomplete answers to the questionnaire.

### Context in Which the Research was Conducted

In our education program, scientific research methods and practices are conducted as a vertically integrated program, Introduction to Clinical Practice (ICP), which covers the first three years of education, and an evidence-based medicine program in the fifth year. In addition to taking theoretical courses on the subject, each year, students conduct scientific research in peer groups of 5-6 students under the supervision of a faculty member. The products of these studies are presented orally or as posters at the national Marmara Student Congress (MaSCo), which is organized with the contributions of volunteer students and the faculty members they voluntarily consult. Students' research reports and individual performances during the year are evaluated by their advisors and program coordinators.

The study was conducted in accordance with the Declaration of Helsinki with the permission of Marmara University Faculty of Medicine Ethics Committee (protocol code: 09.2019.1046, date: 06.12.2019).

### Statistical Analysis

The data obtained from the questionnaire were analyzed using the Jamovi 2.3.21 program. Mean, standard deviation, median, and frequency distributions were used for statistical analysis. Chi-square analysis and Mann-Whitney U test were used for comparisons, and significance value was taken as $p<0.05$.

## Results

### General Data of the Participants

The mean age of the 543 students participating in the study was 21.6±1.6 years and 57.3% (n=310) were female. Table 1 shows the participants' career planning intentions. When asked to evaluate the importance given to scientific research skills at MUSTF in general, 20.6% (n=111) of the participants stated that it was extremely important, 50.2% (n=270) critical, and 23.2% (n=125) moderately important. The rate of those who said that this issue was not given any importance or some importance was 6% (n=32). Of the students, 20.7% (n=111) reported that they voluntarily participated in scientific research outside the compulsory courses at the faculty of medicine. Of those who voluntarily participated in a scientific study, 19.3% (n=21) reported that they had to leave the study at the end of the study. While 39.9% (n=210) of the participants reported that they would definitely participate in an elective course/internship to improve their research skills, 48.1% (n=253) were undecided and 12% (n=63) stated that they would definitely not choose this course/internship.

The status of students regarding the products of scientific research in which they compulsorily or voluntarily participated during their education at the Faculty of Medicine is as follows: 34.6% (n=183) reported that their research was presented as a paper in a congress other than MaSCo, 16.8% (n=88) published articles in national journals, and 13.2% (n=69) published articles in international journals.

Table 2 shows the extent to which the participants agree with the statements that include several variables that may be related to the motivation to conduct scientific research. Table 3 shows the evaluations made by the students considering the courses (ICP research, elective courses, etc.) they are taking at our medical faculty that involve planning, conducting, and evaluating scientific research.

### Analyses of the Participants' Data According to Their Education Periods

Of the participants, 365 were preclinical semester students (2nd grade: 182 and 3rd grade: 183) and 178 were clinical semester students (4th

**Table 1. Participants' career planning intentions**

| Questions | I don't think about it at all | | I am not sure | | I definitely think (d) | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Intention to conduct scientific research when starting medical school | 108 | 19.9 | 184 | 33.9 | 250 | 46.1 |
| Planning to study abroad for a specialization/academic career | 34 | 6.3 | 147 | 27.1 | 362 | 66.7 |
| Plans to pursue an academic career (e.g. conducting and publishing research after faculty, becoming an associate professor or professor) | 52 | 9.6 | 156 | 28.8 | 334 | 61.6 |

grade: 56 and 5th grade: 122). Gender distribution ratios did not differ significantly by semester (p=0.354). Clinical semester students found their English language proficiency higher than that of preclinical semester students in terms of both reading/understanding articles and presenting scientific research orally (Table 4).

The importance given to scientific research skills in the MITF curriculum was found to be higher in preclinical period students than in clinical period students (p=0.032). 72.8% (n=249) of preclinical students and 70.7% (n=116) of clinical students did not take part in scientific research before starting medical school (p=0.672). The rate of voluntary participation in a scientific study other than compulsory courses was higher in clinical semester students (34.1%, n=60) than in preclinical semester students (14.1%, n=51) (p=0.001). Among those who voluntarily participated in scientific research, the rate of dropout before the end of the study was 10.2% (n=5) for the preclinical period and 26.7% (n=16) for the clinical period (p=0.049). The responses did not differ by semester in terms of whether the students would prefer an elective course/internship to improve their scientific research skills (p=0.555).

Table 5 shows the results of the studies conducted by the students during their medical education according to the semesters. Clinical semester students are more likely to present their research results orally at a congress other than MaSCo (p=0.001), to publish national (p=0.001) and international (p=0.001) articles than preclinical semester students.

When the participants were asked to what extent they agreed with some variables that may be related to the motivation to conduct a scientific research, the students in the preclinical group agreed more strongly with the statement that "Making a joint decision by taking my preference into consideration while determining the research topic increases my willingness to conduct research" (p=0.013) and "Facilitating the Ethics Committee Approval process increases the willingness to participate in research" (p=0.004) than the students in the clinical group.

The evaluations of the groups based on the scientific research courses they were taking at our medical faculty were compared according to semesters. Students in the clinical group were more likely to agree than students in the preclinical group with the statements that students' opinions were given importance in the management of the research process (p=0.043), sufficient time was allocated in the program for the

**Table 2. Variables related to participants' motivation to conduct scientific research**

| Questions | Strongly disagree | | Disagree | | Undecided | | I agree | | Totally agree | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % | n | % |
| Making a joint decision by taking my preferences into consideration when determining the research topic increases my willingness to conduct research. | 4 | 0.7 | 15 | 2.8 | 18 | 3.3 | 217 | 40.3 | 285 | 52.9 | 539 | 100 |
| Being able to meet regularly with my research advisor increases my willingness to participate in research. | 1 | 0.2 | 13 | 2.4 | 22 | 4.1 | 185 | 34.4 | 317 | 58.9 | 538 | 100 |
| Facilitating the Ethics Committee Approval process increases the willingness to participate in research | 5 | 0.9 | 13 | 2.4 | 27 | 5.0 | 142 | 26.4 | 351 | 65.2 | 538 | 100 |
| Providing research support/scholarship increases my willingness to participate in research. | 6 | 1.1 | 6 | 1.1 | 36 | 6.7 | 112 | 21.0 | 374 | 70.0 | 534 | 100 |
| The opportunity to conduct research in the field in which I want to advance in my career increases my desire to conduct research. | 2 | 0.4 | 11 | 2.0 | 20 | 3.7 | 117 | 21.7 | 388 | 72.1 | 538 | 100 |
| Research is advantageous for a medical career. | 2 | 0.4 | 12 | 2.3 | 40 | 7.5 | 151 | 28.3 | 328 | 61.5 | 533 | 100 |
| It is difficult to combine a research career with a clinical career. | 13 | 2.5 | 46 | 8.7 | 159 | 30.1 | 183 | 34.6 | 128 | 24.2 | 529 | 100 |
| Conducting research while studying is only an option for students who want a successful, elite, andacademic career. | 80 | 15.0 | 196 | 36.6 | 124 | 23.2 | 74 | 13.8 | 61 | 11.4 | 535 | 100 |
| Providing statistics training as part of the training increases my willingness to participate in research | 29 | 5.4 | 67 | 12.5 | 126 | 23.5 | 166 | 30.9 | 149 | 27.7 | 537 | 100 |
| Receiving regular feedback on the progress of my ability to conduct research increases my desire to conduct research. | 3 | 0.6 | 11 | 2.1 | 69 | 12.9 | 228 | 42.5 | 225 | 42.0 | 536 | 100 |
| When the research is completed, the feeling of accomplishment makes me want to conduct more research. | 5 | 0.9 | 13 | 2.4 | 35 | 6.5 | 159 | 29.7 | 324 | 60.4 | 536 | 100 |
| Conducting the research as a group with friends makes me enjoy the research process more. | 29 | 5.4 | 43 | 8.0 | 91 | 17.0 | 172 | 32.1 | 201 | 37.5 | 536 | 100 |
| Having people around me who are role models for research (family members, educators, counselors, etc.) increases my desire to conduct research. | 5 | 0.9 | 11 | 2.0 | 46 | 8.5 | 177 | 32.8 | 300 | 55.7 | 539 | 100 |
| The idea that I can contribute to scientific knowledge by conducting research increases my desire to conduct research. | 9 | 1.7 | 18 | 3.4 | 58 | 10.8 | 191 | 35.6 | 261 | 48.6 | 537 | 100 |
| Identifying with a research career and conducting research with a higher sense of purpose, such as the pursuit of scientific knowledge, increases my desire for research. | 11 | 2.1 | 21 | 3.9 | 81 | 15.1 | 182 | 34.0 | 241 | 45.0 | 536 | 100 |

processes related to the completion of the research (p=0.001), time was allocated in the training program especially for the interaction of students in the group and students and advisors (p=0.001), and participation in MaSCo supported the student's self-confidence in the subject (p=0.009).

## Discussion

### Career Plans and Mandatory Research Activities

One of the common aspects touched upon by medical education studies is the interest and positive attitude expressed by medical students toward research (1,2,7,10). In this study, approximately half of the students reported that they intended to conduct scientific research when they entered the faculty, and two-thirds of them even reported that they aimed to pursue an academic career. In this sense, knowing the career plans and profiles of students regarding scientific research at the time they entered the faculty is important to support the motivation and competencies to conduct scientific research in the education program and to implement practices that increase the motivation, knowledge, and practice of those who have deficiencies in this regard (3,7,10-12). Rosenkranz et al. (1) reported that students who completed a compulsory research project significantly increased their intention to conduct research in the future. As stated in the review of Stone et al. (7), the number of physician scientists is decreasing, and to prevent this, it is recommended to develop a national research program (13), encourage voluntary participation in research (14), and organize workshops and research courses (15). Studies have recommended mandatory research activities in the education programs of medical faculties (1,4,16). achieving the task of managing a compulsory research project at the faculty increases participation in elective activities related to the subject with the confidence it gives to the individual (1). In this study, more than half of the participants reported that being able to share their research products in a scientific environment increased their confidence and made them realize the importance of evidence-based medicine. More than two-thirds of the students who participated in the study are aware that specific applications with scientific content are important at the faculty. The results of the study show that the research products of the students are not limited to the national MaSCo in line with the practices that are compulsory in the faculty and cover both the clinical and preclinical period, but they also participate in congresses other than MaSCo, and even their studies are transformed into national and international publications. It has been reported that the involvement of medical students in scientific research occurs mostly during their connection with clinical practice (1,2,17,18). As reported in other studies, it was observed in our study that students were more involved in scientific research in the clinical practice environment. In particular,

**Table 3. Please indicate to what extent you agree with the following statements considering the courses you have taken at the faculty of medicine (research, elective courses, etc.) that include planning, conducting, and evaluating scientific research**

| Questions | None | | A little bit | | Middle | | Quite a lot | | Extremely | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % | n | % |
| Our ideas about what/how we want to conduct the research are valued. | 25 | 4.6 | 48 | 8.9 | 167 | 30.8 | 208 | 38.4 | 94 | 17.3 | 542 | 100 |
| Sufficient time is given for planning the research, reviewing the literature, and managing the process. | 33 | 6.1 | 67 | 12.4 | 180 | 33.3 | 185 | 34.2 | 76 | 14.0 | 541 | 100 |
| When planning and conducting a research project, sufficient time is given for students to discuss and exchange ideas among themselves and with the supervisor. | 19 | 3.5 | 84 | 15.5 | 164 | 30.3 | 195 | 36.0 | 79 | 14.6 | 541 | 100 |
| During research planning and execution, no matter how senior, experienced, etc. the consultant may be, we are made to feel that we are equal to those conducting the research. | 45 | 8.3 | 74 | 13.7 | 136 | 25.1 | 177 | 32.7 | 109 | 20.1 | 541 | 100 |
| During the Medical Student Congress, students' self-confidence and awareness of the importance of evidence-based medicine increased with the inclusion of oral presentations, poster preparation, and research. | 19 | 3.5 | 40 | 7.4 | 105 | 19.4 | 201 | 37.2 | 175 | 32.4 | 540 | 100 |
| Gaining experience of working in a group and seeing the positive and negative aspects of working in a group contributes to participation in future teamwork environments. | 7 | 1.3 | 27 | 5.0 | 69 | 12.8 | 223 | 41.2 | 215 | 39.7 | 541 | 100 |
| The fact that the group members in the research group do not support the study at the same level reduces my motivation to work. | 12 | 2.2 | 26 | 4.8 | 55 | 10.2 | 125 | 23.1 | 323 | 59.7 | 541 | 100 |
| The pressure of grades in this program puts stress on us. | 15 | 2.8 | 27 | 5.0 | 87 | 16.3 | 127 | 23.7 | 279 | 52.1 | 535 | 100 |
| In the research planning/execution/interpretation stages, we receive suggestions and encouragement from the advisor at points where we are not organized or do not know what to do. | 25 | 4.6 | 67 | 12.5 | 127 | 23.6 | 183 | 34.0 | 136 | 25.3 | 538 | 100 |
| I think the senior people with whom we conducted the research generally empathized with us about what we went through during the research process. | 56 | 10.4 | 103 | 19.1 | 142 | 26.3 | 135 | 25.0 | 103 | 19.1 | 539 | 100 |
| The person advising, who is senior in research, explains to us the logic of what he/she is asking/recommending. | 28 | 5.2 | 57 | 10.6 | 131 | 24.3 | 189 | 35.1 | 134 | 24.9 | 539 | 100 |
| We receive effective feedback on our progress in planning and conducting research. | 36 | 6.7 | 84 | 15.6 | 141 | 26.2 | 171 | 31.7 | 107 | 19.9 | 539 | 100 |

clinical semester students tend to carry out research projects outside the compulsory courses.

**Motivation to conduct scientific research:** Self-determination theory Kusurkar et al. (2) categorized motivational factors into those that can be manipulated by curriculum developers, including the concepts of autonomy, competence, and relatedness, and those that cannot be manipulated, such as gender, previous educational experience, and socio-economic status. Using the framework of these authors and Rosenkranz et al. (1), the study data related to students' motivation for research and their experiences in curriculum implementation can be interpreted as follows:

Mandatory research activities can be sustained by providing students with choices in selecting topics, advisors, and group members, and can be further enhanced through elective research opportunities (1). Providing such a choice by instructors or educational programmers can increase motivation by supporting the autonomy element of self-determination and support course-related competencies (2,9,19). In our study, especially the students in the preclinical group agreed more intensely with the idea that making a joint decision by considering the student's opinion while determining the research topic would increase their desire to do research. Students, with preclinical period students being more so, stated that their opinions on what/how to do during the research were given importance within the education program. The possibility of choice in the research curriculum should be carefully evaluated because such options, which sometimes contradict one another, can either enhance or limit students' skills, especially in realizing their needs for autonomy and competence (4,20,21). In our study, students stated that offering research opportunities suitable for the specialty they would like to choose in the future would increase their research motivation.

If scientific research is a part of the curriculum, the time limitation in the curriculum should be considered. Having a planned research calendar and following it is important in time management. In this study, approximately half of the participants strongly agreed that they were allocated enough time for the research planning process and for discussion with the group and the supervisor during the process. The training program may need to be revised to make room for such activities.

When the students' responses are evaluated, changes can be made in the program to balance external motivation. Many students found it motivating to facilitate the ethics committee approval process and to provide research award scholarships. In line with these expectations, the program could consider establishing a separate ethics committee commission that evaluates proposals for compulsory research courses. It may also be planned to provide students with additional counseling services that are more effective and supportive of their competencies, especially during the ethics committee application period. Students in the preclinical group were more likely to agree with this statement than those in the clinical group.

Many medical students may lack the ability to conduct research during their undergraduate education (7,22,23), and this deficiency may be associated with low motivation and low self-efficacy (22). Therefore, lack of experience and training on this subject are among the barriers to students' participation in research (1,7,10,24). In this study, the students' expectation of convenience may also be due to the fact that they do not find themselves competent in such bureaucratic procedures. On the other hand, most of the participants think that conducting scientific research is advantageous for a medical career despite the difficulties they may have experienced, and they do not believe that only a certain

**Table 4. Assessing the ability to use English for scientific purposes**

| Period | Preclinical period | | Clinical period | |
|---|---|---|---|---|
| **Reading/understanding articles** | **n** | **%** | **n** | **%** |
| Very weak | 3 | 0.8 | 2 | 1.1 |
| Weak | 16 | 4.4 | 4 | 2.3 |
| Middle | 89 | 24.5 | 21 | 11.9 |
| Good | 185 | 51.0 | 83 | 47.2 |
| Excellent | 70 | 19.3 | 66 | 37.5 |
| Total | 363 | 100 | 176 | 100 |
| U=24218.0, z=-4.93, p=0.001 | Median=4 | | Median=4 | |
| **Oral research presentation** | **n** | **%** | **n** | **%** |
| Very weak | 222 | 6.1 | 5 | 2.8 |
| Weak | 69 | 19.0 | 23 | 13.1 |
| Middle | 131 | 36.1 | 53 | 30.1 |
| Good | 98 | 27.0 | 63 | 35.8 |
| Excellent | 43 | 11.8 | 32 | 18.2 |
| Total | 363 | 100 | 176 | 100 |
| U=26238.0, z=-3.49, p=0.001 | Median=3 | | Median=4 | |

**Table 5. Products of students' work during their medical education by semester**

| Period | Preclinical period | | | | | | Clinical period | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | There is | | No | | Total | | There is | | No | | Total | |
| **Product** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** |
| Oral poster except for MaSCo | 101 | 28.5 | 253 | 71.5 | 354 | 100 | 82 | 46.9 | 93 | 53.1 | 175 | 100 |
| $X^2(1)=17.38$, p=0.001 | | | | | | | | | | | | |
| National article | 43 | 12.3 | 307 | 87.7 | 350 | 100 | 45 | 26.0 | 128 | 74.0 | 173 | 100 |
| $X^2(1)=15.58$, p=0.001 | | | | | | | | | | | | |
| International article | 37 | 10.6 | 313 | 89.4 | 350 | 100 | 32 | 18.5 | 141 | 81.5 | 173 | 100 |
| $X^2(1)=6.35$, p=0.014 | | | | | | | | | | | | |

MaSCo: Marmara Student Congress

group of students can conduct scientific research. In accordance with previous studies (7,25-28), we also found that receiving regular feedback and supporting the process with statistics courses were mostly motivating, but they believed that it was difficult to perform clinical work and research together.

Being able to work in a team is among the professional competencies that medical students need to develop. In the compulsory scientific research training program at the MUMF, students work in groups, performance evaluations are assessed both individually and as a group, and teamwork processes are supported in these practices. This structure is closely related to the relatedness element of self-determination theory: individuals go through a process in which they establish intense relationships with both their teammates and supervisors. In our study, as in other studies, most of the students reported that they enjoyed the research process more when the research was conducted with friends and that the group experience could contribute to future teamwork (1,4). On the other hand, the fact that the group members in the research group did not support the study at the same level decreased their motivation to study. At this point, it can be suggested that the contribution of each group member in the program should be evaluated by the advisor and its contribution to the final grade obtained from the course should be increased.

Increasing clinical interest and awareness of one's researcher identity can be accelerated by connecting with a person to whom the student can relate, such as a role model, mentor, or advisor (1,3,10,29). In the present study, students reported that the advisor explained the logic of what the students wanted to do and that they could get encouragement and suggestions from the advisor when they got stuck in the research process. On the other hand, only about half of the participants reported that they felt equal to their advisor in the process, that they felt that the advisor empathized with them, and that they were able to receive effective feedback on the process. In this respect, it may be considered to conduct qualitative studies to understand the reasons for the feeling of lack of empathy in the program and to support faculty members with training of trainers based on these findings.

## Conclusion

This study suggests that incorporating compulsory, well-supported research activities that integrate evidence-based medicine and scientific research into pre-graduate medical education may encourage students to consider research careers. Additionally, presenting their work at student congresses appears to increase their confidence and appreciation of the importance of evidence-based medicine. Student willingness to participate in research may be enhanced when their research subject preferences and original ideas are considered, adequate time for research is provided, group work is encouraged, effective counseling is available, and the Ethics Committee approval process is facilitated.

**Ethics Committee Approval:** The study was conducted in accordance with the Declaration of Helsinki with the permission of Marmara University Faculty of Medicine Ethics Committee (protocol code: 09.2019.1046, date: 06.12.2019).

**Informed Consent:** It was obtained.

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