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ABOUT WOMEN'S UNDERREPRESENTATION IN SCIENCE

A. Kussaiynkyzy
Narxoz University, Almaty, Republic of Kazakhstan

ABSTRACT

Purpose of the research: The study aims to discover factors that predict students interest in pursuing science, technology, engineering, and mathematics (STEM) fields in relation to their academic background. Participants were 109 female students from STEM fields. Expectations and self-efficacy beliefs positively correlate with students choosing STEM fields, but did not differentiate between their interests in the fields of study.

Methodology: The research was carried out using a qualitative approach and involved conducting semi-structured interviews.

Originality / value of the research: to examine this potential effect, self-determination theory was used to frame how the learning context influences the social and motivational outcomes of a STEM program for youth.

Findings: reinforce the instrumental role of students' positive perceptions of teachers in fostering a more desirable self-determined motivation for STEM program participation. STEM programs must consider and integrate new approaches that mitigate the negative impact of established structures and processes on student motivation for these programs and, potentially, interest in STEM careers.

Keywords – STEM, gender inequality, graduates, motivation, grades, profession.

ҒЫЛЫМ САЛАСЫНДАҒЫ ӘЙЕЛДЕРДІҢ ҮЛЕСІНІҢ ТӨМЕНДІГІ ТУРАЛЫ

А. Құсайынқызы
Нархоз Университеті, Алматы, Қазақстан Республикасы

АҢДАТПА

Зерттеудің мақсаты – ғылым, технология, инженеринг және математика (STEM) салаларындағы мамандықтарды қыздардың сирек таңдау себептерін анықтау мен факторларды сыныптау. Сауалнамаға қатысқан техникалық мамандықтарда оқитын 109 қыз студенттердің сауалнамаларының нәтижелеріне сәйкес, респонденттердің STEM саласына қызығушылығы олардың оқу тәжірибесі мен қоршаған ортаның пікіріне тікелей қатысты екендіктерін көрсетті.

Әдіснамасы – зерттеу барысында қолданылған әдістер: электронды сауалнама және бетпе-бет сұхбат (интервью).

Зерттеудің бірегейлігі / құндылығы – жұмыстың ерекшелігі инновациялық саладағы әйелдердің жұмыспен қамтылу мәселелерін студенттердің мамандық

таңдауымен және мемлекеттік жұмыспен қамту бағдарламаларымен байланыстыра осы саладағы кемшіліктерді анықтау мен мемлекеттік органдарға ұсыныс даярлау.

Зерттеу нәтижелері – зерттеу нәтиелері мен қорытындысына сәйкес, қазақстандық инновациялық саладағы мамандардың тапшылығы болмас үшін, білім беру саласындағы инновациялық мамандықтарға қыз балаларды тарту бойынша мемлекеттік бағдарламаның қажеттілігін көрсетті.

Түйін сөздер: STEM, гендерлік теңдік, мектеп бітірушілер, ынталандыру, оқу үлгерімі, мамандық.

О НЕДОПРЕДСТАВЛЕННОСТИ ЖЕНЩИН В НАУКЕ

А. Кусайынкызы
Университет Нархоз, Алматы, Республика Казахстан

АННОТАЦИЯ

Цель исследования – изучение факторов, которые предсказывают интерес студентов к изучению областей науки, техники, инженерии и математики (STEM) в зависимости от их социально-экономического положения. Результаты анализа ответов на опрос 109 студентов девушек технических специальностей показывают, что опыт обучения в STEM положительно связан с интересом студентов к изучению областей STEM. Ожидаемые результаты и убеждения в собственной эффективности положительно коррелируют со студентами, вступающими в области STEM, но не различают их интересы в областях обучения.

Методология – с практической точки зрения были использованы самые популярные варианты опросов: анкеты и интервью.

Оригинальность / ценность исследования – для изучения этого потенциального эффекта была использована теория самоопределения, чтобы определить, как контекст обучения влияет на социальные и мотивационные результаты программы STEM для молодежи с недостаточным уровнем обеспеченности услугами.

Результаты исследования – усилить инструментальную роль позитивного восприятия учителей учителями в поощрении более желательной самостоятельной мотивации для участия в программе STEM. Кроме того, программы STEM должны учитывать и интегрировать новые подходы, которые смягчают негативное влияние установленных структур и процессов на мотивацию учащихся для этих программ и, возможно, интерес к карьере STEM.

Ключевые слова – STEM, гендерное равенство, выпускники школ,мотивация, успеваемость, профессия.

INTRODUCTION

It is anticipated that in next two years, an extra 2.5 million graduates with science, technology, engineering and mathematics (STEM) degrees will be required

globally, in spite of the fact that there is a setback of around 40,000 STEM graduates per year. Several strategies have been suggested to address this deficit, one of which includes providing STEM outreach activities for school, including STEM mentors, STEM workshops, interactive master classes and competitions about STEM careers. However, there has been very little research that has examined different perspectives and investigated approaches to enhance the STEM outreach among women [1].

There is a strong focus towards guaranteeing the next generation of professionals incorporates a substantial proportion with strong STEM skills. As studies show that a lack of STEM professionals can negatively affect the economy, research, development and global competitiveness of the state [2].

The subject of gender equality in Kazakhstan became very popular after the President of Kazakhstan signed "On ratification of the Convention on Equal Treatment and Equal Opportunities for Men and Women Workers: Workers with Family Responsibilities (ILO Convention 156). However, change toward equality continues to be slow. Examining micro-level connections at the meso- levels of society- specifically in the institution of the university—can shed light on the diffusion of egalitarian norms and the institutional mechanisms that constrain or encourage improvements in gender inequality in science.

For generation of young Kazakhstan citizens the subject of a gender is associated with women's issues. The international and domestic experts imply such status of society when men and women have approximately equal shares in the social power and equal access to public resources (material, financial, information, cultural, natural, etc.) [3].

Although, the difference between men's and women's positions in the country still exists. The equal rights guaranteed by the Constitution are not reinforced by the guaranteed opportunities. Lack of women at decision-making level, i.e. there are no women at high positions, there is a gender inequality in the labor market.

The gender inequality hinders with formation of the full-fledged types of social activities considering the experience of both men and women, so, limited involvement of women in political life, discharge of women from the power at any level will restrict efficiency of the state and its policy.

Women's participation in the labor market is 65.4% compared to 76.7% of men, and women make up 38.6% of Kazakhstan's GDP. [4]. The official labor market in Kazakhstan reflects professional segregation, with women making up 70% of the workforce in traditional "women" sectors, such as education and health. Other sectors, such as food services, the hospitality industry, financial services and insurance, also account for a high proportion of female workers. Sectors where men work at a high level, with the highest paid jobs, are the most profitable. [5].

Kazakhstan's average reading and science indicators in 2018 were close to the level observed in 2009, when the country first participated in PISA. On the contrary, in mathematics, average productivity showed significant improvements compared to 2009 levels [6]. The results in mathematics have improved, especially among the most productive students; and the percentage of students who have completed grades 5 or 6 in mathematics has increased by 1 percentage point between 2012 and 2018. At the same time, reading and science rates declined among the highest performing students.

Table 1 – Female share of graduates from STEM in Kazakhstan

Series Name	2016	2017	2018	2019
Female share of graduates from Science, Technology, Engineering and Mathematics (STEM) programmes, tertiary (%)	35.05	33.09	32.87	..
Note – compiled by the authors based on Data from database of Gender Statistics				

Socioeconomic status has been a strong predictor of math and science performance in all PISA member countries. This explains the 2 % difference in maths in PISA 2018 in Kazakhstan (compared to 14 % on average for the OECD countries) and 3 % of the differences in academic performance (compared to the OECD average of 13 % differences) [7].

In the course of recent decades, scientists from psychology, economics, sociology and other different disciplines have attempted to comprehend why women are under-represented in STEM field. According to Blau and Kahn, one of the main causes of the gender wage gap is male-female sorting into different degrees also corresponding professions, this is why motivating female students into STEM fields has become a vital policy of our state. Despite the higher education levels of women compared to men, the majority of the female labour force is predominantly concentrated in three low-paid sectors such: an education, health and services. Men are concentrated in STEM fields such as hydrocarbon, transport and energy industries [8].

There is a high share of those who have acquired STEM degrees out of "inadequacy", the lack of other alternatives or the opportunity to study on a state grant. For 34 % of graduate students, 41 % of undergraduate students and 56 % of parents's choice of their children's profession was not the main and priority. The reason for this is a low passing score on STEM degrees and low qualification requirements for work.

A significant part of STEM students consider their profession as a short-term career: in the next 5 years of their profession, 58 % of students in STEM fields and 21 % of parents.

In Kazakhstan, at the moment, there are only few studies aimed at revealing the professional motivation of female students at STEM fields. This research allowed us to find out why young women choose the profession of STEM fields and what motivates them to stay in it. The results of the research will serve as a basis for the development of scientifically based decisions to increase the attractiveness of the STEM degree, as well as to strengthen the professionalism and support of the STEM fields.

Despite the current growing popularity of the STEM degrees, women remain underrepresented in the field, continuing to earn only 16 % of bachelor's (men 40 %) degrees in Kazakhstan. Understanding women's low rates of participation in STEM fields is vital given that the demand for individuals with STEM training has grown recently. Attracting and retaining more women to high-paying fields like STEM may also help narrow the gender pay gap in Kazakhstan. It will be expected that by 2022,

an additional 2,5 million workers trained with STEM skills will be required in the global market, however there are around 40,000 STEM graduates per year [9].

Several strategies have been suggested by policy makers and researchers to tackle this problem, one of them includes providing STEM propaganda for school pupils, including interactive STEM activities, competitions and talks about STEM careers. Mostly, the main subject of gender research in Kazakhstan is the ethical, historical and cultural aspects of the women's role in the development of the society, while their impact in the economic development of the state is being discussed less. Women represent 70 % of all employees in sectors that are traditionally feminised, where the prevalence of low-paying wages is high.

Because women are underrepresented in the workforce in most countries, they are a significant source of untapped talent. According to WorkplaceTrends.com and Saba data, women comprise less than 40 percent of the global workforce in 2018 and the World Economic Forum's Future of Jobs report notes that women hold fewer line roles across multiple industries [10].

For example, in Kazakhstan, only 2,5 women out of ten or only 25% chose the STEM fields as a workplace. [11].

For example, according to Kazakhstan's data from World Bank Gender Statistics data, Female share of graduates in Kazakhstan indicated in Figure 1, which had been decreased from 35 % in 2015 to 32 % in 2018. indicate that women make up 60.2 % of students in Master's programmes and 61.7 % of doctoral students (the OECD reported a slightly higher rate of Master's students at 64 % and a slightly lower rate of doctoral students at 58 %) [12].

THE MAIN PART OF THE STUDY

Methods of achievement of gender equality differ depending on many social, economic, political and cultural factors, characteristic for this society. Feminists see the reason of a social inequality particularly in the subordinate position of women, in exploiter entity of capitalist or patriarchal systems, i.e. the gender is aspect of class stratification. They believe that only with liquidation of the system, there is a solution of the women's problem of unequal position.

The purpose of this research is to identify the factors influencing the motivation of young women in the STEM fields of Kazakhstan, as well as the factors influencing their decision to continue their professional activities, non-professional activities and prejudices, the status of the STEM profession.

The study included the participation of 1-4 year students and masters of STEM fields, as well as a teachers and parents. For the collection of data in the survey used a mixed method. In the formation of quantitative data, a random selection of respondents was carried out. The target selection is used for the collection of quality data.

Besides, the inclusion in the selection of students of STEM colleges allowed to find the motivation to choose a profession and the desire to stay in another target group and enrich the received data.

Carrying out in-depth research in a specific context allowed to understand, to what extent the context and climate of this or that University has an impact, the effect

is greater understanding of the factors of influence on the motivation of female students to choose STEM profession and to stay in it.

The survey also included the participation of 12 master's program students from among active STEM workers. This category of respondents was included in the analysis for obtaining more complete pictures of opinions about the pros and cons of the STEM profession, in particular, it concerns questions about the conditions of the STEM work and the status of the STEM profession.

The aim of this research:

1. To determine the factors influencing the choice of the profession of STEM as a career for students of 1-4th courses and undergraduates of STEM fields, as well as the degree of influence of the identified factors.

2. Determine the factors influenced by the choice of the profession of a teacher as a career of STEM teachers, as well as the degree of influence of the identified factors.

3. To determine the factors influencing the motivation of 1-4th year students, undergraduates and teachers to continue their professional activity as a STEM teacher.

4. To study the opinion of parents about the factors that influence the choice of young women in the STEM fields and to continue their professional activity.

5. Develop recommendations for resolving identified problems with the aim of increasing the attractiveness of STEM fields and retention of women in the profession, as well as strengthening professionalism and support of the female STEM girls of the country.

The subject of this research: factors influencing the choice of young women of Kazakhstan STEM degrees, as well as factors influencing their decision to continue professional activity.

The choice of a person's profession is influenced by individual, as well as external factors, for example, social and economic [13]. Conscious career choice, as a rule, is based on internal motivation and understanding of their needs, interests, capabilities, skills and values.

Understanding the reasons for choosing a profession is critically important. This question acquires even greater importance when it comes to speaking about women in STEM, as teachers play a key role in shaping the future generation [14].

A review of the literature testifies to the fact that motivation affects the type, duration and degree of involvement of women in this or that activity. In this connection, the motivation can determine whether the candidate will go to the profession of STEM, as long as he stays in it, and to what degree he will be focused on his professional activity [15].

Intrinsic, altruistic and external types of motivation are highlighted as the main reasons for choosing STEM degree. Youth can also choose the profession of STEM as a career under the influence of the surrounding people: parents, teachers, peers and so on. Determining the motivation of choosing a profession by teachers and reasons for which they remain in the profession, are an important step in the light of many solutions to problems and challenges, which are faced by women. In this study, three main types of motivation, influencing the choice of the profession of the STEM students and the

desire to remain in the profession: altruistic-internal, external motivation and social influence.

Altruistic intrinsic motivation. The analysis of the earlier studies testifies to the fact that altruistic and intrinsic motivations are the main reasons for choosing candidates for the STEM degrees.

The development and formation of altruistic-internal motivation is very important, as it contributes to greater satisfaction of labor. Besides, STEM workers who have this kind of motivation are more likely to stay in the profession [16].

External motivation. Under external motivation is understood the desire to choose the STEM field, based on such external factors as the availability of guaranteed work, more convenient conditions of work [17].

Influence of surroundings. The influence of the people surrounding the choice of profession is also one of the dominant factors influencing the choice of the STEM profession. Under the surrounding people are meant parents, teachers, partners, colleagues and other persons. Daniel and Farrell note that the influence of parents on the choice of children's specialisation is reduced. Many studies show that former teachers play a significant role in the selection of candidates for the profession of teacher [18]. This conceptual framework is the basis of the current research. The methodological part of the study is presented in more detail below.

Methodology. The current survey was conducted through a survey of students of 1-4 courses and undergraduates of STEM degrees of universities. Also to get a wider picture of the data conducted interviews with teachers and parents.

Thus, the triangulation of data is carried out at two levels.

In the first place, the triangulation was carried out by studying the views of various interested persons on the factors of influence on the attraction of interest. The purpose of triangulation is to study the question from different angles and perspectives, to prevent misunderstandings in the interpretation of data and to achieve maximum objectivity in the presentation of results.

Second, the triangulation of data is carried out using a mixed method of research – a questionnaire online survey and interview. The benefits of such triangulation include increasing self-confidence in the results of research and ensuring a more detailed understanding of the problem [19]. These benefits are due in large part to the diversity and quantity of data that can be used for analysis.

Population and Sample: The study also included the participation of students from 6 universities (SDU, ETU, KazNITU, KazNU, Narxoz, UIB) in Almaty. Selected universities also represent different universities of the country. The online survey involved 97 students of 1-4 courses and 12 undergraduate students.

Research tools (online questionnaires) are developed for the purpose of identifying factors influencing the choice of young women in the STEM field of Kazakhstan, as well as factors influencing their decision to continue their degree.

First of all, there was a review of the literature on the topic under study for the formation of the conceptual framework of the study.

Secondly, for the composition of online questionnaires, there was a review of the tools conducted earlier, the purpose of which was to study the motivation of STEM

students to choose their profession and the desire to work in this field. Thus, the tools of this research are based on:

- Questionnaire surveyor OECD TALIS-2018, [20].
- Questionnaires about Factors of trendy occupations (FIT-Choice. Factors of new professions) [21].

The final versions of the questionnaire consist of 27 questions for students and undergraduates and 9 questions for STEM teachers and parents. Within this sample, there were teachers who specialised in a range of subjects including biology, chemistry, physics, informatics and mathematics as a facilitator varied across the sample.

Questionnaires are kept open, as well as closed questions. Questionnaires are presented in two languages: Kazakh and Russian. The specific decision on the use of a given language in each case was determined according to the preferences of the respondent.

Analysis and processing of data to achieve statistical objectivity and reliability were carried out taking into account the specifics of the segments of the target audience and the parameters of the selected sample of each segment. The input and processing of the conducted surveys were carried out using special software SPSS.

Interviews with parents and teachers were conducted in Almaty. According to Seidman, the interview is a powerful way to get presentations on education issues through understanding the experiences of people working in this field. Interviews also allow you to improve the interpretation of the data obtained earlier [22]. The survey of the directors of the organisations of secondary education was conducted in the technique of a personal deep structured interview. A total of 5 interviews were conducted with teachers of secondary education and parents. The duration of each interview was no more than 40 minutes.

Analysis of data on the results of the interview were conducted by the method of content analysis.

RESEARCH RESULTS (CONCLUSIONS)

This study focuses only on the motivation of young female students of STEM degrees. Consequently, all the factors identified in the course of the investigation are self-determined, that is, they reflect the opinion and perception of the respondents. Moreover, this restriction is not a public one, as an application of the opinion polls, revealing the opinion and the voice of the target group, which is widely practiced in international sociological and other sociologists.

The questionnaire consisted of 27 questions, including blocks of questions to identify the degree of influence of various factors on the choice of a STEM field - external motivation (material conditions, expectation of an award), motivation coming from the influence of others (family, friends), internal altruistic motivation (the desire to make a contribution to the development of society, the desire to become an engineer, interest in the subject).

The following are the results of a survey of 1-4-year students in two key areas:

- Factors affecting motivation when choosing STEM degree;

- Factors affecting the desire to continue professional activities as STEM worker.

Table 2 – The proportion of respondents (%) who noted the great influence of the following factors on the choice of specialty.

Factors influencing interest in STEM	%
Altruistic intrinsic motivation	
Views about the future (e.g. educational/career-related goals)	58
Views about STEM subjects (e.g. interest, enjoyment, perceived difficulty of subject).	40
Self-esteem/confidence/ achievements in this field	26
Cognitive preferences	29
Serving to the community	19
Social contribution to the development of our society	11
External motivation	
National or regional level factors (easier to get a grant)	69
Cultural influences (e.g. views about family heritage)	16
High income	58
Stable career growth	23
Labour market demand	53
Optimal balance of time for work and family	39
Influence of surroundings	
Family influences (e.g. sex-stereotyped attitudes about careers or practical advice/encouragement)	41
STEM qualifications are recognised everywhere/ options to immigrate to another country	68
Teachers/other school staff influences	22
Peer influences	11
School-level factors (e.g. school type)	8
Did not enter the grant for the specialty of their first choice	49
Note – compiled by the authors based on findings.	

To determine the reliability of this data indicators of the Cronbach coefficient were obtained, which shows that the internal consistency of the description of one object [23].

The value of the Cronbach coefficient alpha (α) above .90, means very high reliability; α between .80 - .90 indicates good reliability; α in the range from .70 to .79 indicates that the value is reliable; if the coefficient value falls within the range of .60-.69, then the reliability is minimal; α <0.60 indicates unacceptably low reliability [24]. Thus, the tools used in the survey proved its reliability for determining the motivation of the students surveyed [25].

This means that external motivation and influence of surroundings played a decisive role in motivation when choosing STEM degree by representatives of the female students. The second most important aspect of influence was the altruistic intrinsic motivation.

Intrinsic motivation does not come from the expected result, but from the process, which for the subject itself is a reward. Here, for a person, internal satisfaction from activity, interest, positive impressions are more important [26]. In the case of future STEM workers, this is the perception of STEM professionals as a noble and important profession for society, and the internally high value of this profession for an individual student [27].

“How do I feel about myself” - when making decisions, this question is subconsciously asked by people guided by altruistic motivation. Representatives of this category primarily seek to make a choice that will raise them in their own eyes, as well as in the eyes of society. To a large extent, such people can be called altruists, since the most acceptable act for society, as a rule, is an action aimed at the benefit of other people.

Taking into account the age of school graduates, the eleven-year-old being under the care of school teachers and the general influence of the family on the choice of young people, it is not surprising that international studies have repeatedly noted the weight of the opinions of the immediate environment for the professional choice of applicants [28].

The formation of the external motivation of the subject is mainly affected by the expectation of a reward - the focus is the final result of the activity. The level of external motivation is primarily affected by the perceived attractiveness of the goal (its value) and the level of a person’s confidence in the ability to achieve this goal [26]. So, if a person perceives a certain goal as one that she can do, the goal itself will become more attractive to him. In our case, if a student believes that STEM degree will allow her to achieve certain generally recognised goals and believes in her abilities, it is external motivation that will prevail in her decision.

It is no secret that the possibility of obtaining free education is one of the key reasons that both applicants and their parents take into account when choosing a future profession. In particular, it is precisely for STEM degrees that a large share of state grants is allocated annually, which partly motivates applicants from socially vulnerable sectors of the population to choose this particular professional direction. According to

one of the respondents opinion they also got a combination of circumstances. In general, it was not they chose the profession. The profession chose them - the grant chose so. Since they didn't apply for their specialty, it turned out that they were going to study . Also, If their daughter didn't get a grant, she would go to another profession, if there is a situation where she get paid.

Tet-a-tet interview members in response to a question about the reasons for choosing STEM degree.

According to interview results with parents and teachers, parents (69 %) and teachers (91 %) agree that STEM education do not have high- profile female role models in Kazakhstan. Almost all parents and teachers agreed, that professional experience, conversations from sector professionals and success stories from well-known tech women in STEM could help to female students.

Another problem identified during this interview: 35 % of parents and 22 % of teachers say there is no comprehensive information about STEM career opportunities for girls or even states policies do not promote STEM education among girls. Schools and educational institutions are seen as being the most effective in their activities to encourage women into STEM and are seen by young people as those with the responsibility to do this. According to our interview, they see a domino effect: when one boy sees the power in computing, he becomes a role model for his friends and community, but if girls can play in computer much better that boys, she would be respected by other boys, because computer games are for boys. Furthermore, most girls believe that jobs requiring programming are "not for them."

From interview with informatics teacher in response to a question about the computer games are for boys or girls. According to our interview, respondents daughter's physics teacher was making her build a rocket ship with some other students, so that she got interested in rocket science a little bit because she liked to build and create. But where she will be working in Baykonur?

From interview with one of the parents in response to a question about the professional future of their daughters.

It's crucial for fathers not only for mothers to step up their support. Encouragement from girls fathers have a consistently positive influence on a girl's interest and likelihood to study STEM degrees in the future according to several studies and our research results could prove it.

Girls who are encouraged by their parents and teachers are much more likely to take STEM degrees than girls who had not been encouraged by their parents and teachers.

An even bigger impact is possible when encouragement comes from both a parents and a school teachers.

One barrier in motivating the next generation of girls to work in STEM fields is not having enough female role models in. It's much easier for Kazakhstani girls to imagine a career in STEM fields if they see successful examples they can relate among tech women, female mathematicians. Having female teachers who encourage and advice girls in STEM subjects can have an even greater impact than support from their parents or state grants.

However, a significant majority of parents and teachers still believe that STEM degrees more closely fit boys' brains and their personalities and hobbies. Furthermore, 60 % of teachers and 45 % of parents perceive STEM degrees are more geared towards boys and this is why relatively few girls chose STEM degrees. A significant number of both groups (mote than 60 %) believe in stereotypical career paths, such as nursing and teaching, appeal to girls and are promoted to them.

Additionally over 75 % of parents and teachers thinks that media, state policy and marketing policies have a huge role to play in changing the gender stereotypes about STEM degrees.

Based on our research results, the following are our recommendations. according to teachers opinion, we should intervene earlier STEM subjects in the education system to predict or prevent gender gap in STEM degrees and to adjust female assumptions of STEM classes are not boring.

In order to improve parents' influence on their girls choice and promote positive changes about STEM education, parents should educate themselves more about STEM degrees and current labour market changes in Kazakstan.

Unfortunately, at the present time in Kazakhstan there is lack of system of tracking the work of graduates of STEM degrees directly in different sector. It is from time to time that this layer of data is needed for full-fledged strategic planning in part for the training of future STEM workers.

According to the research results, for 49% of graduates's choice of their profession was not the main and priority. The perception of the STEM degree as the most optimal choice for those whose priority is to receive free higher education is preserved. Such a situation is an alarming prerequisite for the deterioration in the quality of the country's STEM workers - after all, an increase in the proportion of applicants for whom STEM degree are a backup option (as opposed to the category of "consciously choosing") suggests their subsequent departure from the profession.

In other words, the results of the study recall that among the country's current STEM students there is a high proportion of those who by accident fell into this profession [29].

While the choice of a profession by most students was influenced by factors of external motivation and influence of surroundings, which can be summarised as a desire to benefit society, at the same time, most female students plan to use the STEM degree as a transitional area to another area of activity, intending to work in it for less than 1 year.

As part of its global commitment to women's economic empowerment, the Kazakhstan should increase its investment in STEM education for girls. Women are largely underrepresented in the information and communications technology (ICT) sector in Kazakhstan due to lack of access to STEM training. As innovation, automation, and new technologies change the global nature of work, girls who acquire the skills necessary to participate in the digital economy will improve their own financial literacy and self-confidence.

In order to tackle stereotypes, greater efforts must be made at school and at the broader national level. Unfortunately, young girls do not get much advice from adults about how computing can enable them to fulfill their aspirations. Steps to attract more

women teachers and parents should be accompanied by initiatives to ensure that girls–especially teachers and parents–are better informed about those people who influence, teach and guide high school girls. This could include providing teachers with real-world examples of how computing transforms different industries for their lesson plans. According to our research, having inspiring computer /coding teachers makes girls much more likely to go into computing–and if those inspiring teachers are female, the uplift is even greater. Computer science classrooms, existing public policies do not do enough to adequately measure and address the gender imbalance because they focus almost exclusively on increasing access. However, decades-old stereotypes about who can and should be an informatics scientist still prevent girls from enrolling in courses at this age, regardless of access.

For example, in Finland, STEM development of the institutional framework created in 2007. [30].

Kazakhstan has made considerable progress since the turn of the century in bringing education and labour market policies in line with international standards. In education, efforts show the gradual move away from centrally planned educational governing systems to a greater autonomy of institutions, through advisory governing boards [31].

Women's access and use of public and communicative spaces is often mediated by not only gender inequalities in our society, but also financial-economical factors, traditional divisions of labor market and social norms which exclude girls from equal participation in technology [32]. These norms in Kazakhstan are socially constructed based on historical inequalities built on relationships of domination and subordination, which translate into both the public and private realms nowadays. For example, priority of use of the household computer or other technologies by fathers, husbands and brothers or censorship of content may prevent access to communicative networks and platforms by women at home.

Given this growing communication capacity gap, the possibility that STEM education development could further rather than diminish hierarchies, be they gender relations or geopolitical, whether at a global, regional, national or local level, between populations as a whole and specific population groups (women and men, non-literate and literate populations, etc.) is cause for concern.

Nevertheless, given that STEM identity is strongly associated with STEM career intentions, researchers, practitioners, and policy makers should pay more attention to the role of talking about science and engaging young students in science media as components of programs that aim to inspire young people to pursue STEM careers. There is a need for more focused research on students' level of science discourse and usage of science media, in particular as these relate to their identity development and specific career goals. Further study should unravel the content and context of these conversations (e.g., at home with family, at museum with a friend) to better identify the characteristics of effective science talk.

Administrative control of educational program has been extricated, supported by a national demonstration of accreditation of higher instruction, with a slow move from state certification to open and proficient accreditation. Expanded efficiency within the work market has been seen beside a change in coordinating aptitudes with industry

needs. Several challenges still torment Kazakhstan's economy, such as a shortage of social inclusion within the work advertise, unequal get to instruction, limited independence and adaptability within the instruction framework and the quality of work.

For STEM education to attain its objectives and goals, tending to the boundaries to STEM instruction ought to begin by settling the issues at the primary, senior and high schools. Instruction encompasses a greater part to play for student's success in STEM field. Proficient advancement ought to be empowered and proceed to prepare instructors in viable classroom administration so as to upgrade their information within the advanced instructing STEM field.

The results of this research demonstrate that respondents perceived STEM professions as the most challenging area of study for girls. According to our respondents answers, in middle school and high school, the imbalance among STEM students continues into the university degree. Innovative jobs are the fastest growing jobs in the Republic of Kazakhstan economy and are expected to increase.

In order to tackle stereotypes, greater efforts must be made at school and at the broader national level. Unfortunately, young girls do not get much advice from adults about how computing can enable them to fulfil their aspirations. Steps to attract more women teachers and parents should be accompanied by initiatives to ensure that girls–especially teachers and parents–are better informed about those people who influence, teach and guide high school girls. This could include providing teachers with real-world examples of how STEM transforms different industries for their lesson plans. According to our research, having inspiring STEM teachers makes girls much more likely to go into computing–and if those inspiring teachers are female, the uplift is even greater. STEM classrooms, existing public policies do not do enough to adequately measure and address the gender imbalance because they focus almost exclusively on increasing access. However, decades-old stereotypes about who can and should be an informatics scientist still prevent girls from enrolling in courses at this age, regardless of access.

The respondents perceived their personal interest and ability to choose STEM degree career. On the other side, these findings contradict with some of the previous studies, which concluded that female students are less motivated and confident to study STEM.

Our study reveals that girls who are interested in studying STEM are less likely to see the subject as just for boys or think it is better for boys than girls. They do not see themselves as not sharp students comparatively with their peers. STEM teachers and other subject teachers are gatekeepers to ensure girls to choose a STEM classes and to ensure that in those classrooms they find welcoming and inclusive environment. Male students are encouraged more often than female students to pursue STEM degrees by their parents or teachers.

While there are still many open questions relating to degree follow-through and career longevity, the results of this study are very encouraging in terms of actionability. Not only do uncontrollable factors play a limited role in explaining the decision of a young woman to pursue a degree in STEM, the most important influencers are the controllable factors of encouragement and exposure.

Through research results, there are immediate and practical steps that state, schools, parents, teachers, NGOs can take to improve girls' engagement with STEM degree. These include next recommendations on promotion of STEM education in Kazakhstan as a state program:

- 2020-2022 years increasing awareness of public and interest among students in STEM fields using media promotions and partnership with other parties (state-schools- business);
- 2023-2025 years improving the quantity and quality of STEM fields using the modern versions of curriculum, teacher and mentos training systems, use of integrated and digital learning platforms;
- 2026-2028 years evaluate and verify the results of the previous two periods and be open to new ideas from educational centres.

It has been suggested to increase funding toward both research and projects aimed at understanding and promoting conversations between young girls and family/teachers/peers about STEM degrees. In particular, informal science learning institutions, like science exhibitions, expo centres, natural science museums, and scientific libraries, should be leveraged in their capacity to facilitate meaningful parent–child or father-girl and peer conversations around STEM future. These contexts have been shown to engender conversations that help girls to better understandSTEM fields.

Furthermore, we should bring attention to the accessibility of "speaking science" as an activity. In general, talking about science with friends and family does not require material resources, and supporting projects that help to foster those types of discussions would not necessarily require great financial investment. This makes promotingscience talk amenable to a variety of free-choice learning institutions and contexts. Whereas more research needs to be done on what effective science talk sounds like andhow institutions can best motivate girls to carry out conversations about science, engendering science talk can be as simple as asking participants a question.

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SUMMARY

Despite great institutional efforts to recruit female students into STEM pipeline, the number of students choosing STEM careers remains low. Using data, we estimated a model graduates choice of STEM-related careers with gender as predictors.

ТҮЙІНДЕМЕ

STEM мамандықтарына студенттерді тарту бойынша үлкен институционалдық жұмыс жүргізілгеніне қарамастан, STEM мамандықтарды таңдаған студенттердің саны әлі де аз. Деректерді қолдана отырып, біз мектеп бітірушілердің STEM-мен байланысты мамандықты таңдаудың моделіне болжам жасадық.

РЕЗЮМЕ

Несмотря на институциональные усилия по набору девушек-студентов в STEM, число студентов, выбирающих профессии, в STEM, остается низким. Используя данные, мы оценили модель выбора выпускниками профессии, связанной с STEM.

СВЕДЕНИЯ ОБ АВТОРАХ

Айгерим Кусайынкызы – докторант 2-курса по специальности «Государственное и местное управление», Университет Нархоз, Алматы, Республика Казахстан, e-mail: aigerim.kussainkyzy@narxoz.kz, ORCID: 0000-0002-9544-0628.