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Comparison of Kazakhstan and Russian university students in learning science motivation

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Abstract

Science motivation scale is a valid and reliable tool used to determine students' motivation in learning science courses. In the study, science learning motivations of students studying at Kazakhstan and Russian Universities were compared. In addition, it was also examined whether the science motivation scores of the students changed according to the demographic variables. The science motivation scale was used as a measurement tool. For statistical analysis, t-test and ANOVA from Bayesian statistics were used. As a results, the data supported the students' motivation levels a) at a high level, where they differed from the countries they studied at b) at a moderate level, where they did not differ by gender c) at a moderate level, where there was a difference in the total score according to the age group, d) at a moderate level, where there was no differentiation by departments.

Keywords: university students, learning science, Russia, Kazakhstan

INTRODUCTION

Students' prior education and experience in the area have a significant impact on the kinds of careers that interest them and motivate them to pursue such careers. The development of an interest in science is often recognized as an essential component of effective science education and the acquisition of scientific literacy (Glynn et al., 2011). Report (National Science Foundation, 2017) has highlighted the need to improve student participation and professional success in science, technology, engineering, and mathematics (STEM). It is believed that combining the arts with STEM (Scientific, Technology, Engineering, and Mathematics) will make educational scientific courses more engaging for a wider variety of pupils, even those who are not interested in STEM (Henriksen, 2014; Ng & Fergusson, 2020). Reports have highlighted the need to improve STEM (science, technology, engineering, and mathematics) student engagement and professional success (Dixon & Wendt, 2021).

Motivation is a big part of all of these things (Wolfson et al., 2014). It helps people learn science, do better in school, seek help more often, and be more dedicated. The significance of student motivation in the educational process has been the subject of a great deal of research. The vast majority of studies (Duckworth et al., 2011; Eccles & Wigfield, 2002; Potvin & Hasni, 2014; Nauzeer, & Jaunky, 2021; Sen, 2022) have shown that a positive attitude toward learning not only helps students do better in school but is also one of the most important factors that will determine how well they do in the future (Kaltakci-Gurel, 2021; van Vo & Csapó, 2021).

"Motivated" refers to someone who is "moved to do something" (Ryan & Deci, 2000), and in this context, "moved to do something" implies "moved to learn science." It is not possible to directly witness motivation; rather, it can be inferred from observed behavior or (self)

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Contribution to the literature

- This study will contribute to the learning science motivation literature in terms of examining science majors and non-science majors.
- Learning science motivation will contribute to the literature as it provides data on whether there is differentiation in the context of different countries.
- The study will add methodological diversity to the field due to the use of the Bayesian approach in the analysis.

reports (Schunk et al., 2014). According to this definition, motivation is anything that "arouses, directs, and sustains" our actions: Even if motivation can't be seen directly, it can be figured out by looking at actions or listening to words (Schumm & Bogner, 2016a). Many studies have been conducted on students' motivation to learn, and these studies show that there are many factors related to motivation. Besides intrinsic and extrinsic aspects, factors include self-perceptions of ability, effort, task value, self-efficacy, test anxiety, self-regulated learning, task orientation, and learning strategies (Deci et al., 1991; Garcia, 1995; Habtamu et al., 2022; Odabas, 2022; Ryan & Deci, 2000; Tee et al., 2018; Wicaksono et al., 2018). In the literature, there have been a number of studies relating to individual factors affecting students' motivation in science, such as home life, parental influence, and peer pressure (. Schönfelder & Bogner, 2020). Numerous studies have shown the importance of student motivation in the learning process. Positive learning motivation not only increases kids' academic performance during their school years but is also one of the most crucial elements influencing their future success, according to the majority of study (Aristeidou & Herodotou, 2020; Riswanto & Aryani, 2017; van Vo & Csapó, 2021).

The academic motivation of students is caused by relative dynamic elements that are influenced by both dispositional and environmental influences. Some aspects of motivation are a product of an individual's qualities, while others are the result of interactions—both direct and indirect—with people in their homes, schools, and communities (Anderman & Dawson, 2011; Schunk et al., 2014). The condition of being motivated to learn science is an internal one that initiates, controls, and maintains the learning behavior of science (Bryan et al., 2011; Glynn et al., 2011). Students' actions, as they relate to their academic performance in science, are influenced by their level of motivation in the subject. Learners that are intrinsically motivated will put in more effort and learn more because they are driven from within to achieve the goals that they have set for themselves (Liu, 2021; Schumm & Bogner, 2016b; Wicaksono et al., 2018).

The incentive at hand is what is commonly known as a "science motivation," which may be defined as a motivation that is associated with conducting scientific research (Wicaksono et al., 2018). Learning behavior in regard to science is initiated, led by, and maintained by a person's degree of internal motivation for science. This level of motivation is what a person considers to be most important. Learners who are motivated to study science will, at a bare minimum, have attitudes and behaviors that lead them to be involved in the process of becoming motivated in the first place. Learners who are interested in pursuing a scientific education will find that this is an excellent place for them to get started studying science (Schumm & Bogner, 2016a; Simpkins et al., 2006). Students' achievement-related actions can be influenced by their level of motivation in science (Liou, 2021; Schumm & Bogner, 2016b; Singh et al., 2002; Tekin & Muştu, 2021; Wicaksono et al., 2018). According to Van Vo and Csapó (2021), certain components of motivation are impacted by personal characteristics, while others are influenced by direct and indirect connections in families, schools, and society.

Based on Bandura's social-cognitive theory of human learning (Bandura, 1977), the Science Motivation Questionnaire II (SMQ-II) (Glynn et al., 2011) combines internal and external aspects of science motivation as an implied multi-component construct covering the following five sub-categories: Two external variables span both ends of a continuum: the desire to do something because of the expected external recompense (for example, a good school grade), and the urge to do something because the consequences are regarded to be important (for example, job prospects) (Ryan & Deci, 2000). The areas of enjoyment and interest (a subscale termed intrinsic motivation) as well as perceived self-efficacy and self-determination, which is the perceived competence in executing a task and the autonomy felt while performing it, are three internal elements that contribute to self-motivation (Ryan & Deci, 2000). We think that the subscales that deal with intrinsic motivation and self-efficacy focus on internal categories, while the subscale that deals with self-determination focuses on accomplishment behavior as an external process.

Despite the fact that boys managed slightly higher points in self-efficacy than girls and girls received higher scores on the self-determination scale, no significant gender-related differences have been found in the scales of motivation toward science (intrinsic and extrinsic motivation, self-determination, and self-efficacy) (Britner, 2008; Glynn et al., 2009; van Vo & Csapó, 2021;

Zeyer, 2010; Zeyer & Wolf, 2010). This is the case despite (Britner, 2008; Glynn et al., 2009). However, gender differences were only found to exist in the areas of self-determination (which was found to be greater in females) and self-efficacy (which was shown to be higher in boys) (Glynn et al., 2011). According to the findings of several research, males and females do not vary in terms of self-efficacy, learning environment stimulation, or active learning techniques when it comes to their levels of motivation for science (Andressa et al., 2015; Chan & Norlizah, 2017). Females, on the other hand, were discovered to be substantially more motivated in relation to scientific learning values and accomplishment goal scales (Chan & Norlizah, 2017), in addition to performance levels (Andressa et al., 2016). Other research (King & Ganotice, 2014) found that females had a superior average score on attainment objectives and on self-efficacy scales related to Earth science. This was the case despite the fact that males also participated in the studies (Britner, 2008). One further thing that was discovered was that boys have greater self-assurance in their scientific abilities than females do (Schumm & Bogner, 2016b). In light of the findings presented above, it is essential to examine the extent to which the data support the hypothesis that the motivation for scientific endeavors vary according to gender. In light of the findings presented above, it is essential to examine the extent to which the data support the hypothesis that the motivation for scientific endeavors vary according to gender.

Due to age-related modifications in students' motivating patterns, various grade levels provide somewhat distinct motivational obstacles (Wolfson et al., 2014). Empirical studies (Dorfman & Fortus, 2019; Józsa et al., 2017) have demonstrated that the patterns of science motivation change as one progresses through the grade levels. According to the findings, students' levels of motivation have a propensity to gradually diminish as they advance through the various phases of the educational system. This is a trend that is likely to continue as students continue their education. In addition, Gottfried et al. (2001) carried out a research project that followed the same participants over the course of five years and discovered that academic intrinsic motivation had dramatically reduced in a linear fashion over the course of those years. However, the rates of decrease in motivation varied depending on the specific subject areas being studied, with mathematics showing the greatest fall in this regard and social studies appearing to show no change. According to the findings of the research that was mentioned before, the evolution of science motivation was analyzed considering the different age groups and departments. It is also significant in terms of research outcomes to determine the extent to which the data from this study will support whether it varies according to age and departments (science major or non-science major).

METHOD

The aim of the study is to determine to what extent the data obtained from undergraduate students in Russia and Kazakhstan support the students' science motivation levels according to the country, gender, age, and departments. A validated and reliable survey (Zhdanov et al., 2022) was used in the study. As a methodological approach, it is counted among the quantitative approach (Fowler Jr, 2014; Fraenkel et al., 2012).

Participants

The participants comprise 543 undergraduate students now enrolled at various institutions in Russia and Kazakhstan. The gender of the students, their countries of origin, their ages, and the departments in which they majored in science were collected as independent variables. While 414 of the participants are now enrolled in higher education institutions in Russia, 129 of the participants are currently enrolled in higher education institutions in Kazakhstan. No information on the racial or ethnic backgrounds of the participants was gathered. There are 330 female students and 213 male students in total in the class. When the age groupings are broken down, there are 304 students who fall into the category of being between the ages of 18 and 19, however there are only 146 students in the category of being between the ages of 20 and 21. It was discovered that there were 93 pupils aged 22 and older at the school. Although 339 of the students are enrolled in scientific major departments, the remaining 213 students are enrolled in departments that are not related to science.

Data Collection Tool

Science motivation questionnaire used as a measurement tool was firstly developed by Glynn et al. (2009). Validity and reliability study of the scale in the context of Russia was conducted by Zhdanov et al. (2022). According to the results of the study, the dimensions of the scale were Self-Efficacy (Cronbach α= 0.941 and McDonald's ω= 0.942), Career Motivation (Cronbach α= 0.903 and McDonald's ω= 0.907), Anxiety (Cronbach α= 0.953 and McDonald's ω= 0.954), Grade Motivation (Cronbach α= 0.893 and McDonald's ω= 0.897), Intrinsic Motivation (Cronbach α= 0.872 and McDonald's ω= 0.874), Total (Cronbach α= 0.925 and McDonald's ω= 0.952). Values for this study were recalculated (**Table 1**).

When the reliability values in the table are examined, their values are good or very good for all dimensions and for the overall scale.

Data Analysis

In order to do statistical analysis for the study, Bayesian statistics were utilized. Both the null

Table 1. Reliability results for each dimension

Dimension	McDonald's ω	Cronbach's α
Self-Efficacy	0.944	0.944
Career Motivation	0.955	0.955
Anxiety	0.908	0.906
Grade Motivation	0.896	0.896
Intrinsic Motivation	0.882	0.879
Total	0.947	0.925

Table 2. Bayesian factor's interpretations

Criteria	Interpretation of BF01
> 100	Extreme evidence for H0
30 – 100	Very strong evidence for H0
10 – 30	Strong evidence for H0
3 – 10	Moderate evidence for H0
1 – 3	Anecdotal evidence for H0
1	No evidence
1/3 – 1	Anecdotal evidence for H1
1/3 – 1/10	Moderate evidence for H1
1/10 – 1/30	Strong evidence for H1
1/30 – 1/100	Very strong evidence for H1
< 1/100	Extreme evidence for H1

hypothesis, which states that there is no difference, and the alternative hypothesis, which states that there is a difference, are evaluated in terms of the probability of being supported by the data (Dienes, 2014; Saputra, 2019). The Bayesian factor computations served as the foundation for the interpretations. It has been determined what the value of B01 is. The Bayes factor can vary from 0 through infinity, with 1 indicating that the available data do not favor one explanation over another (Dienes, 2014). The interpretation of Bayesian Factors was done using the criteria that are presented in **Table 2** (Kass & Raftery, 1995). In order to do statistical analysis, the JASP 0.16 application (*JASP*, 2021) was utilized.

FINDINGS

When presenting the data, the first thing that was done was to offer some descriptive statistics about the sample. After that, the Bayesian statistical findings were disseminated in accordance with the variables of country, gender, age, and department, respectively.

Table 3. Descriptive statistics for each dimension

Dimension	Mean	Std. Deviation
Self-Efficacy	3.225	0.977
Career Motivation	3.337	1.118
Anxiety	2.987	1.126
Grade Motivation	3.451	0.978
Intrinsic Motivation	3.333	1.065
Total	3.260	0.691

Table 4. Descriptive statistics according to country variable

Dimensions	Group	N	Mean	SD
Self-Efficacy	Russia	414	3.098	0.942
	Kazakhstan	129	3.633	0.979
Career Motivation	Russia	414	3.205	1.079
	Kazakhstan	129	3.762	1.138
Anxiety	Russia	414	3.098	1.090
	Kazakhstan	129	2.634	1.169
Grade Motivation	Russia	414	3.377	0.969
	Kazakhstan	129	3.688	0.971
Intrinsic Motivation	Russia	414	3.236	1.035
	Kazakhstan	129	3.643	1.105
Total	Russia	414	3.184	0.668
	Kazakhstan	129	3.503	0.708

When all the averages (**Table 3**) are taken into consideration, the "Grade motivation" dimension has the highest average score, which comes in at 3.451. The average of respondents fell into the "agree" category for this criterion. The phrase "I agree with grade motivation" was the one most frequently chosen by the students. Other sub-factors, such as self-efficacy, career motivation, anxiety, and intrinsic motivation, as well as the overall score, have averages that fall between 2.60 and 3.39 and are at the slightly agree level. One cannot say that the students' level of motivation in science is high.

When comparing the averages (**Table 4**), the averages of students in Kazakhstan are greater than those of students in Russia in all other dimensions and overall scales, with the exception of "anxiety".

Upon examining the box-plot and density chart of the scores of students in each dimension across nations (**Figure 1**), it was discovered that Kazakhstan's students performed substantially better. In terms of anxiety dimension, the reverse is true. The score is so lower. In

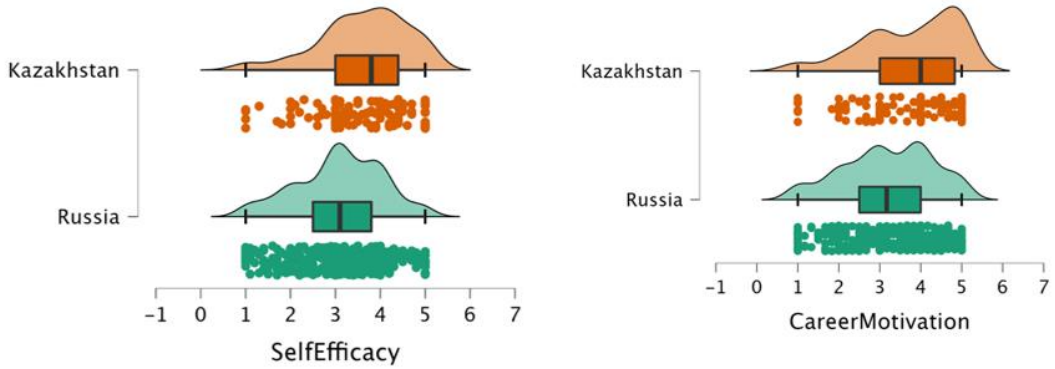

Figure 1. Raincloud plots for each dimension according to country variable

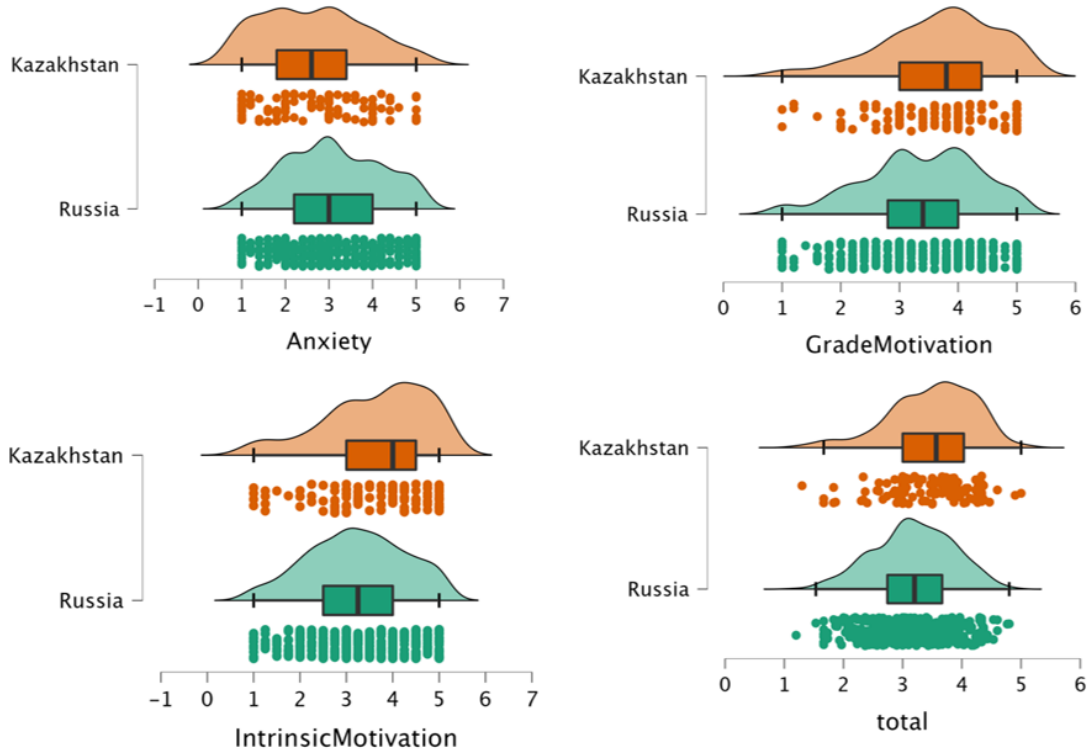

Figure 1 (continued). Raincloud plots for each dimension according to country variable

Table 5. Bayesian factor according to country variable

Dimension	BF_{01}	error %
Self-Efficacy	<0.001	<0.001
Career Motivation	<0.001	<0.001
Anxiety	0.002	<0.001
Grade Motivation	0.069	<0.001
Intrinsic Motivation	0.008	<0.001
Total	<0.001	<0.001

light of these findings, the hypothesis Ho: "There is no differentiation in science motivation scores across countries" and H1: "There is differentiation in science motivation across countries" were developed. Using a Bayesian t-test, the amount of data support for both hypotheses was determined.

A computation of the Bayesian Factor (BF01) was carried out. It is represented as a ratio of the number of cases that support the H_0 hypothesis to the number of cases that support the H_1 hypothesis. Extreme evidence, as measured by a Bayesian factor of less than 1/100, was supplied for the H_1 hypothesis in each of the sub-dimensions and overall. In other words, undergraduate students in the two nations have quite different reasons for being interested in science. When taken into consideration alongside **Table 5**, these findings provide credence to the notion that students in Kazakhstan are driven to study science in a manner that is distinct from that of students in Russia, with the exception of Anxiety.

When the averages of the students are broken down according to their genders, as shown in **Table 6**, the female group's averages are significantly higher than

Table 6. Descriptive statistics according to gender variable

Dimensions	Group	N	Mean	SD
Self-Efficacy	Female	330	3.252	0.976
	Male	213	3.183	0.980
Career Motivation	Female	330	3.389	1.120
	Male	213	3.257	1.113
Anxiety	Female	330	2.896	1.106
	Male	213	3.129	1.144
Grade Motivation	Female	330	3.502	0.962
	Male	213	3.372	0.998
Intrinsic Motivation	Female	330	3.306	1.045
	Male	213	3.374	1.097
Total	Female	330	3.269	0.683
	Male	213	3.246	0.704

those of the male group in all categories with the exception of anxiety.

It was found that the scores of female students were significantly higher as compared to male students when the box-plot and density graphs (**Figure 2**) of the students' scores in each sub-dimension were analyzed according to gender. On the other hand, the reverse is true in the Anxiety dimension. To put it another way, the students who identify as feminine report lower levels of anxiety. On the basis of this, H_0: "no differentiation by gender in science motivation" was a null hypothesis. Also, H_1: "There is differentiation by gender in science motivation" was determined. A Bayesian t-test was carried out in order to evaluate the amount of support provided by the data for each of the hypotheses.

The findings lend moderate support to the H0 hypothesis across the board, with the exception of

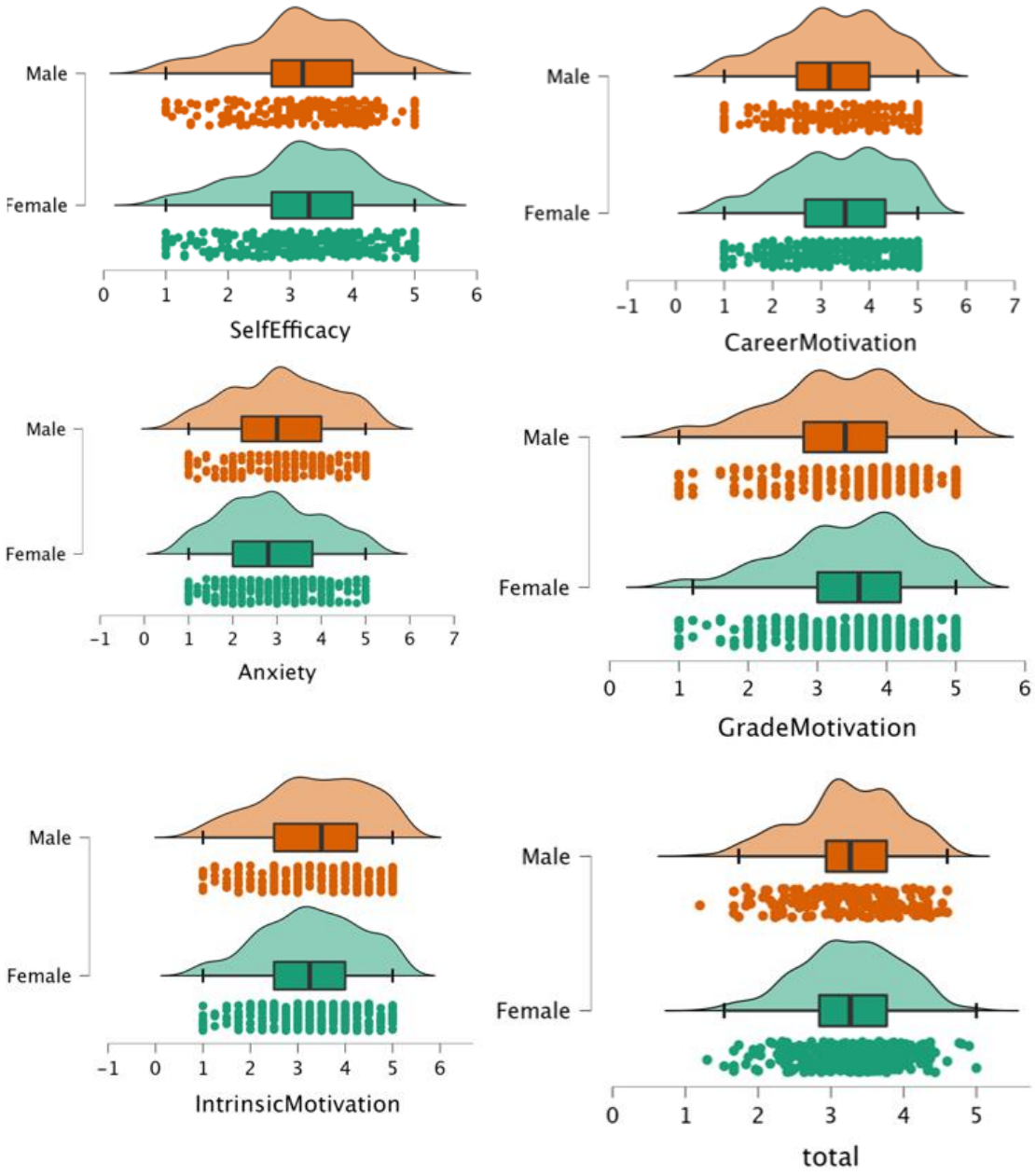

Figure 2. Raincloud plots for each dimension according to gender variable

Table 7. Bayesian factor according to gender variable

Dimensions	BF_{01}	error %
Self-Efficacy	7.456	<0.001
Career Motivation	4.215	<0.001
Anxiety	0.693	<0.001
Grade Motivation	3.358	<0.001
Intrinsic Motivation	7.897	<0.001
Total	9.515	<0.001

anxiety. Anecdotal evidence for H1 can be found in the anxiety dimension. That is to say, there was no discernible difference in the science motivation of the male and female members of the university group, and the results provided further support for the idea. The null hypothesis, which states that there is no difference in the motivation of female and male students in other dimensions, except for the anxiety dimension, and in the whole scale, was moderately supported.

When it comes to self-efficacy, the age group between 18 and 19 years old has the greatest average, followed by the group of people aged 22 and older with the highest average, and then the age group between 20 and 21 years old with the lowest average. The averages are presented in **Table 8**. The age group of 22 and older has the greatest mean score for career motivation, grade motivation, intrinsic motivation, and total, while the age group of 20-21 has the lowest mean score. The age range of 18-19 years old has the lowest levels of anxiety, while the age range of 22 and older has the greatest levels of this dimension.

In terms of self-efficacy, the distribution and density graphs (**Figure 3**) show that the 20-21 age group has a wider range, while the 18-19 age group has the shortest

Table 8. Descriptive statistics according to age variable

Dimension	18-19 (N=304)		20-21 (N=146)		22 and over (N=93)	
	Mean	SD	Mean	SD	Mean	SD
Self-Efficacy	3.300	0.939	3.047	1.063	3.261	0.934
Career Motivation	3.401	1.080	3.105	1.143	3.493	1.158
Anxiety	2.928	1.137	3.003	1.125	3.159	1.082
Grade Motivation	3.509	0.955	3.281	0.998	3.529	0.997
Intrinsic Motivation	3.391	1.023	3.123	1.166	3.470	0.998
Total	3.305	0.660	3.100	0.734	3.363	0.686

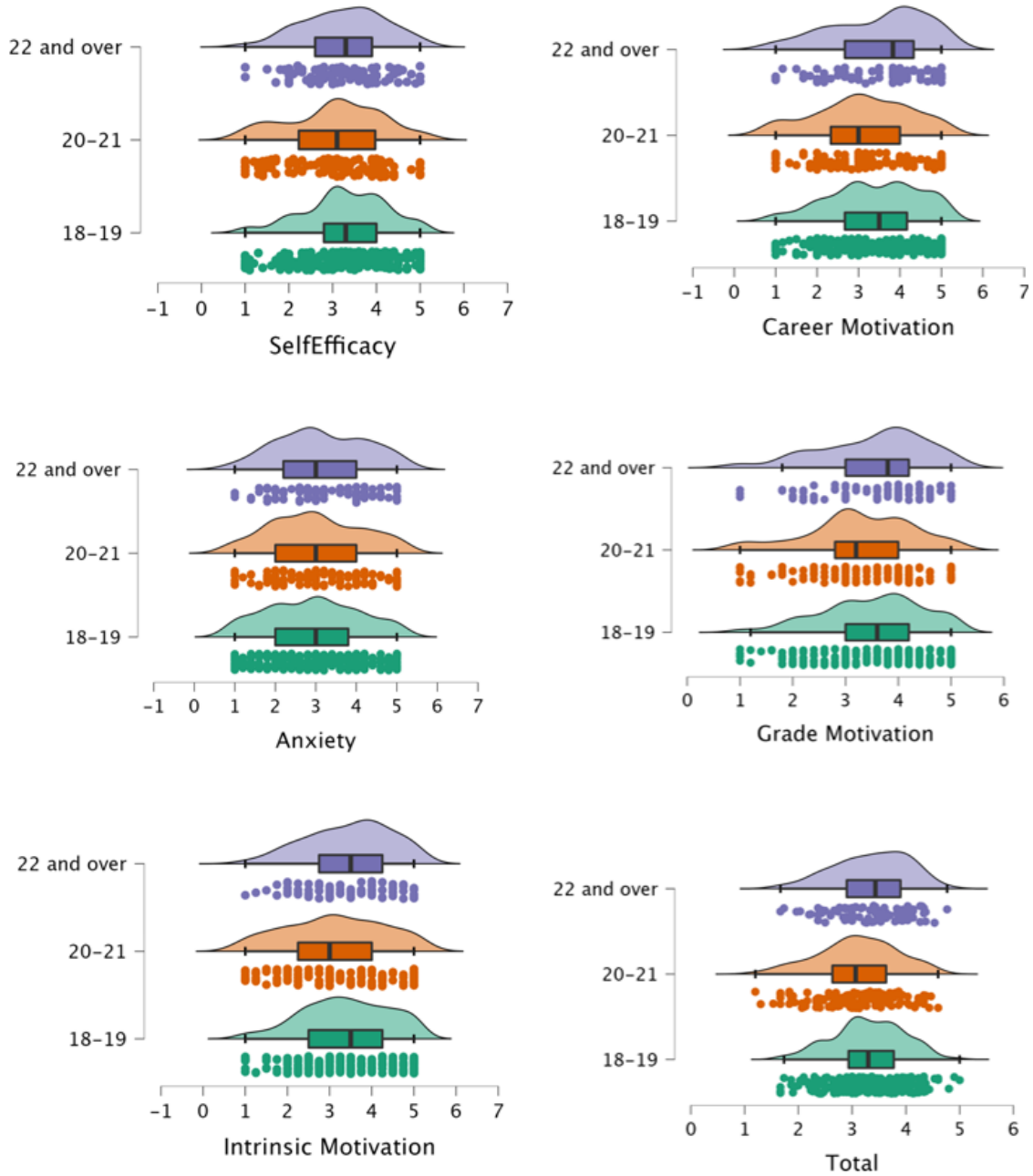

Figure 3. Raincloud plots for each dimension according to age variable

range. The narrowest range is shown in the 18-19 age group. In the age group of 22 and older, the level of intensity grew as the component titled "Career motivation" progressed to its left end. In the 18-19 age group, the range is the narrowest when compared to the other age groups. When looking at the Anxiety dimension, the density distribution is rather consistent; nevertheless, the age group of 22 and older has the lowest overall prevalence of the dimension. When looking at the dimension of grade motivation, those above the age of 22 have a leftward tilting distribution of responses. The age group between 18 and 19 years old

Table 9. Bayesian factor according to age variable

Variables	Models	P(M)	P(M | data)	BF_M	BF_{01}	error %
	Null model	0.500	0.619	1.625	1.000	
Self-Efficacy	Age	0.500	0.381	0.616	1.625	0.022
	Null model	0.500	0.363	0.570	1.000	
Career Motivation	Age	0.500	0.637	1.753	0.570	0.025
	Null model	0.500	0.908	9.843	1.000	
Anxiety	Age	0.500	0.092	0.102	9.843	0.023
	Null model	0.500	0.700	2.334	1.000	
Grade Motivation	Age	0.500	0.300	0.428	2.334	0.023
	Null model	0.500	0.472	0.895	1.000	
Intrinsic Motivation	Age	0.500	0.528	1.117	0.895	0.024
	Null model	0.500	0.172	0.207	1.000	
Total	Age	0.500	0.828	4.825	0.207	0.030

Table 10. Bayesian factor based on post-hoc test according to age variable

Dimension	Age		Prior Odds	Posterior Odds	$BF_{01, U}$	error %
Anxiety	18-19	20-21	1.702	12.395	7.281	<0.001
		22 and over	1.702	3.116	1.830	<0.001
	20-21	22 and over	1.702	6.896	4.051	<0.001
Total	18-19	20-21	1.702	0.222	0.130	<0.001
		22 and over	1.702	10.113	5.940	<0.001
	20-21	22 and over	1.702	0.328	0.193	<0.001

has the lowest range in this dimension. The range of ages 22 and higher has the lowest levels of intrinsic motivation, despite the fact that the levels of intensity in the intrinsic motivation component are comparable. It is interesting to observe that the age group of those above the age of 22 has a leftward tilt when the total is examined as a whole. The 18-to-19-year-old age cohort was the lowest group in the range. In light of this, the Bayesian ANOVA test was utilized for each dimension in order to determine whether or not the hypotheses H_0: "There is no differentiation according to age groups" and H_1: "There is differentiation according to age groups" are true.

Bayesian ANOVA analysis provides an analysis based on model comparisons. "Null model" was preferred in comparisons. When the self-efficacy and grade motivation dimensions were examined, BF01 values were 1.625-2.334, respectively, and anecdotal evidence for H_0. Age group comparisons were not analyzed since the H_0 hypothesis was insignificantly supported. In Career motivation and Intrinsic Motivation dimensions, the BF01 value was obtained as 0.570-0.895, respectively. Accordingly, the data is in the state of anecdotal evidence for H_1. Age group comparisons were not examined, as differentiation was not strongly supported. Since the size of Anxiety is BF01 9.843, the data provided moderate evidence for H_0. Post Hoc comparisons were made for age group details (**Table 9**). When evaluated on the total score, BF01 was calculated as 0.207 and the data provides moderate evidence for H_1. A post-hoc test was performed for age groups on the total score.

The computed BF01 scores between the ages of 18-19 and 20-21 and between the age groups of 20-21 and 22 and older are 7.281 and 4.050, respectively, when the outcome of the Post-Hoc test in the Anxiety dimension is analyzed. In this particular instance, the data for the aforementioned categories show moderate evidence in support of H_0. On the other hand, the anecdotal evidence provided support for the idea that there was no disparity between the age groups of 18-19 and 22 and older. The difference in BF01 between the age groups of 18-19 and 20-21, as well as the difference in BF01 between the age groups of 20-21 and 22 and above, were each estimated to be 0.130 and 0.193, respectively, in the total score evaluation. Based on these findings, the data offered a reasonable amount of support for H_1. Our hypothesis that there is a significant difference between the age groups was only supported with moderate evidence. However, the value of BF01 was determined to be 5.94 in order to differentiate between the age groups of 18-19 and 22 and older. Our prediction that the data did not distinguish between the two groups was only partially confirmed by the evidence.

When the students' values of science motivation are examined according to the sections in **Table 11**, the averages of the students in the Science major departments are partially higher in all dimensions and total scores, with the exception of the Anxiety dimension. This is because the students in these departments are more interested in the field of science. On the other hand, the reverse is true in the Anxiety dimension.

Table 11. Descriptive statistics according to department variable

Dimension	Group	N	Mean	SD
Self-Efficacy	Science Major	339	3.258	0.981
	Non-Science Major	204	3.171	0.971
Career Motivation	Science Major	339	3.341	1.115
	Non-Science Major	204	3.332	1.126
Anxiety	Science Major	339	2.956	1.115
	Non-Science Major	204	3.040	1.144
Grade Motivation	Science Major	339	3.460	0.966
	Non-Science Major	204	3.436	0.999
Intrinsic Motivation	Science Major	339	3.353	1.063
	Non-Science Major	204	3.300	1.069
Total	Science Major	339	3.270	0.686
	Non-Science Major	204	3.243	0.700

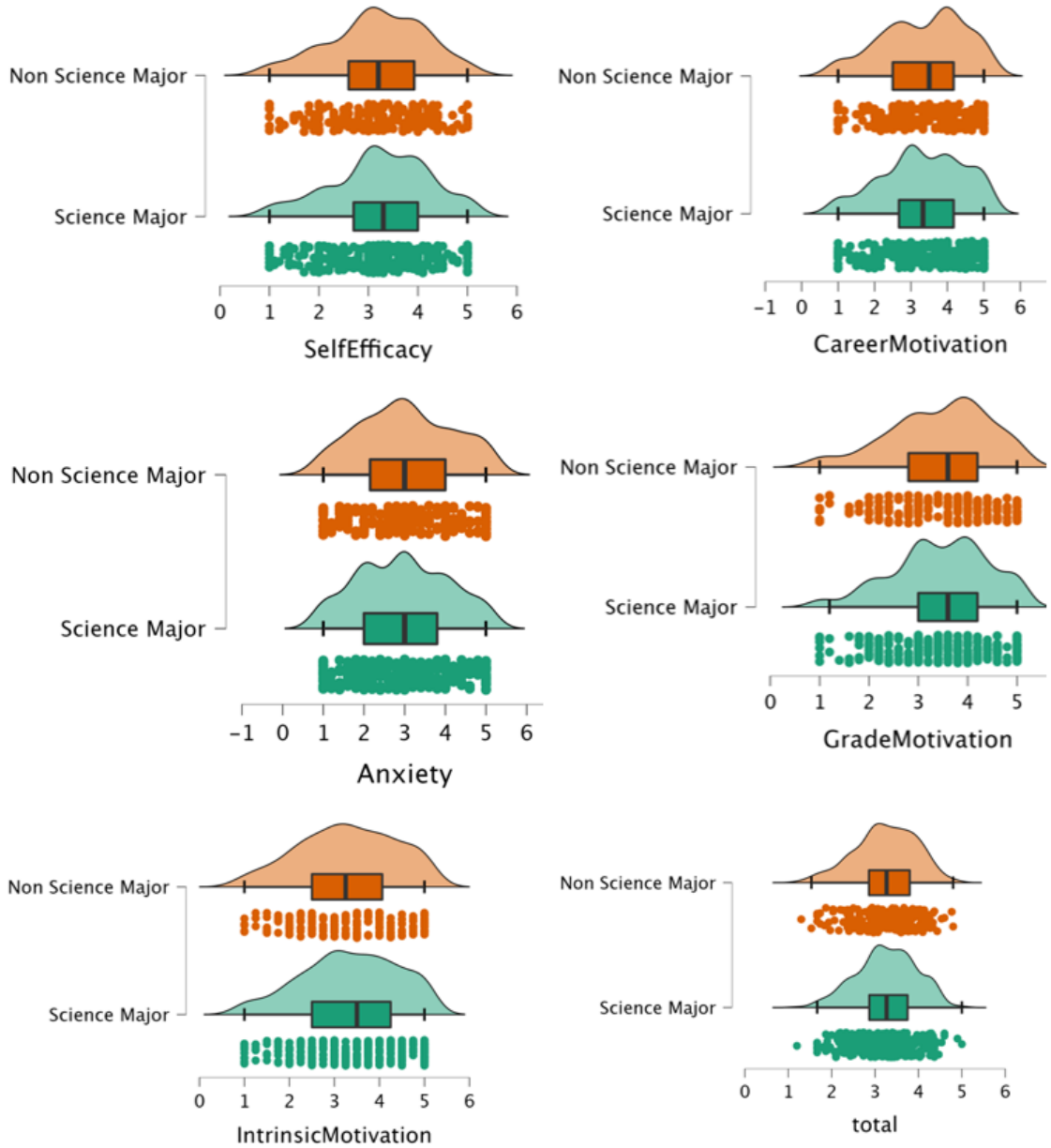

Figure 4. Raincloud plots for each dimension according to department variable

When the intensity of the students' scores as well as the range of those values are compared (**Figure 4**), it can be observed that the groups do not significantly differ from one another in terms of the intensities of their scores. Students who major in science have a narrower range of options across all dimensions. For the purpose of differentiation, two hypotheses were formed: H_0, which said that "Students' scores do not differ according

Table 12. Bayesian factor according to department variable

Dimension	BF_{01}	error %
Self-Efficacy	6.235	<0.001
Career Motivation	10.112	<0.001
Anxiety	7.168	<0.001
Grade Motivation	9.802	<0.001
Intrinsic Motivation	8.748	<0.001
Total	9.205	<0.001

to whether they study for a science major"; and H_1, which stated that "Students' scores differ according to whether they study for a science major." The data was put through a Bayesian t-test, and the results supported both hypotheses.

When the BF01 values that are presented in **Table 12** are analyzed, there is moderate support offered for the null hypothesis that H_0 is true. This is due to the fact that the BF01 values fall within the range of 3-10, with the exception of the career motivation dimension. Strong support was presented for Null Hypothesis (Career motivation dimension) due to the fact that the BF01 value was more than 10 in this study. As a consequence of this, the findings provided further evidence to support the hypothesis that the students' interest in science was not affected by the type of education they received, namely whether they majored in science or another subject.

DISCUSSION AND CONCLUSION

The purpose of the study is to establish how well the data collected from undergraduate students in Russia and Kazakhstan support the students' levels of science motivation in accordance with the students' country, gender, age, and departments of study. The science motivation scale was used as a measurement tool. For statistical analysis, t-test and ANOVA from Bayesian statistics were used.

When compared according to countries, the data support the hypothesis that there is a differentiation in all dimensions of science motivation according to the countries at the extreme evidence level. It's possible that the students' prior experiences (Carpi et al., 2017) and the diverse learning settings (Józsa et al., 2017) played a role in the difference according to the countries. The research (Józsa et al., 2017), which he carried out in both Hungary and Taiwan, concluded that there was no significant difference between the two countries. It is well known that Studies based on PISA (Chang, 2015; Fonseca et al., 2011) and TIMSS (Marsh et al., 2013) data determined that students' motivation levels differ according to country.

The hypothesis that there is no difference according to gender in all dimensions of the scale and in the whole scale, with the exception of the anxiety dimension, is moderately supported when gender differentiation is evaluated. On the other hand, the hypothesis that there is a difference in the Anxiety dimension predominates but is only weakly supported. Therefore, it may be concluded that there is no difference in the level of science motivation between male and female students. According to the findings of many research studies (Britner, 2008; Glynn et al., 2009; van Vo & Csapó, 2021; Zeyer, 2010; Zeyer & Wolf, 2010), the levels of motivation in science among male and female students do not significantly vary when measured in general.

In the science motivation literature, age-related work is also associated with general grade level (Wolfson et al., 2014). According to the results of the research, both the null hypothesis that there is no differentiation according to age in the other dimensions except for anxiety and the total score and the alternative hypothesis that there is differentiation according to age were only supported at the level of anecdotal evidence. The hypothesis that there is no age difference in the anxiety dimension was supported at the level of moderate evidence. In the whole scale score, the alternative hypothesis, that is, the hypothesis that there is a differentiation in the levels of science motivation according to age, was supported at the level of moderate evidence. The age group in which this differentiation is clearly seen is the age group between 18-19 and 20 and over. The motivation levels of students aged 20 and over are higher than those of the 18-19 age group. However, empirical research (Dorfman & Fortus, 2019; Józsa et al., 2017) have shown that the patterns of science motivation alter as a student advances through the grade levels.

The differentiation status of science motivations according to whether students read or not in science major departments was examined. The null hypothesis stating that the science motivation levels do not change according to the students' attendance to the science major or non-science major section in the scale total score and in the other dimensions was supported at moderate evidence level. The career motivation dimension was supported at a strong evidence level. So, the research data strongly showed that there was no difference between students based on which departments they attended. There are additional studies in the literature indicating that there are department-specific differences in the degrees of science motivation among students (Glynn et al., 2011).

In summary, the data collected from the students in the universities of Russia and Kazakhstan supported the students' motivation levels a) at a high level, where they differed from the countries they studied at b) at a moderate level, where they did not differ by gender c) at a moderate level, where there was a difference in the total score according to the age group, d) at a moderate level, where there was no differentiation by departments.

The quantitative measurement tool was used to measure science motivation. In future studies, the results

of the study can be compared by using measurement tools based on qualitative approaches. In addition, Bayesian approaches can be used in the analysis of study data. Study data includes university students in Russia and Kazakhstan. It is a limitation to consider in generalizing the data for Russia and Kazakhstan.

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