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Students' Motivation for Learning Mathematics in Mathematical and Language-Program Gymnasiums[1]

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Abstract

The aim of this study was to determine whether there are differences between students of mathematical-program gymnasiums and language-program gymnasiums regarding their expectancies of success, subjective values and attributions of success in mathematics and how these variables predict different educational choices: the intention of choosing the higher level of mathematics at the State Matura examinations (national exit examinations) and the intention of choosing the undergraduate studies for which mathematics is important. The sample consisted of 191 students from mathematical-program gymnasiums and 146 students from language-program gymnasiums. The results show that students from mathematical gymnasiums have higher expectancies of success and subjective values in mathematics. There were no differences regarding the attributions of success. Hierarchical regression analyses for both groups showed that, when predicting choice of higher level of mathematics on exit examinations, attributions were significant predictors, but only in the first step. In the second step, only expectancy of success remained as a statistically significant predictor. For both groups expectancy of success, together with the utility value, were significant predictors of the choice of undergraduate studies for which mathematics is important.

Key words: *attributions of success; expectancies of success; mathematics; motivation; subjective task values.*

[1] Gymnasiums are state-maintained secondary schools which prepare students for higher academic education

Introduction

Motivation for learning is a process that has a significant contribution to the quality of learning and students' achievement and there are several theoretical frameworks trying to explain its role. One of the most prominent contemporary theoretical frameworks is the expectancy-value theory (Eccles, 2005; Eccles & Wigfield, 2002; Wigfield, 1994; Wigfield & Eccles, 2000). The most important assumption of this model is that expectancies and values are direct predictors of achievement performance and academic choices (Wigfield, Tonks, & Klauda, 2009).

According to the expectancy-value theory, expectancies of success are person's beliefs about how well he or she will do on an upcoming task (e.g. "How well do you think you will do in math next year?"). Expectancies for success are conceptually different from an individual's beliefs about ability or competence, which refer to person's evaluations of his/her current ability or competence, both in terms of assessments of his/her own ability and its comparison to other people.

Eccles and her colleagues define values with respect to the qualities of different tasks and how those qualities influence an individual's desire to do the task. Eccles et al. (1983) propose four components of subjective task values: attainment value or importance, intrinsic value or interest, utility value or usefulness of the task, and cost. Attainment value is the importance of doing well on a given task. It incorporates identity issues – tasks are important when individuals view them as central to their own sense of themselves, or allow them to express or confirm important aspects of self. Intrinsic value or interest is the enjoyment one gains from doing the task. Although this component is in some aspects similar to intrinsic motivation and interest (e.g. Hidi & Renninger, 2006), it is important to note that in this model it is the task that produces the enjoyment. Utility value or usefulness refers to how a task fits into an individual's future plans. It can be similar to extrinsic motivation in some aspects, however it also reflects some important goals that the person holds deeply, and is also connected to personal goals and sense of self (Wigfield & Cambria, 2009). Cost refers to what a person has to give up to do a task (e.g. "Will I do homework or see my friends?"), as well as the anticipated effort needed to finish the task.

According to the expectancy-value model, expectancies and values are influenced by task-specific beliefs such as perceptions of competence, perceptions of the difficulty of different tasks, individual goals and self-schema, as well as affective memories for different achievement-related events. These beliefs, goals and affective memories are influenced by individuals' perceptions of other people's attitudes and expectations for them and by their own interpretations of previous achievement outcomes, including causal attributions and locus of control. Finally, individual's perceptions and interpretations are influenced by many social and cultural factors – parents' and teachers' beliefs and behaviors, individual's differential aptitudes and the cultural milieu in which they live.

Eccles and Wigfield (1995), and Eccles, Wigfield, Harold, and Blumenfeld (1993) showed that across activity domains, competence-related beliefs form distinct factors

in children as young as 6 differentiate across the domain. E.g., expectancy-related beliefs in math are distinct from expectancy-related beliefs in reading. The same is true of task values. Also, within a given domain the components of task values can be distinguished in children in the fifth grade and beyond.

The assumption that expectancies of success and task values are directly related to achievement-related choices and performance is confirmed in many studies in different domains. Individuals' expectancies of success and task values predict achievement outcomes, including their performance, persistence and choices of which activities to do (e.g. Bong, 2001; Eccles et al., 1983; Dennissen, Zarret, & Eccles, 2007; Simpkins, Davis-Kean, & Eccles, 2006). As indicators of choice, researchers usually used intentions or decisions of taking different subjects in high school or in college, e.g. enrolling in mathematics or computer courses (e.g. Eccles, Adler, & Meece, 1984) or choosing a school or a profession in some field (e.g. Simpkins et al., 2006)

Although the expectancy-value model proposes that expectancies of success and task values would predict the same outcomes, findings from empirical studies suggest that expectancies of success are directly related mostly to performance (Wigfield, 1994), while values are directly related to choices (e.g. Durik, Vida, & Eccles, 2006; Simpkins et al., 2006). However, competence beliefs and values are positively correlated, which means that each of them also has indirect effects on other academic outcomes: expectancies on choices and values on performance.

The results of studies focused on the domain of mathematics confirm the assumptions of the expectancy-value theory (e.g. Chouinard, Karsenti, & Roy, 2007; Fan, 2011; Meece, Wigfield, & Eccles, 1990; Simpkins et al., 2006; Trautwein & Lüdtke, 2009). These studies also show that expectancies of success and values are correlated with achievement in mathematics, choice of activities or investment of effort, and that expectancies are more correlated with achievement, while values are more correlated with activity choices.

Studies conducted in the Croatian educational context show similar results. A study conducted by Jugović, Baranović, and Marušić (2012) revealed that expectancy of success was a strong predictor of academic achievement in mathematics for eighth grade elementary school students: students who expected higher success and thought of themselves as more competent in mathematics had higher marks. In the study of fifth to eighth grade elementary school students' motivation for learning mathematics, Rovan, Pavlin-Bernardić, and Vlahović-Štetić (2013) showed that, besides achievement goals, expectancies and values are important predictors of mathematics marks, even when prior achievement is controlled. The results of confirmatory factor analysis clearly supported the structure of motivational beliefs in mathematics in accordance with the expectancy-value theory.

As we mentioned earlier, expectancy-value model includes causal attributions as important factors which influence a person's beliefs, goals, and affective memories, which then affect expectancies of success and task values. Since there is no previous

research linking attributions to expectancies and values, we included attributions of success in mathematics in the present study. One of the most influential theories of attribution is Weiner's (1974; 1986) theory, which focuses on causal attributions in achievement context. Weiner identified ability, effort, task difficulty, and luck as the most important factors affecting attributions for achievement. Attributions are classified along three causal dimensions: locus of causality (internal or external), stability (whether the causes change over time or not), and controllability (whether a person can control the causes of success or failure or not).

In this research, we were interested in comparing motivation for mathematics in two different types of programs - mathematical-program gymnasiums and language-program gymnasiums. Gymnasiums are schools providing secondary general education with programs focused on different study areas. The mathematics curriculum is much deeper and broader in the mathematical-program gymnasiums than in the language-program gymnasiums, being more demanding and challenging to students. So, we assumed that students in mathematical-program gymnasiums will have higher expectancies of success in mathematics and higher perceived interest, importance and utility value of mathematics. Also, we expected that students from mathematical-program gymnasiums will attribute their success in mathematics more to internal factors (motivation, aptitude and personality) than students from language-program gymnasiums. Therefore, the first research problem in our study was to determine whether there are differences between the students of mathematical-program gymnasiums and language-program gymnasiums in their expectancies of success, subjective values and attributions of success in mathematics.

The second research problem was to examine the role of expectancies of success, subjective values and attributions of success in mathematics in predicting different educational choices. In Croatia, secondary school students can choose whether they will take a higher or a basic level of mathematics on national high school exit examinations. Faculties from the STEM area usually demand a higher level of mathematics as a condition for enrolment. Thus, the outcome variables in this study were the intention of choosing a higher level of mathematics on exit examinations and the intention of choosing the undergraduate studies for which mathematics is important (science, biochemical or technical studies). We expected statistically significant contribution of subjective task values in predicting educational choices, especially for the language-program students since only the most motivated of them are expected to enter undergraduate studies in programs related to mathematics.

Methods

Participants

Participants were 337 third-grade students from two mathematical-program and two language-program gymnasiums in Croatia. The participants' mean age was 17.1 years. There were 191 participants from mathematical-program gymnasiums (45.5% female) and 146 participants from language-program gymnasiums (78.1% female).

Instruments and Procedure

The research was conducted according to ethical standards for research in psychology and it was anonymous. Participants completed several scales during their regular classes in school:

Subjective values of mathematics scale. The scale was adapted for the area of mathematics from the Jugović (2010) scale, which was constructed for the subject of physics. The scale consists of three subscales, which measure subjective task values. *Intrinsic value or interest for mathematics* subscale consists of five items, e.g. "How interesting is solving mathematical problems to you?" (Cronbach alpha in this study was .88). *Attainment value or importance of mathematics* subscale consists of four items, e.g. "How important is being successful in mathematics to you?" (Cronbach alpha=.84). *Utility value or usefulness of mathematics* subscale consists of three items, e.g. "What do you think, how useful will the materials you learn in mathematics be in your future?" (Cronbach alpha=.85)

For each item, participants gave answers on a Likert-type scale ranging from 1 to 5, where the larger number means greater value of mathematics. The total result for each subscale is calculated as a mean of participant's ratings and ranges from 1 to 5.

Expectancies of success in mathematics and perceived mathematics competence scale. This scale was also adapted for the area of mathematics from Jugović (2010) scale constructed for physics. It consists of two subscales: *Present expectancies (competence)* subscale that consists of five items, e.g. "What do you expect, how successful will you be in mathematics in this school year?" (Cronbach alpha=.87) and *Future expectancies* subscale that consists of three items, e.g. "How successful do you think you will be in the profession which demands mathematics knowledge?" (Cronbach alpha=.90)

The participants answered using a Likert-type scale from 1 to 5, where the larger number means greater expectancies of success. Since the correlation coefficient between two subscales in this study was .70, we used this scale as a one-factor scale and calculated the total result for each participant as a mean of his/her ratings on all items.

*Attributions of specific reasons for succes*s *scale* (Kamenov, 1991). This scale contains 17 categories of causal attributes for school success. In this study, participants were asked to recall a situation when they were successful in mathematics and for each of the causal attributes assess the extent to which they attribute their success to that factor. For each attribute, the participants answered on a scale from 1 to 4, where larger number means greater responsibility of that factor for success. The scale measures three factors: activity and motivation (e.g. discipline, activity on classes, motivation for learning), aptitude and personality (e.g. intelligence, concentration, personality traits, self-confidence) and external factors (e.g. help from others, favoring by the teacher, easy materials for learning, luck). After recoding the items, the total result on each of these subscales is calculated as a mean of participant's ratings and ranges from 1 to 4. In this study, Cronbach's alpha coefficients for internal consistency for three subscales range from .73 to .75.

Measures of educational choices. We assessed two educational choices: participants' intention to choose higher level of mathematics on national secondary general education exit examinations ("How likely is it that you will choose higher level of mathematics on exit examinations?") and participants' intention to choose undergraduate studies program for which mathematics is important ("How likely is it that you will try to enroll to science, biochemical or technical college?"). Answers for both items were given on a scale ranging from 1 ("I certainly won't") to 5 ("I certainly will").

Results

Expectancy of Success and Subjective Task Values in Mathematics

Table 1 shows descriptive statistics for expectancy of success and subjective task values in mathematics and the results of t-tests between mathematical and language-program gymnasiums.

Table 1

Descriptive results and results of t-tests for expectancy of success and components of subjective task values in mathematics, attributions of success in mathematics and educational choices for the students of mathematical-program and language-program gymnasiums

Scale/subscale	Mathematical-program gymnasiums (n=191)		Language-program gymnasiums (n=146)			
	M	SD	M	SD	t-test	Cohen d
Expectancy of success	3.71	0.826	2.85	0.799	9.61**	1.05
Interest	3.16	1.002	2.16	0.873	9.57**	1.06
Importance	3.73	0.926	3.15	0.960	5.57**	0.61
Utility	3.48	0.993	2.53	0.974	8.82**	0.97
Attributions of success						
Activity and motivation	2.93	0.655	2.82	0.616	1.58	
Aptitude and personality	3.03	0.602	2.92	0.546	1.63	
External factors	2.69	0.589	2.74	0.572	0.77	
Educational choices						
Higher level of mathematics on exit examinations	4.53	0.863	2.64	1.499	14.57**	1.54
Choice of faculty for which mathematics is important	3.73	1.226	2.10	1.278	11.93**	1.30

Note. **p<.01

As can be seen for both, expectancies of success and the components of subjective task values, students of mathematical-program gymnasiums have higher results. Effect sizes are mostly large (Cohen, 1988).

Attributions of Success in Mathematics

Table 1 also shows descriptive statistics and the results of t-tests between mathematical and language-program gymnasiums for three subscales of the *Attributions of specific reasons for success scale*.

There were no significant differences between the students of mathematical and language-program gymnasiums on either of the scales (p>.05).

Educational Choices

Descriptive statistics for participants' answers for different educational choices are shown in Table 1. As shown, students from mathematical-program gymnasiums assessed as more likely the choice of higher level of mathematics on national high school exit examinations and the choice of undergraduate studies for which mathematics is important. Effect sizes are large (Cohen, 1988). Of course, because higher level of mathematics on exit examination is needed for enrolment into science, biochemical or technical faculties, these two educational choices variables are not independent: correlation between them was r=.42 for mathematical-program gymnasiums and r=.58 for language-program gymnasiums.

Regression Analyses for the Criteria of Educational Choices

Correlations between variables used in the study are shown in Table 2.

Table 2

Correlations between the variables used in the study for students of mathematical-program gymnasiums (n=191; above the diagonal) and students of language-program gymnasiums (n=146; beneath the diagonal)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Gender	-	.10	-.12	.05	-.27**	-.11	-.04	-.17*	-.09	-.10
2. Attributions to activity and motivation	.21**	-	.46**	.26**	.27**	.47**	.46**	.37**	.19**	.23**
3. Attributions to aptitude and personality	.01	.48**	-	.33**	.46**	.42**	.43**	.30**	.26**	.27**
4. Attributions to external factors	.09	.35**	.45**	-	-.05	.05	.07	.03	-.01	.08
5. Expectancy of success	.06	.35**	.37**	.01	-	.55**	.54**	.43**	.53**	.51**
6. Interest	.11	.33**	.23**	.06	.68**	-	.55**	.61**	.41**	.40**
7. Importance	.06	.47**	.32**	.11	.68**	.56**	-	.53**	.38**	.35**
8. Utility	.07	.40**	.37**	.12	.60**	.52**	.62**	-	.30**	.42**
9. Higher level of mathematics on exit examinations	.02	.28**	.22**	-.06	.76**	.57**	.49**	.51**	-	.42**
10. Choice of undergraduate studies for which mathematics is important	-.06	.22**	.22**	.05	.56**	.46**	.40**	.54**	.58**	-

Note. **p<.01; *p<.05

Tables 3 and 4 show the results of hierarchical regression analyses for different samples with the choice of higher level of mathematics on exit examinations and the choice of undergraduate studies for which mathematics is important as dependent variables. In the first step, we entered attributions of success in mathematics, and in the second step, we entered expectancies of success and subjective task values.

Table 3
Results of hierarchical regression analyses with the choice of higher level of mathematics on exit examinations as a dependent variable for students of mathematical-program gymnasiums (n=191) and students of language-program gymnasiums (n=146)

	Mathematical-program gymnasiums		Language-program gymnasiums	
	Step 1 β	Step2 β	Step1 β	Step 2 β
Predictors				
Attributions to activity and motivation	.10	-.03	.27**	.06
Attributions to aptitude and personality	.25**	-.03	.21*	-.07
Attributions to external factors	-.12	.02	-.24**	-.06
Expectancy of success		.42**		.71**
Interest		.16		.09
Importance		.10		-.12
Utility		-.01		.13
R	.29	.55	.37	.77
R^2	.08	.30	.14	.60
Adj. R^2	.07	.28	.12	.58
F(df)	5.71** (3,187)	11.42** (7,183)	7.40**(3,142)	29.13** (7,138)
Δ R^2		.21		.46
F Δ (df)		14.46**(4,183)		39.43**(4,138)

Note. **p< .01; *p< .05

For students in the mathematical-program, in the first step attributions of success to aptitude and personality were the significant predictor of choice of higher level mathematics. In the second step, the addition of expectancy of success and task value added significantly to the prediction of criterion variable. However, the attribution of success to aptitude and personality was no longer significant and the only significant predictor was expectancy of success. The predictors explained 28% of the variance. For language-program students, in the first step all three types of attributions were significant predictors, but in the second step, once again, only expectancy of success was a significant predictor. The predictors explained 58% of the variance of the choice of higher level of mathematics on exit examinations.

As can be seen, for the choice of undergraduate studies for which mathematics is important, in the first step, attributions of success to aptitude and personality was the significant predictor for students in the mathematics program. In the second step, significant predictors were expectancy of success and utility value, and the attributions were no longer significant. The predictors explained 30% of the variance. For language-program students, there were no significant predictors in the first step, but in the second step significant predictors were expectancy of success and usefulness. The predictors explained 36% of the variance.

Table 4

Results of hierarchical regression analyses with the choice of undergraduate studies for which mathematics is important as a dependent variable for students of mathematical-program gymnasiums (n=191) and students of language-program gymnasiums (n=146)

	Mathematical-program gymnasiums		Language-program gymnasiums	
Predictors	Step 1 β	Step2 β	Step1 β	Step 2 β
Attributions to activity and motivation	.141	.02	.17	-.03
Attributions to aptitude and personality	.21*	-.06	.19	-.04
Attributions to external factors	-.02	.11	-.09	-.04
Expectancy of success		.43**		.40**
Interest		.05		.09
Importance		-.03		-.12
Utility		.23**		.35**
R	.29	.57	.27	.63
R^2	.09	.33	.07	.39
Adj. R^2	.07	.30	.06	.36
F(df)	5.83** (3,187)	12.65** (7,183)	3.79* (3,142)	12.76**(7,138)
Δ R^2		.23		.33
F Δ (df)		16.33** (4,183)		18.13** (4,138)

Note. **p <. 01; *p<.05

Discussion and Conclusions

The aim of this study was to determine whether there are differences between students of mathematical-program gymnasiums and language-program gymnasiums in attributions of success in mathematics, subjective values and expectancies of success in mathematics, as well as to examine how these variables predict different educational choices.

Regarding the expectancies of success in mathematics, students of mathematical-program gymnasiums had higher results. Studies show that expectancies of success in some areas are highly correlated with current, but also with future achievements (Crombie et al., 2005; Jugović et al., 2012; Rovan et al., 2013). Therefore, it is not surprising that students from mathematical-program gymnasiums, who probably have a history of experienced success in mathematics during elementary and high school, had higher expectancies of success. Also, they had higher results on all subjective task values. Students from language-program gymnasiums assessed interest and utility value of mathematics beneath the average point on the scale, while the mean for importance of mathematics was somewhat above the average point on the scale. The results of mathematical-program gymnasium students are similar to those obtained in Rovan et al. (2013) study on motivation of the fifth to eighth grade elementary school students. Longitudinal studies (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Wigfield et al., 1997) showed that correlations between expectancies of success

and subjective task values for different activities increase over time. When children and adolescents think that they are competent in an activity, they assess its task values higher. In accordance with these findings, students from language-program gymnasiums in our study, whose expectancies of success in mathematics were not very high, also had lower assessments of task values (correlations between expectancy of success and task values ranged from .60 to .68).

There were no statistically significant differences between the attributions of success in mathematics between students from mathematical and language-program gymnasiums. Apparently, students from different high school programs see their achievement in mathematics in the same manner, as resulting from the combination of engagement, aptitude and external circumstances. However, in this study we did not include causal attributions of failure in mathematics, so we cannot be sure that the students from different high school programs link their failure in mathematics to the same or different causes. In future studies it would be interesting to see if there are any differences between these attributions. It can also be noted that in both samples, attributions of success to activity and motivation, and aptitude and personality are in small, but significant positive correlations with the choice of higher level of mathematics on exit examinations and choice of undergraduate studies for which mathematics is important, while attribution of success to external factors is not significantly correlated to these or any other variables.

Hierarchical regression analyses with the choice of higher level of mathematics on exit examinations as a dependent variable showed that in both samples attributions have an important contribution to explaining this variable. However, when expectancy of success and subjective task values were introduced in the second step, only expectancy of success remained as a statistically significant predictor. In the second step of hierarchical regression analysis predicting the choice of undergraduate studies for which mathematics is important, expectancy of success and utility value were significant predictors for both samples. These findings are in line with the presumption of the expectancy-value model that causal attributions are antecedents of students' expectancies, values and their achievement. Since there were no previous studies on causal attributions as the part of the expectancy-value model, this is an important addition to this line of research.

The finding that expectancy of success is the most important predictor of educational choices is not completely in accordance with previous studies which show, as mentioned earlier, that expectancies have the strongest direct influence on achievement (Wigfield, 1994), while task values have an influence on activity choices (e.g. Durik et al., 2006; Jugović, 2010; Simpkins et al., 2006). However, because of their positive correlation, expectancies also have an indirect influence on activity choices, while task values have an influence on achievement. Although the choice of higher level of mathematics on exit examinations is an educational choice variable, it is not surprising that in our study students' expectancy of success in mathematics is the most

important predictor variable, since the higher level in examination includes more difficult mathematical problems. Also, we examined students' educational choices in their third grade, asking them to estimate how likely it is that they will make these choices, which is not the same as to examine their actual, real choices. Thus, it is possible that students relied on the assessment of their competences while assessing the probability of their choices.

Concerning educational choices, students from mathematical-program gymnasiums estimated that they were more likely to choose higher level of mathematics on exit examinations (their average estimation on a scale from 1 to 5 was 4.53, as opposed to just 2.64 for students from language-program gymnasiums) and that they were more likely to choose science, biochemical or technical undergraduate studies (3.73 as opposed to just 2.10). As can be seen, there are significant differences between students from different types of gymnasiums in their motivation for learning mathematics (except their attributions of success) and educational choices related to the area of mathematics. However, when we examine the mechanism of these relations, the pattern is almost the same. Thus, although their motivation is different, the motivational mechanism underlying the educational choices for both groups is very similar. This finding has practical implications for high school mathematics teachers. The results of this research indicate that students from language-program gymnasiums assess their intention to enroll to undergraduate studies for which mathematics is important as low, and their expectancies of success and task values in the area of mathematics are also low. Of course, these students most probably entered language-program gymnasiums led by interest for other subjects and not for mathematics, but teachers should nevertheless try to improve their perception of the importance, usefulness and interest in mathematics. They should help students to form high, but accurate expectancies of success and give them quality feedback. It is also advisable that teachers enhance students' attributions of success in mathematics to ability and effort and teach them that ability is not fixed and can be further developed. Several studies show that fairly simple interventions can increase students' interest and utility value of mathematics (e.g. Harackiewicz, Rozek, Hulleman, & Hyde, 2012; Hulleman & Harackiewicz, 2009). Thus, teachers should encourage discussion of importance and usefulness of educational content, and show students how they can apply acquired knowledge in their everyday life and future professions.

However, this particular study also has some limitations. Considering the sample, we included four high schools from two cities, and only third-grade students, so without further studies we cannot claim that our results can be generalized to other mathematical or language-program gymnasiums. In further studies, it would be interesting to examine the results of students from general-program gymnasiums. We should also note that this is a correlational study, so the results do not show causal relations: for example, it is possible that students who intend to enroll to science, biochemical or technical undergraduate studies think that mathematics is useful

because they know that they will need it in their future studies. Also, in further studies it would be interesting to explore real-life indicators of the choice of undergraduate studies, as well as other educational outcome variables (e.g. academic emotions and student engagement).

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Motivacija učenika prirodoslovno-matematičkih i jezičnih gimnazija za učenje matematike

Sažetak

Cilj ovog istraživanja bio je ispitati postoje li razlike između učenika prirodoslovno-matematičkih i jezičnih gimnazija s obzirom na njihova očekivanja uspjeha, subjektivne vrijednosti matematike i atribucije uspjeha u matematici i kako te varijable predviđaju različite obrazovne izbore: namjeru odabira više razine matematike na državnoj maturi i namjeru odabira studija za koji je matematika važna. Sudionici su bili 191 učenik prirodoslovno-matematičkih gimnazija i 146 učenika jezičnih gimnazija. Rezultati su pokazali da učenici iz prirodoslovno-matematičkih gimnazija imaju viša očekivanja uspjeha i subjektivne vrijednosti matematike. Nije bilo statistički značajne razlike u atribucijama uspjeha u matematici. Rezultati hijerarhijskih regresijskih analiza za obje su skupine pokazali da su, kada je kriterij odabir više razine matematike na državnoj maturi, u prvom koraku atribucije uspjeha statistički značajni prediktori. U drugom se koraku samo očekivanje uspjeha pokazalo statistički značajnim prediktorom. Za kriterij odabira fakulteta za koji je matematika važna, za obje su se skupine statistički značajnim prediktorima pokazali očekivanje uspjeha i korisnost.

Ključne riječi: *atribucije uspjeha; matematika; motivacija; očekivanje uspjeha; subjektivne vrijednosti zadatka.*

Uvod

Motivacija za učenje je proces koji ima bitan doprinos za kvalitetu učenja i postignuće učenika te postoji nekoliko teorijskih okvira koji nastoje objasniti njezinu ulogu. Jedan od najistaknutijih suvremenih teorijskih okvira jest teorija očekivanja i vrijednosti (Eccles, 2005; Eccles i Wigfield, 2002; Wigfield, 1994; Wigfield i Eccles, 2000). Najvažnija postavka te teorije jest da su očekivanja i vrijednosti direktni prediktori postignuća i akademskih odabira (Wigfield, Tonks, i Klauda 2009).

Prema teoriji očekivanja i vrijednosti, očekivanja uspjeha su uvjerenja osobe o tome koliko će biti uspješna u budućim aktivnostima (npr. „Što mislite o tome koliko ćete biti

uspješni u matematici sljedeće godine?"). Očekivanja uspjeha su konceptualno različita od uvjerenja osobe o njezinim sposobnostima, koja se odnose na to kako osoba vrednuje svoje trenutne sposobnosti, i u terminima procjene vlastitih sposobnosti i u terminima usporedbe s drugima.

Eccles i njezini suradnici definiraju vrijednosti s obzirom na karakteristike zadatka i kako one utječu na želju osobe da se uključi u zadatak. Eccles i sur. (1983) tako predlažu četiri komponente subjektivnih vrijednosti zadatka: važnost, interes ili intrinzična vrijednost, korisnost i cijena truda. Važnost se odnosi na važnost dobrog, kvalitetnog rada na određenom zadatku. Ona uključuje i pitanja vezana uz identitet – zadaci su važni kada ih osobe vide kao središnje za svoje samopoimanje ili im omogućuju da izraze ili potvrde bitne aspekte sebe. Interes ili intrinzična vrijednost jest užitak koji osobi pruža obavljanje zadatka. Iako je ta komponenta u nekim aspektima slična intrinzičnoj motivaciji ili interesu (npr. Hidi i Renninger, 2006), važno je istaknuti da je u ovom modelu zadatak taj koji dovodi do užitka. Korisnost se odnosi na to kako se zadatak uklapa u buduće planove osobe. Ona može u nekim aspektima biti slična ekstrinzičnoj motivaciji, no također odražava bitne ciljeve koje osoba ima i povezana je sa samopoimanjem (Wigfield i Cambria, 2009). Cijena truda odnosi se na to čega se osoba treba odreći da bi obavila zadatak (npr. „Hoću li napraviti domaću zadaću ili se vidjeti s prijateljima?"), kao i na očekivani trud koji je potreban da bi se zadatak dovršio.

Prema tom modelu, na očekivanja i vrijednosti utječu uvjerenja specifična za zadatak kao što su percepcija svojih sposobnosti, percepcija težine različitih zadataka, individualni ciljevi i shema o sebi, kao i afektivno pamćenje za različite događaje povezane s postignućem. Na ta uvjerenja, ciljeve i afektivno pamćenje utječu percepcije osobe o stavovima i očekivanjima drugih osoba od njih i vlastite interpretacije prethodnih postignuća, što uključuje kauzalne atribucije i lokus kontrole. Napokon, na percepcije i interpretacije osobe utječu različiti društveni i kuturološki čimbenici: uvjerenja i ponašanja roditelja i nastavnika, različite sklonosti osobe i kulturološko okruženje u kojem žive.

Eccles i Wigfield (1995) i Eccles, Wigfield, Harold i Blumenfeld (1993) pokazali su da se već kod djece od 6 godina nadalje uvjerenja o sposobnostima u različitim područjima međusobno razlikuju. Primjerice, očekivanja uspjeha u matematici razlikuju se od očekivanja uspjeha u čitanju. Isto vrijedi i za vrijednosti zadatka. Također, unutar pojedinog područja komponente vrijednosti zadatka formiraju različite faktore već kod djece od petog razreda naviše.

Pretpostavka da su očekivanja uspjeha i vrijednosti zadatka direktno povezane s odabirima i izvedbom u situacijama postignuća potvrđena je u mnogim istraživanjima u različitim područjima. Očekivanja uspjeha i vrijednosti zadatka predviđaju različite ishode, kao što su izvedba, ustrajnost i odabir u koje će se aktivnosti osoba uključiti (npr. Bong, 2001; Eccles i sur., 1983; Dennissen, Zarret, i Eccles, 2007; Simpkins, Davis-Kean, i Eccles, 2006). Kao mjere odabira istraživači su se obično koristili namjerama ili odlukama o upisivanju različitih predmeta u srednjoj školi ili na fakultetu, primjerice

upisivanjem matematičkih ili računalnih kolegija (npr. Eccles, Adler, i Meece, 1984) ili odabirom fakulteta ili zanimanja u nekom području (npr. Simpkins i sur., 2006).

Iako model očekivanja i vrijednosti pretpostavlja da očekivanja uspjeha i vrijednosti zadatka predviđaju iste ishode, nalazi istraživanja ukazuju na to da su očekivanja uspjeha direktno povezana najviše s izvedbom (Wigfield, 1994), a da su vrijednosti direktno povezane s odabirima (e. g. Durik, Vida, i Eccles 2006; Simpkins i sur., 2006). No, očekivanja uspjeha i vrijednosti su u pozitivnim korelacijama, što znači da svaka od tih varijabli također ima posredne efekte na druge akademske ishode: očekivanja na odabire i vrijednosti na izvedbu.

Rezultati istraživanja za područje matematike potvrđuju pretpostavke teorije očekivanja i vrijednosti (npr. Chouinard, Karsenti, i Roy, 2007; Fan, 2011; Meece, Wigfield, i Eccles, 1990; Simpkins i sur., 2006; Trautwein i Lüdtke, 2009). Ta istraživanja također pokazuju da su očekivanja uspjeha i vrijednosti povezana s uspjehom u matematici, odabirom aktivnosti ili ulaganjem napora te da su očekivanja više povezana s postignućem, a vrijednosti s odabirom aktivnosti.

Istraživanja provedena u Hrvatskoj pokazuju slične rezultate. U istraživanju koje su provele Jugović, Baranović, i Marušić (2012) pokazalo se da je očekivanje uspjeha bitan prediktor uspjeha u matematici za učenike osmog razreda osnovne škole: učenici koji su očekivali bolji uspjeh i smatrali sebe kompetentnijima u matematici, imali su više ocjene. U istraživanju koje je uključilo učenike od petog do osmog razreda osnovne škole, Rovan, Pavlin-Bernardić, i Vlahović-Štetić (2013) pokazale su da su, uz ciljeve postignuća, očekivanja i vrijednosti bitni prediktori ocjena iz matematike, čak i kad je prethodno postignuće kontrolirano. Rezultati konfirmatorne faktorske analize jasno su potvrdili strukturu motivacijskih uvjerenja u matematici u skladu s teorijom očekivanja i vrijednosti.

Kao što smo prije spomenuli, model očekivanja i vrijednosti uključuje kauzalne atribucije kao važne čimbenike koji utječu na uvjerenja, ciljeve i afektivno pamćenje osobe, što dalje utječe na očekivanja i vrijednost zadatka. Kako do sad nisu provedena istraživanja koja bi povezivala atribucije s očekivanjima i vrijednostima, u ovom smo istraživanju uključili atribucije uspjeha u matematici. Jedna od najutjecajnijih teorija atribucija je Weinerova (1974; 1986) teorija, koja je usmjerena na kauzalne atribucije u kontekstu postignuća. Prema Weineru, glavni faktori kojima se pripisuje uspjeh ili neuspjeh su sposobnost, trud, težina zadatka i sreća. Atribucije se mogu klasificirati na tri dimenzije: mjesto uzročnosti (unutrašnje ili vanjsko), stabilnost (mijenja li se uzrok s vremenom ili ne mijenja) i podložnost kontroli (može li osoba kontrolirati uzroke uspjeha ili neuspjeha ili ne može).

U ovom istraživanju željeli smo usporediti motivaciju za učenje matematike kod učenika uključenih u dvije vrste programa: prirodoslovno-matematičke gimnazije i jezične gimnazije. U prirodoslovno-matematičkim gimnazijama program matematike je puno širi i dublji nego u jezičnim gimnazijama. Prvi problem našeg istraživanja odnosio se na to postoje li razlike između učenika prirodoslovno-matematičkih i

jezičnih gimnazija u očekivanjima uspjeha, subjektivnim vrijednostima i atribucijama uspjeha u matematici. Naša je hipoteza bila da će učenici prirodoslovno-matematičkih gimnazija imati viša očekivanja uspjeha u matematici i više percipirane vrijednosti matematike (interes, važnost i korisnost) nego učenici jezičnih gimnazija. Također, očekivali smo da će učenici prirodoslovno-matematičkih gimnazija atribuirati svoj uspjeh u matematici više internalnim faktorima (motivaciji, sposobnostima i ličnosti) nego učenici jezičnih gimnazija.

Drugi problem istraživanja odnosio se na ulogu očekivanja uspjeha, subjektivnih vrijednosti i atribucija uspjeha u matematici u predviđanju različitih obrazovnih odabira. U Hrvatskoj učenici srednjih škola mogu odabrati hoće li polagati višu ili osnovnu razinu matematike na državnoj maturi. Fakulteti iz prirodoslovnog, biokemijskog ili tehničkog područja obično zahtijevaju položenu višu razinu matematike kao uvjet za upis. Stoga su varijable ishoda u ovom istraživanju bile namjera odabira više razine matematike na državnoj maturi i namjera odabira fakulteta za koji je matematika važna. Očekivali smo da će subjektivne vrijednosti zadatka imati statistički značajan doprinos u objašnjavanju tih obrazovnih odabira, osobito kod učenika jezičnih gimnazija, jer se za samo najmotiviranije od njih očekuje da odaberu fakultet čiji je program vezan uz matematiku.

Metodologija

Sudionici

Sudionici su bili 337 učenika trećeg razreda iz dvije prirodoslovno-matematičke i dvije jezične gimnazije u Hrvatskoj. Prosječna dob sudionika bila je 17,1 godina. Iz prirodoslovno-matematičkih gimnazija bio je 191 sudionik (od čega 45,5% djevojaka), a iz jezičnih je gimnazija bilo 146 sudionika (od čega 78,1% djevojaka).

Instrumenti i postupak

Istraživanje je provedeno u skladu s etičkim načelima psihologijskih istraživanja i bilo je anonimno. Sudionici su tijekom redovne nastave u školi zamoljeni da ispune nekoliko upitnika:

Ljestvica za ispitivanje subjektivnih vrijednosti matematike. Ljestvicu je Jugović (2010) konstruirala za područje fizike, a u ovom je istraživanju preuzeta i prilagođena za područje matematike. Sastoji se od tri podljestvice, koje mjere subjektivne vrijednosti matematike. Podljestvica *intrinzične vrijednosti ili interesa za matematiku* sastoji se od pet čestica, npr. „Koliko ti je zanimljivo rješavati zadatke iz matematike?" (Cronbachov alpha koeficijent pouzdanosti u ovom istraživanju iznosi ,88). Podljestvica *vrijednosti postignuća ili osobne važnosti matematike* sastoji se od četiri čestice, npr. „Koliko je tebi osobno važno biti uspješan/na u matematici?", a Cronbachov alpha iznosi ,84. Podljestvica *utilitarne vrijednosti ili percipirane korisnosti matematike* sastoji se od tri čestice (npr. „Što misliš, koliko će ti ono što učiš u matematici biti korisno za budućnost?"), a Cronbachova alpha iznosi ,85.

Sudionici odgovaraju na ljestvici Likertova tipa od 1 do 5, pri čemu viši broj znači višu subjektivnu vrijednost matematike. Ukupni rezultat za svaku podljestvicu računa se kao prosjek svih odgovora i može se kretati od 1 do 5.

Ljestvica za ispitivanje očekivanja uspjeha u matematici i percipirane sposobnosti za matematiku. Konstruirala ju je Jugović (2010) također za područje fizike, a u ovom istraživanju je preuzeta i prilagođena za područje matematike. Sastoji se od dvije podljestvice: *Sadašnja očekivanja (sposobnost)*, koju čini 5 čestica, npr. „Koliko očekuješ da ćeš biti uspješan/na u matematici ove školske godine?" (Cronbachova alpha=,87) i *Buduća očekivanja*, koju čine tri čestice, npr. „Koliko misliš da bi bio/bila uspješan/na u zanimanju koje zahtijeva znanja iz matematike?" (Cronbachova alpha=,90).

Sudionici odgovaraju na ljestvici Likertova tipa od 1 do 5, pri čemu viši broj znači više očekivanje uspjeha. No, kako je korelacija između rezultata na te dvije podljestvice u našem istraživanju iznosila ,70, ljestvicu smo upotrijebili kao jednofaktorsku te je za svakog sudionika ukupan rezultat izračunat kao prosjek odgovora na svim česticama.

Ljestvica za atribuiranje specifičnih razloga uspjeha (Kamenov, 1991). Ljestvica sadrži 17 kategorija kauzalnih atributa školskog uspjeha. U našem istraživanju sudionicima je dana uputa da se prisjete situacije u kojoj su bili uspješni u matematici i za svaki od navedenih razloga označe u kojoj mjeri pripisuju svoj uspjeh tom čimbeniku. Odgovori se daju na ljestvici od 1 do 4, pri čemu veći broj znači veću odgovornost tog čimbenika za uspjeh. Ljestvica mjeri tri faktora: aktivnost i motivaciju (primjerice, disciplina, aktivnost na satu, motivacija za učenje), sposobnost i ličnost (primjerice, inteligencija, koncentracija, osobine ličnosti, samopouzdanje) i vanjske činitelje (primjerice, tuđa pomoć, naklonost učitelja, lakoća gradiva, sreća). Nakon rekodiranja čestica, ukupan rezultat na svakoj podljestvici računa se kao prosjek odgovora i kreće se od 1 do 4. U ovom istraživanju Cronbachovi alpha koeficijenti pouzdanosti za te tri podljestvice kretali su se od ,73 do ,75.

Mjere obrazovnih odabira. Ispitali smo dvije vrste obrazovnih odabira: namjeru sudionika da odaberu višu razinu matematike na državnoj maturi (česticom „Koliko je vjerojatno da ćeš odabrati višu razinu matematike na državnoj maturi?") i namjeru da odaberu fakultet za koji je matematika važna (česticom „Koliko je vjerojatno da ćeš odabrati fakultet iz prirodoslovnog, biokemijskog ili tehničkog područja?"). Sudionici su odgovore na obje čestice trebali označiti na ljestvici od 1 („sigurno neću") do 5 („sigurno hoću").

Rezultati

Očekivanja uspjeha i komponente subjektivne vrijednosti matematike

U Tablici 1. prikazane su deskriptivne statističke vrijednosti za očekivanje uspjeha i komponente subjektivnih vrijednosti matematike i rezultati t-testova između učenika prirodoslovno-matematičkih i jezičnih gimnazija.

Tablica 1

Kao što možemo vidjeti, učenici prirodoslovno-matematičkih gimnazija imaju više rezultate i za očekivanja uspjeha i za komponente subjektivnih vrijednosti. Veličine efekata su uglavnom visoke (Cohen, 1988).

Atribucije uspjeha u matematici

U Tablici 1. također su prikazane deskriptivne vrijednosti za tri podljestvice Ljestvice za atribuiranje specifičnih razloga uspjeha i rezultate t-testova. Ni na jednoj od podljestvica nije bilo statistički značajne razlike između učenika prirodoslovno-matematičkih i jezičnih gimnazija (p>,05).

Obrazovni odabiri

U Tablici 1. možemo vidjeti i deskriptivnu statistiku i rezultate t-testova za odgovore sudionika na mjerama obrazovnih odabira. Učenici prirodoslovno-matematičkih gimnazija procjenjuju vjerojatnijim da će odabrati višu razinu matematike na državnoj maturi i odabrati fakultet za koji je matematika važna. Veličine efekata su visoke (Cohen, 1988). Naravno, budući da je odabir visoke razine matematike na državnoj maturi potreban za upis prirodoslovnih, biokemijskih i tehničkih fakulteta, te dvije varijable nisu neovisne: korelacija između njih je r=,42 na uzorku učenika prirodoslovno-matematičkih gimnazija i r=,58 na uzorku učenika jezičnih gimnazija.

Regresijske analize za kriterije obrazovnih odabira

Korelacije između varijabli koje su se koristile u istraživanju prikazane su u Tablici 2.

Tablica 2

Tablice 3. i 4. prikazuju rezultate hijerarhijskih regresijskih analiza za različite poduzorke s odabirom više razine matematike na državnoj maturi i odabirom fakulteta za koji je matematika važna kao kriterijskim varijablama. U prvom koraku uvrstili smo atribucije uspjeha u matematici, a u drugom koraku očekivanja uspjeha i subjektivne vrijednosti zadatka.

Tablica 3

Za učenike prirodoslovno-matematičkih gimnazija, u prvom koraku hijerarhijske regresijske analize, atribucije uspjeha sposobnosti i ličnosti pokazale su se kao statistički značajan prediktor odabira više razine matematike na državnoj maturi. U drugom koraku, dodavanje očekivanja uspjeha i subjektivnih vrijednosti statistički je značajno doprinijelo objašnjavanju varijance kriterijske varijable. No, atribucije uspjeha sposobnosti i ličnosti više se nisu pokazale statistički značajnim prediktorom i jedini značajan prediktor bilo je očekivanje uspjeha. Prediktori su objasnili 28% varijance. Za učenike jezičnih gimnazija u prvom su koraku sve tri vrste atribucija bile statistički značajni prediktori, no u drugom je koraku također samo očekivanje uspjeha bilo statistički značajan prediktor. Prediktori su objasnili 58% varijance odabira više razine matematike na državnoj maturi.

Tablica 4

Za odabir fakulteta za koji je matematika važna, na uzorku učenika prirodoslovno-matematičkih gimnazija, u prvom su koraku atribucije uspjeha sposobnosti i ličnosti bile statistički značajan prediktor. U drugom koraku, statistički značajnim prediktorima pokazali su se očekivanje uspjeha i korisnost matematike, a atribucije više nisu bile statistički značajan prediktor. Prediktorima je objašnjeno 30% varijance kriterija. Za učenike jezičnih gimnazija, u prvom koraku, nije bilo statistički značajnih prediktora, no u drugom koraku statistički značajni prediktori bili su očekivanje uspjeha i korisnost matematike. Prediktorima je objašnjeno 36% varijance kriterija.

Rasprava i zaključci

Cilj ovog istraživanja bio je ispitati postoje li razlike između učenika prirodoslovno-matematičkih i jezičnih gimnazija u atribucijama uspjeha u matematici, subjektivnim vrijednostima matematike i očekivanjima uspjeha u matematici, zatim utvrditi kako te varijable predviđaju različite obrazovne odabire.

Učenici prirodoslovno-matematičkih gimnazija imali su viša očekivanja uspjeha u matematici. Istraživanja pokazuju da su očekivanja uspjeha u nekom području visoko povezana s trenutnim, ali i s budućim postignućima (Crombie i sur., 2005; Jugović i sur., 2012; Rovan i sur., 2013), pa nije iznenađujuće da učenici prirodoslovno-matematičkih gimnazija, koji su vjerojatno doživljavali uspjehe iz matematike tijekom osnovne i srednje škole, imaju viša očekivanja uspjeha. Također, učeniciovih gimnazija imali su više rezultate na svim komponentama subjektivne vrijednosti matematike. Učenici iz jezičnih gimnazija procijenili su interes i korisnost matematike ispod prosječne vrijednosti na ljestvici, a procjena važnosti matematike bila je nešto iznad prosječne vrijednosti na ljestvici. Rezultati učenika prirodoslovno-matematičkih gimnazija slični su onima dobivenim u istraživanju Rovan i sur. (2013) o motivaciji učenika petih do osmih razreda osnovne škole za učenje matematike. Longitudinalna istraživanja (Jacobs, Lanza, Osgood, Eccles, i Wigfield, 2002; Wigfield i sur., 1997) pokazala su da se korelacija između očekivanja uspjeha i subjektivne vrijednosti zadatka za različite aktivnosti s vremenom povećavaju. Kada djeca i adolescenti smatraju da su kompetentni u nekoj aktivnosti, oni percipiraju i komponente vrijednosti te aktivnosti višima. U skladu s tim rezultatima učenici jezičnih gimnazija u našem istraživanju, čija očekivanja uspjeha u matematici nisu bila vrlo visoka, imali su također i niže procjene subjektivnih vrijednosti matematike (korelacije su iznosile od ,60 do ,68).

Nije bilo statistički značajnih razlika između učenika prirodoslovno-matematičkih i jezičnih gimnazija u atribucijama uspjeha u matematici. Čini se da učenici tih gimnazija vide svoj uspjeh na sličan način, kao rezultat truda, sposobnosti i vanjskih čimbenika. No, u ovom istraživanju nisu bile uključene kauzalne atribucije neuspjeha u matematici, tako da ne možemo biti sigurni da učenici gimnazija različitih programa pripisuju svoj neuspjeh sličnim ili različitim faktorima. U budućim istraživanjima bilo bi zanimljivo ispitati postoje li razlike u navedenim atribucijama. Također,

možemo primijetiti da su u oba uzorka atribucije uspjeha, aktivnosti i motivaciji, kao i sposobnosti i ličnosti u niskim, ali pozitivnim korelacijama s odabirom više razine matematike na državnoj maturi i odabirom fakulteta za koji je matematika važna, a da atribucije uspjeha vanjskim faktorima nisu u statistički značajnim korelacijama s tim, a ni ostalim varijablama.

Hijerarhijske regresijske analize s odabirom više razine matematike na državnoj maturi kao kriterijskom varijablom pokazale su da u oba uzorka atribucije imaju važan doprinos objašnjavanju te varijable. No, kad su u drugom koraku uvedeni očekivanje uspjeha i komponente subjektivne vrijednosti matematike, samo se očekivanje uspjeha pokazalo statistički značajnim prediktorom. U drugom koraku hijerarhijske regresijske analize u kojoj je kriterijska varijabla bio odabir fakulteta za koji je matematika važna, u oba su uzorka očekivanje uspjeha i korisnost bili statistički značajni prediktori. Ti rezultati su u skladu s pretpostavkom teorije očekivanja i vrijednosti da su kauzalne atribucije antecedenti očekivanja, vrijednosti i postignuća učenika. Kako do sad nisu provedena druga istraživanja s kauzalnim atribucijama kao dijelom modela očekivanja i vrijednosti, ovaj je nalaz bitan doprinos istraživanjima u ovom području.

Nalaz da je očekivanje uspjeha najvažniji prediktor obrazovnih odabira nije sasvim u skladu s prijašnjim istraživanjima koja pokazuju, kao što smo naveli, da očekivanja imaju najjači direktan utjecaj na postignuće (Wigfield, 1994), a da vrijednosti imaju utjecaj na odabir aktivnosti (npr. Durik i sur., 2006; Simpkins i sur., 2006; Jugović, 2010). No, zbog toga što su očekivanja i vrijednosti u pozitivnoj korelaciji, očekivanja također imaju posredan utjecaj na odabir aktivnosti, kao što i vrijednosti imaju utjecaj na postignuće. Iako je odabir više razine matematike na državnoj maturi varijabla obrazovnog odabira, nije iznenađujuće da je u našem istraživanju očekivanje uspjeha u matematici najvažniji prediktor, jer viša razina matematike na maturi uključuje teže matematičke zadatke. Uz to, obrazovne odabire učenika ispitali smo u trećem razredu, pri čemu su trebali procijeniti koliko je vjerojatno da će napraviti takav odabir, što nije isto kao i ispitati njihove prave, realne odabire. Stoga je moguće da su se učenici pri tim procjenama oslanjali na procjenu svojih sposobnosti.

U odnosu na učenike jezičnih gimnazija učenici prirodoslovno-matematičkih gimnazija procijenili su vjerojatnijim da će polagati višu razinu matematike na državnoj maturi (njihova prosječna procjena na ljestvici od 1 do 5 bila je 4,53, nasuprot samo 2,64 za studente jezičnih gimnazija) i da je vjerojatnije da će odabrati prirodoslovni, biokemijski ili tehnički fakultet (3,73 nasuprot 2,10). Kao što možemo vidjeti, postoje značajne razlike između učenika različitih vrsta gimnazija u motivaciji za učenje matematike (osim atribucija uspjeha) i obrazovnim odabirima vezanim uz učenje matematike. Međutim, kada ispitamo mehanizam u podlozi tih povezanosti, obrazac je vrlo sličan. Ovaj nalaz ima praktične implikacije za nastavnike matematike. Naši rezultati pokazuju da učenici iz jezičnih gimnazija procjenjuju niskom svoju namjeru da upišu fakultete za koje je matematika bitna, kao i očekivanja uspjeha i subjektivne vrijednosti u području matematike. Naravno, ti su učenici

najvjerojatnije i upisali jezičnu gimnaziju vođeni interesom za druge predmete, ali nastavnici bi ipak trebali pokušati poboljšati percepciju učenika o važnosti, korisnosti i interesu za matematiku. Trebali bi pomoći učenicima da formiraju visoka, ali realna očekivanja uspjeha i dati im kvalitetne povratne informacije. Također je poželjno da nastavnici utječu na to da učenici uspjeh u matematici pripisuju svojoj sposobnosti i trudu i da ih uče da sposobnost nije nepromjenjiva, već da se može dalje razvijati. Nekoliko istraživanja pokazuje da već i jednostavne intervencije mogu povećati interes i percepciju korisnosti matematike kod učenika (npr. Harackiewicz, Rozek, Hulleman i Hyde, 2012; Hulleman i Harackiewicz, 2009). Stoga bi nastavnici trebali poticati raspravu o važnosti i korisnosti obrazovnih sadržaja i pokazati učenicima kako usvojeno znanje mogu primijeniti u svakodnevnom životu i svojim budućim zanimanjima.

Naše istraživanje ima i određena ograničenja. U uzorak su uključene četiri gimnazije iz dva grada i samo učenici trećeg razreda, pa bez daljnjih istraživanja ne možemo tvrditi da se rezultati mogu generalizirati i na druge prirodoslovno-matematičke i jezične gimnazije. U budućim istraživanjima bilo bi zanimljivo ispitati i učenike općih gimnazija. Također, ovo je korelacijsko istraživanje, pa rezultati ne ukazuju na uzročno-posljedične veze: primjerice, moguće je da učenici koji namjeravaju upisati prirodoslovni, biokemijski ili tehnički fakultet smatraju da je matematika korisna jer znaju da će im biti potrebna na budućem studiju. U budućim istraživanjima bilo bi zanimljivo i ispitati stvarne pokazatelje odabira fakulteta, kao i druge varijable obrazovnih ishoda (npr. akademske emocije i uključenost u nastavu).