

# ATTITUDES OF POLYTECHNIC STUDENTS IN INFORMATICS ON THE CROATIAN HIGHER EDUCATION SYSTEM, THE CHOSEN COURSE OF STUDY AND STUDY CONDITIONS

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The reform of the Croatian higher education was initiated by the need to increase its quality and competitiveness, to harness universities, polytechnics and colleges for the purpose of economic and social development, as well as to integrate the system as a whole into the international education space. Considering the reforms undertaken so far, the paper aims to establish the attitudes of polytechnic students in informatics on higher education system, the chosen course of study and study conditions. The research attempted to create an information base that is required for an objective assessment and evaluation of the changes brought about by the Bologna process implementation. Furthermore, the paper surveyed the differences in perceptions between students in informatics and their peers enrolled in other courses of study. The obtained results show that polytechnic students' perception of the higher education system, the chosen course of study and study conditions is not sufficiently positive, which indicates they need to be revised and upgraded. It was especially alarming to find that the assessments of students enrolled in informatics programmes were generally lower than those of other students. The relevance of this study lies in the fact that opinions of the Croatian polytechnic students on the analyzed issues have so far been disregarded.

**Keywords:** *assessment of the chosen course of study, Bologna process, Croatian higher education system, information base, study conditions, polytechnic students in informatics*

## Stavovi veleučilišnih studenata informatike o hrvatskom sustavu visokog obrazovanja, upisanom studiju i uvjetima studiranja

Izvorni znanstveni članak

Reforma hrvatskog visokog obrazovanja bila je inicirana nužnošću podizanja njegove kvalitete i konkurentnosti, stavljanja sveučilišta, veleučilišta i visokih škola u funkciju bržeg ekonomskog i društvenog razvoja, te integracije cjelokupnog sustava u međunarodni obrazovni prostor. Intencija ovog rada bila je utvrditi kakvi su, u kontekstu poduzetih reformi, stavovi veleučilišnih studenata informatike o sustavu visokog obrazovanja, upisanom studiju i uvjetima studiranja. Istraživanjem se nastojala stvoriti informacijska podloga koja je neophodna za objektivnu ocjenu i prosudbu promjena koje su nastupile kao rezultat implementacije bolonjskog procesa. U radu su također ispitane razlike u percepciji između studenata informatike i njihovih kolega upisanih na ostale studije. Dobiveni rezultati pokazuju da veleučilišni studenti ne percipiraju sustav visokog obrazovanja, upisani studij i uvjete studiranja u dovoljnoj mjeri pozitivno, što ukazuje na potrebu njihovog daljnjeg preoblikovanja. Posebno je upozoravajući nalaz da su ocjene studenata upisanih na studije iz područja informatike uglavnom niže od ocjena ostalih studenata. Važnost ove studije proizlazi iz činjenice da su mišljenja hrvatskih veleučilišnih studenata o analiziranim pitanjima bila do sada zanemarena.

**Ključne riječi:** *bolonjski proces, hrvatski sustav visokog obrazovanja, informacijska podloga, ocjena upisanog studija, uvjeti studiranja, veleučilišni studenti informatike*

## 1 Introduction

Higher education is a crucial factor in any society, tasked with producing human and intellectual capital, i.e. qualified, well-educated professionals required for the smooth functioning of the community as a whole. Another important role of the higher education system is to educate scientists whose main task is to expand the existing knowledge, contributing with their insights to better understanding of nature and society. Some ten years ago it became clear that the Croatian higher education system was not efficient in meeting the challenges of the modern age, which instigated comprehensive and on-going reforms.

Excessive duration of studies, low exam passing rates, a relatively low percentage of students completing their studies, low student and teacher mobility, lack of adequate relations with the community and disregard for its needs, as well as lack of recognisability of the Croatian higher education at an international level were some of the shortcomings noticed in the previous system. The reforms and restructuring of the higher education system were therefore focused on improving the quality and efficiency of studying, devising a framework for more flexible, ICT-based forms of learning, harnessing universities, polytechnics and colleges for the purpose of economic and social development, increasing employability, promoting life-long learning, setting up efficient quality monitoring mechanisms, enhancing

competitiveness in comparison to foreign higher education institutions, and harmonizing the Croatian system with other systems abroad, in particular with the one prevalent in Europe, in order to ensure the comparability of academic and professional degrees and to promote mobility [1, 2, 3, 4].

The Bologna Declaration, adopted in 1999, marked a turning point in the evolution of higher education. It was a response to the previous fragmentation of the European higher education area, which was seen as obsolete and actually detrimental [5]. Its main goal, defined more precisely in the ensuing documents, was to establish a comparable and compatible higher education system that should act as a cohesion factor among the signatories [6, 7]. The Republic of Croatia joined the Bologna process in 2001. The Bologna reforms were supposed to focus on students, putting them in the spotlight of the education process [8, 9]. However, research indicates that the Croatian higher education system has not managed to fully achieve this goal [10, 11].

Given the fact that intensive ICT development exerts a powerful impact on the society as a whole, and thus obviously on the higher education system, one of the key prerequisites for successful reforms is making an adequate response to a range of challenges arising from technology development. The introduction of ICT-based study programmes might be one of the first steps in this process. For the most part, Croatian higher education institutions have been implementing e-learning in their

teaching, but there are significant differences in the form and intensity of its usage. To participate actively not only in technologically supported teaching, but also in all aspects of the information society, students have to possess both contemporary ICT equipment and adequate level of knowledge and skills. On the basis of the conducted research it can be concluded that Croatian students generally have no problems with the equipment, while their ICT competencies are less satisfactory, although there are significant differences between particular student categories in this respect [12, 13, 14, 15].

The most noticeable result of the higher education reform in the Republic of Croatia is probably the significant increase of the number of higher education institutions, students and teachers, as well as the number of graduates, both from professional and university studies. To illustrate this, at the beginning of the reform, in the academic year 2001/2002, there were 95 higher education institutions (63 faculties, 4 art academies, 7 polytechnics and 21 colleges), with a total of 107 911 students, whereas the total number of teaching staff was 8 132. In the year 2001 there were 13 810 students who graduated from all Croatian higher education institutions [16]. In the academic year 2011/2012 the Republic of Croatia had 134 higher education institutions (83 faculties, 6 art academies, 16 polytechnics and 29 colleges), with 152 857 students and 16 594 teachers. In the course of 2011, there were 36 448 students who graduated from professional and university study programmes in Croatia [17]. In the observed period polytechnics were the fastest growing category. Their number more than doubled, accompanied by a significant increase of enrolled students and a total number of teachers. Notably, in the academic year 2001/2002 polytechnics had a total of 16 024 students, and 863 employed teachers. In the academic year 2011/2012, a total of 24 346 students were enrolled in polytechnics, while the number of teaching staff rose to 2 204. Even more impressive are the data on graduates. While there were 542 students who completed their studies at polytechnics during 2001, in the year 2011 there were 4 558 such graduates. One of the reasons for such a strong development of polytechnics is surely their adaptability to labour market needs through a range of professional studies in which students can acquire practical skills and competencies that enable them to be directly employable, i.e. to be immediately included in the work process. There are, however, other reasons, primarily social ones. The interest in studying at polytechnics was also spurred by the fact that many of these institutions are located in settings that previously had no immediate access to higher education. By establishing polytechnics, it became easier for people from such areas to continue their education, since they no longer have to leave their place of residence in order to gain further qualifications.

## 2 Aims and relevance of the study

The main intention of the paper was to determine how, in the context of the Bologna process, polytechnic students in informatics assess the Croatian higher education system, the quality of their chosen course of

study and study conditions. In addition, the paper examined the differences in perceptions between students in informatics and students enrolled in other professional programmes. Although polytechnic students represent a significant portion of the Croatian higher education system, their opinions on the mentioned issues have largely been disregarded. For this reason, the present study is an important step forward, and its scientific contribution lies in creating the information base which is necessary for an objective appraisal of the Croatian higher education system. Without relevant information it is not possible for higher education policy makers to fully understand the true impact of reforms, or to undertake corrective measures, which are actually imperative, as can be seen from this research.

## 3 Review of related research

Researchers and scholars from different countries have shown interest in student attitudes and opinions regarding the changes resulting from the Bologna process, although their interest should have been even more pronounced, considering the importance of these issues [18, 19, 20, 21, 22]. In this section we focused on studies that examined the way Croatian students perceive the higher education system, the chosen course of study and study conditions in the context of the Bologna reform implementation. Some more relevant results of the available studies are presented below.

The paper by Crnjac Milic, Martinovic and Fercec [23] examined the overall satisfaction of student enrolled in technical faculties in the context of Croatian university reform. Their analysis was based on data obtained through a student survey. The results showed that students were relatively satisfied with the chosen course of study. They expressed a higher degree of satisfaction with the theoretical part of teaching, and lower with laboratory exercises. In this respect, they think that the relationship between the theoretical and practical parts of the programme should be improved. The surveyed students gave mostly positive ratings to the acquired knowledge, but they were less content with the level of equipment at their institutions. Foreign language proficiency was seen as very important. The respondents also supported the statement that a smaller number of students per teacher can significantly improve the teaching process.

While examining the perception of the Bologna process, Bouillet and Gvozdanović [24] aimed to establish how students view the Croatian higher education system and factors of success/failure in studies. Slightly more than two thirds of the respondents noticed certain deficiencies in the system. The authors discovered that the reasons for dissatisfaction with the Croatian higher education system are mostly a consequence of dissatisfaction with the way the Bologna process was conducted. A frequently mentioned drawback is lack of clear guidelines and standards, whereas some positive aspects of the reform are higher level of student rights, i.e. freedom of choice, and improved teaching in terms of both content and organisation. According to the results of the analysis, failure in one's studies is mostly caused by personal traits, decisions and behaviours of students, that is, their lack of interest for studies, and lack of dedication.

Yet, one third of the respondents believed that failure was the consequence of deficiencies in the higher education system, e.g. the programme might be too demanding, and it is possible to postpone one's study responsibilities.

Reić, Ercegovac and Jukić [25] examined the level of satisfaction with the chosen course of study and checked if there is a connection between the motive for choosing a particular programme and satisfaction with that course of study. The surveyed students showed mediocre satisfaction with their course of study, and slightly higher satisfaction with the study programme than with the teachers. Students who were guided by intrinsic motives in their choice had a more positive attitude towards their chosen course of study.

In their study Piršl and Ambrosi-Randić [26] aimed to determine whether the higher education reform, initiated by the Bologna Declaration, had in any way modified students' approach to studying. To check this, they included in their sample students who studied according to both pre- and post-Bologna programmes. The responses of the surveyed students indicated there were statistically significant differences between groups, to the advantage of those studying in the new system. According to the results of the analysis, students pursuing their studies within the Bologna system significantly more use auxiliary tools, spend more time working on teaching content, they are more flexible in learning, more active and motivated than pre-Bologna students.

Škuflić, Turuk and Rkman [27] examined whether the implementation of the Bologna process improved the quality of studying in comparison to the pre-Bologna programmes, in particular regarding the course in theoretical economics. On the basis of responses of the surveyed students the authors concluded that the Bologna process was not equally efficiently implemented at all universities. The main reason is the fact that the reform was undertaken only partially, without full regard for its elements and goals. According to the authors, the number of contact i.e. teaching hours was reduced, but the same did not happen with the curriculum scope or the number of students per group. Furthermore, continuous student assessment has not been implemented. Rather, the old way of examination survives, together with the number of times students are allowed to re-sit exams.

It should be noted that there are other studies dealing with the efficiency of the Bologna process implementation in the Croatian higher education, however, their approach is more theoretical, or they are based on secondary statistical data.

#### 4 Methods

The data analysis was based on statistical methods. Descriptive statistics was used to establish the main characteristics of the examined variables. The non-parametric Mann-Whitney test was applied to test the significance of differences in the ratings of the higher education system, the chosen course of study and study conditions between polytechnic students in informatics and students enrolled in programmes covering other areas. The level of significance was set at  $p < 0,05$ . The mean values of attitudes are shown also in a graph.

#### 5 Sample

The research included a total of 702 students from six Croatian polytechnics. Out of this number, 194 (27,6 %) were students enrolled in a professional programme in the area of informatics, whereas 508 students (72,4 %) were in professional studies in other areas.

The number of male and female students in the sample was quite well balanced: there were 347 male respondents (49,4 %) and 355 women (50,6 %). Among students in informatics the majority were men, with the total number of 150 (77,3 %). In this group there were 44 women (22,7 %). As for students in other areas, men were fewer in number. This group was comprised of 197 men (38,8 %) and 311 women (61,2 %).

The average age of all students who participated in the survey was 21,88 years with standard deviation 5,21 years. The surveyed students in informatics were on average slightly younger than other students. Their average age was 21,22 years with standard deviation 4,01 years, while students in other areas were on average 22,13 years old with standard deviation 5,59 years.

In the sample 371 students were enrolled in the first year of studies (52,8 %). There were 246 second-year students (35 %) and 85 third-year students (12,1 %) in the sample. As for the group comprised of students in informatics, 102 respondents (52,6 %) were first-year students, 71 (36,6 %) were enrolled in the second year, and 21 (10,8 %) in the third year of studies. Among students from other areas, 269 (53 %) were in the first year, 175 (34,4 %) in the second, and 64 (12,6 %) in the third year of studies.

#### 6 Results

Student attitudes were measured on a five-point scale (1 = Poor, 2 = Fair, 3 = Average, 4 = Good, 5 = Excellent). Table 1 shows the basic descriptive statistics calculated for the group of students in informatics on one hand and for students enrolled in other programmes. The last two columns list the descriptive statistics calculated on the basis of responses of all students.

The Croatian higher education system received the average rating 2,85 by the surveyed students. Its competitiveness in comparison with foreign higher education systems was rated even lower. These attitudes of polytechnic students are far from satisfactory and indicate a great need for further reshaping and adaptation of the system. A more positive view is noticeable when it comes to the role of polytechnics in the Croatian higher education system, where the average rating was 3,12. Student ratings that showed their satisfaction with the Bologna process were rather uniform. The Bologna process as a whole, in the sense of increasing study efficiency and promoting motivation and creativity, received average ratings of only slightly above 3. Thus, students believe that the Bologna reform effects are quite average, which is also a less than satisfactory result, as it questions the point of implementing these reforms.

The lowest mean was calculated for the attitude referring to investments in the Croatian higher education. Insufficient investment in the system of polytechnics is

mostly felt by students through their obligation to pay tuition fees.

When compared with the higher education system and Bologna reforms, the chosen course of study was perceived more positively by respondents. The polytechnic where they are enrolled was given the average rating 3,35. There was a similar assessment of quality and content of the chosen study programme, and a slightly lower rating for the suitability of the study programme to labour market needs. Competencies

acquired during studies at the polytechnic were given the average rating 3,53, whereas knowledge and expertise of teachers at the polytechnic received the most positive ratings in this research. Although the highest, this rating should not be interpreted as a sign that the current situation is good and that teachers have no need for further professional development. On the contrary, if the teaching process is to be improved, teachers have to develop continuously by acquiring new knowledge and skills.

**Table 1** Descriptive statistics of student attitudes on the Croatian higher education system, the chosen course of study and study conditions

Rated item	Students in informatics		Students from other areas		Total	
	Mean	Median	Mean	Median	Mean	Median
Croatian higher education system as a whole	2,58	3,00	2,95	3,00	2,85	3,00
Competitiveness of the Croatian higher education system	2,43	2,00	2,63	3,00	2,58	3,00
Role of polytechnics in the Croatian higher education system	3,03	3,00	3,15	3,00	3,12	3,00
Bologna process as a whole	2,92	3,00	3,11	3,00	3,05	3,00
Bologna process in terms of increasing study efficiency	2,93	3,00	3,13	3,00	3,07	3,00
Bologna process in terms of promoting motivation and creativity	2,97	3,00	3,07	3,00	3,04	3,00
Investment in the Croatian higher education	2,31	2,00	2,70	3,00	2,59	3,00
The polytechnic in which the student is enrolled	3,24	3,00	3,39	3,00	3,35	3,00
Quality and content of the chosen study programme	3,23	3,00	3,42	3,00	3,37	3,00
Suitability of the study programme to labour market needs	3,24	3,00	3,09	3,00	3,13	3,00
Competencies acquired during studies at the polytechnic	3,31	3,00	3,61	4,00	3,53	4,00
Knowledge and expertise of teachers at the polytechnic	3,65	4,00	3,83	4,00	3,78	4,00
Level of equipment at the polytechnic	3,25	3,00	3,30	3,00	3,28	3,00
Availability of course literature and library holdings	2,89	3,00	3,03	3,00	2,99	3,00

Study conditions at polytechnics are also in need of improvement. For example, the level of equipment at their polytechnic received the average rating 3,28, and availability of course literature and library holdings was rated slightly under 3. In the economic crisis, one of the biggest challenges for Croatian polytechnics is how to maintain the current level and to improve the conditions of studying.

When responses of all students are taken into account, there were only two items where the median had the value 4: the rating of competencies acquired during studies at the polytechnic and the rating of knowledge and expertise of teachers at the polytechnic. In all the other cases the median was 3.

**Table 2** Results of the Mann-Whitney test

Rated item	Mean rank		Test statistics
	Students in informatics	Students from other areas	
Croatian higher education system as a whole	293,14	369,24	Z=-4,814; p<0,001
Competitiveness of the Croatian higher education system	319,56	361,69	Z=-2,601; p=0,009
Role of polytechnics in the Croatian higher education system	326,13	357,08	Z=-1,935; p=0,053
Bologna process as a whole	326,35	359,69	Z=-2,011; p=0,044
Bologna process in terms of increasing study efficiency	326,03	359,75	Z=-2,037; p=0,042
Bologna process in terms of promoting motivation and creativity	334,84	353,06	Z=-1,110; p=0,267
Investment in the Croatian higher education	294,39	372,01	Z=-4,765; p<0,001
The polytechnic in which the student is enrolled	320,13	359,23	Z=-2,404; p=0,016
Quality and content of the chosen study programme	320,45	359,11	Z=-2,383; p=0,017
Suitability of the study programme to labour market needs	369,45	339,17	Z=-1,869; p=0,062
Competencies acquired during studies at the polytechnic	294,08	364,11	Z=-4,405; p<0,001
Knowledge and expertise of teachers at the polytechnic	323,54	357,27	Z=-2,093; p=0,036
Level of equipment at the polytechnic	340,50	351,53	Z=-0,673; p=0,501
Availability of course literature and library holdings	330,91	353,08	Z=-1,347; p=0,178

Polytechnic students in informatics gave the lowest rating, 2,31 on average, to investments in the Croatian higher education, whereas their attitude regarding its competitiveness was slightly more positive. They rated the Croatian higher education system as a whole with an

average grade 2,58. All three average ratings of students in informatics referring to the Bologna process were also below 3, as well as their rating of availability of course literature and library holdings. The remaining average ratings given by students in informatics were above 3, and

the highest mean was calculated for the assessment of knowledge and expertise of teachers at the polytechnic. When it comes to the polytechnic in which the student is enrolled, quality and content of the chosen study programme, suitability of the study programme to labour market needs, and level of equipment at the polytechnic, the average ratings were very similar, with values in the range between 3,23 and 3,25.

The median for attitudes of students in informatics predominantly had the value 3. The median value 2 was determined in two cases: assessment of competitiveness of the Croatian higher education system and assessment of investment in the Croatian higher education, whereas the value 4 was calculated in only one case, namely for the assessment of knowledge and expertise of teachers at the polytechnic.

The surveyed polytechnic students in informatics gave on average lower ratings to all the analyzed items, except one, when compared to their peers enrolled in professional studies in other areas. The only item that the former group rated more positively was the suitability of the study programme to labour market needs. The values of median calculated for students in informatics were lower than for other students in the case of these three assessments: of the competitiveness of the Croatian higher education system, of investment in the Croatian higher education, and of the competencies acquired during studies at the polytechnic. To examine if and which of the differences in attitudes between students in informatics and students in other areas were statistically significant, the Mann-Whitney test was used. The results of testing are given in Tab. 2.

According to the Mann-Whitney test, statistically significant are the differences in ratings for the following

items: the Croatian higher education system as a whole, competitiveness of the Croatian higher education system, the Bologna process as a whole, the Bologna process in the sense of increasing study efficiency, investment in the Croatian higher education, the polytechnic in which the student is enrolled, quality and content of the chosen study programme, competencies acquired during studies at the polytechnic, and knowledge and expertise of teachers at the polytechnic. Thus, the difference in the item covering the suitability of the study programme to labour market needs, which was rated more positively by students in informatics, is not statistically significant. All this leads to the conclusion that students enrolled in professional studies in the area of informatics generally assess more negatively the Croatian higher education system, the chosen course of study and study conditions when compared to their polytechnic peers in other areas.

To give an easy overview of differences in ratings between the two analyzed student groups, the means of their responses are shown in a graph (Fig. 1).

## 7 Conclusion

The Croatian higher education system has been going through complex and demanding reforms for more than a decade. The Bologna process, synonymous with all the changes that took place in the Croatian higher education in this period, is supposed to ensure comparability of academic and professional degrees, contribute to teacher and student mobility, increase employability, create a framework for more flexible ICT-based modes of learning, promote life-long learning, and establish efficient mechanisms for operation and quality monitoring.

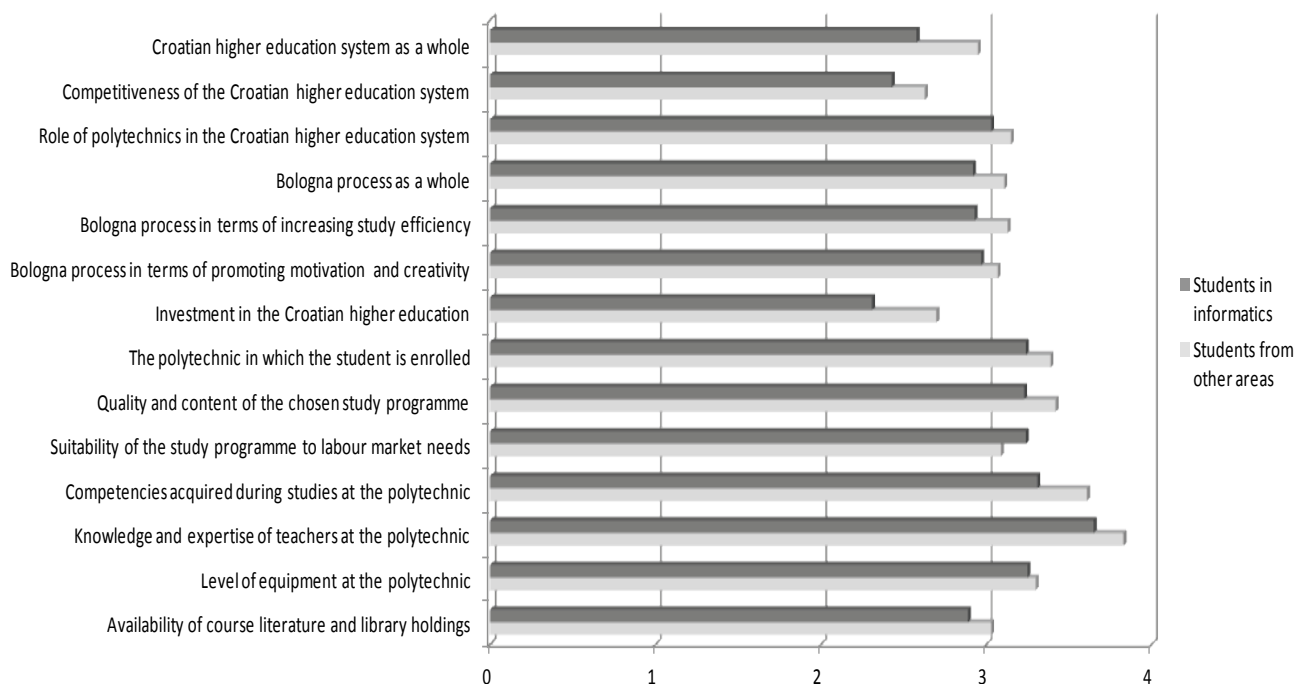


Figure 1 Means of student attitudes

Within the Croatian higher education system polytechnics provide professional post-secondary education. At each polytechnic there are at least three courses of study from different areas. The main intention

of this paper was to determine how polytechnic students, particularly those enrolled in programmes of informatics, assess the Croatian higher education system, the chosen course of study and study conditions. This was expected

to provide some insight into the results of the Bologna reform so far, from the perspective of polytechnic students in informatics.

The research was based on student opinions, i.e. their perceptions, which is a certain limitation of this study. Still, the obtained results are indicative and cannot be seen as satisfactory since the analysis showed that polytechnic students gave average or lower than average ratings to all the research items. Even less encouraging is the finding that the ratings of polytechnic students in informatics are generally lower than those given by their peers in other courses of study. Overall, there is slightly more satisfaction with the enrolled programme and study conditions, and less with the Croatian higher education system and the Bologna process. Although the Bologna reform has doubtlessly improved the higher education system, the results of this study indicate that some aspects need to be reviewed and corrective measures taken in order to fully achieve the set goals. In that sense, this research can be seen as an information base for conducting such activities.

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