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TRENDS OF NUMBER OF WOOD TECHNOLOGY STUDENTS SINCE INTRODUCTION OF THE BOLOGNA PROCESS IN UNIVERSITY TEACHING IN CROATIA

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ABSTRACT

Croatia joined the Bologna process in 2001 and has been an active participant ever since. All study programmes have been aligned with the Bologna structure in 2005, and all students graduating in Croatia from these programmes receive ECTS credits and are entitled to diploma supplements. This article presents an analysis of the number of enrolled students of various study curricula at the Faculty of Forestry in Zagreb since academic year 2005/06. The base for these analyses are data of the number of students, gathered from the Information System of Higher Education Institutions (ISVU) for students of various undergraduate study curricula, and specially for two wood technology graduate programmes. Correspondence analysis was performed for students enrolled in undergraduate programmes. Time series data analysis was performed for three wood technology study programmes.

Key words: wood technology, students, Bologna process, correspondence analysis, trend

1. INTRODUCTION

The European Union has committed itself to the principle of sustainable development as its policies and actions, based on balanced economic growth, price range of stability, strengthening the internal market, research and development, innovation, education, competitive social market economy and a high level of protection and improvement of the environmental quality (Lučić, 2009). University education is more than the next level in the learning process; it is a critical component of human development worldwide. It provides not only the high-level skills necessary for every labor market, but also the training essential for teachers, doctors, nurses, civil servants, engineers, humanists, entrepreneurs, scientists, social scientists, and a myriad of other personnel. It is these trained individuals who develop the capacity and analytical skills that drive local economies, support civil society, teach children, lead effective governments, and make important decisions which affect entire societies (EPI, 2019).

The UNESCO Recommendation concerning the Status of Higher-Education Teaching Personnel provides the following definitions of academic freedom and institutional autonomy: Academic Freedom: Higher-education teaching personnel are entitled to maintaining of academic freedom, that is to say, the right, without constriction by prescribed doctrine, to freedom of teaching and discussion, freedom in carrying out research and disseminating and publishing the results thereof, freedom to express freely their opinion about the institution or system in which they work, freedom from institutional censorship and freedom to participate in professional or representative academic bodies. All higher-education teaching personnel should have the right to fulfil their functions without discrimination of any kind and without fear of repression by the state or any other source. Higher-education teaching personnel can effectively do

justice to this principle if the environment in which they operate is conducive, which requires a democratic atmosphere; hence the challenge for all of developing a democratic society (UNESCO, 1997).

The *Trends series* has been published by the European University Association and its predecessor organisation since the signing of the Bologna Declaration in 1999, and provide an institutional perspective on higher education policy and institutional developments in Europe. Over the years, the focus of Trends has been changing. Whereas previous reports analysed mainly how the Bologna reforms have been implemented at the European universities, Trends 2015 discussed, amongst other themes, also developments in learning and teaching (L&T). Trends 2018 research continues and further enhances this focus, and explores recent European policy developments and institutional strategies and practice on L&T (EUA, 2019).

The Bologna Declaration was a common declaration of the European education ministers singed in 1999 in Bologna, which marked the process of higher education reform known today as the Bologna Process (AZVO, 2019). Croatia joined the Bologna process in 2001 and all study programmes have been aligned with the Bologna structure in 2005. All students graduating in Croatia from these programmes receive ECTS credits (European Credit Transfer and Accumulation System) and are entitled to diploma supplements. The Croatian Qualifications Framework is a reform instrument for regulating the system of qualifications at all levels in the Republic of Croatia through qualifications standards based on learning outcomes and following the needs of the labour market, individuals and society (CROQF, 2019).

This article presents an analysis of the number of enrolled students of various study curricula at the Faculty of Forestry in Zagreb since the academic year 2005/2006, and analysis of the author's teaching hours per given course in a particular academic year. The base for these analysis are data of the number of students gathered from Information System of Higher Education Institutions (ISVU, 2019) for students of various undergraduate study programmes and specially for two Wood Technology graduate curricula.

Correspondence analysis was performed for students enrolled in three undergraduate Bachelor's programmes. Time series data analysis was performed for three wood technology study programmes, one Bachelor's and two Master's curricula. It is known that future projections can not predict in detail the movement of analized variables, such as the number of students. They are only a rough indication of the future course, assuming that the policies won't change significantly (Hanke and Reitsch, 2001). According to Rozga and Grčić (2002), by analyzing data we got a picture of what happened in the (near) past, what the current situation is, and planned and future course of events, i.e. the movement of the number of wood technology students in the near future.

Demographic changes affecting the number of students have to be taken into consideration when designing higher education policies and goals. Many countries are concerned about the decreasing number of young people and how such changes will affect higher education participation and funding (EACEA, 2018).

2. MATERIAL AND METHODS

The base for these reserch are data of the number of students gathered from the Information System of Higher Education Institutions (ISVU) for students of five courses in four undergraduate study curricula (university and professional) and specially for students of two courses in two wood technology graduate curricula at the Faculty of Forestry in Zagreb since the academic year 2005/2006. Also, the database includes the author's teaching hours per given course in a particular academic year. Since the analyses include the last 14 academic years, for the purpose of shortening the name we used mark **A05** for the academic year 2005/2006, the **A06** for the academic year 2006/2007, etc., up to **A18** for the academic year 2018/2019. Study curricula involved in this research are shown in Table 1., and the names of courses with abbreviations for variable names are shown in the legend in Table 2.

Table 1. *Legend for study curricula*

Name of study programme	Code	Type of study programme	Semesters	ECTS
Wood Technology	**DT**	undergraduate university	6	180
Wood Technology	**SS**	undergraduate professional	6	180
Forestry	**ŠP**	undergraduate university	6	180
Urban Forestry, Nature Conservation and Environmental Protection	**PU**	undergraduate university	6	180
Wood Technology Processes	**DP**	graduate university	4	120
Design of Wood Products	**DD**	graduate university	4	120

Table 2. *Legend for the analysed variables*

Variable	Course	Course Code	TEHINSU	Academic years	Semester	ECTS	Lectures (hours)	Exercises (hours)	Exercises groups
M1	Mathematics	DT-1101	33556	A05-A18	1st	7	**45**	**45**	**2**
M2	Mathematics	ŠP1002	33852	A05-A17	1st	7	45	**45**	**2**
M3	Mathematics	PU1002	33780	A05-A17	1st	7	45	**45**	**2**
M4	Mathematics for Engineers	SS102	48478	A08	1st	7,5	**45**	**60**	**1**
		SS103N	163675	A13-A18					
S1	Basic Statistics	DT-2314	33636	A06-A18	3rd	4	30	**30**	**2**
S2	Applied Statistics	DP-2353	33701	A09-A18	3rd	4	30	**15**	**1**
S3	Applied Statistics	DD-2376	33725	A09-A18	3rd	4	30	**15**	**1**

The database for this reserch includes the number of students involved in four Mathematical courses (M1, M2, M3, M4) and three Statistical courses (S1, S2, S3) since introduction of the Bologna process in university teaching at the Faculty of Forestry in Zagreb, as well as the author's teaching hours. The author of this paper worked as *an assistant* from A05, *a senior assistant* from A12, and *an associate professor* from A16 (as *an associate teacher for exercises* on all of the courses from A05, and as *a lecturer*, with exercises, on M4 from A17 and M1 from A18). Data gathered for these analyses are shown in Table 3.

Table 3. *Number of students and author's teaching hours according to courses*

Academic year	Number of students according to Courses							Author's teaching hours according to Courses						
	M1	**M2**	**M3**	**M4**	**S1**	**S2**	**S3**	**M1**	**M2**	**M3**	**M4**	**S1**	**S2**	**S3**
A05	78	118	51					90	90	90				
A06	83	122	49		20			90	90	90		60		
A07	115	129	74		58			90	90	90		60		
A08	81	123	75	44	40			90	90	90	60	60		
A09	115	125	70		32	11	7	90	90	90		60	15	15
A10	131	117	98		49	11	5	90	90	90		60	15	15
A11	131	112	86		47	15	8	90	90	90		60	15	15
A12	139	117	92		31	22	5	90	90	90		60	15	15
A13	143	110	90	41	35	23	6	90	90	90	60	60	15	15
A14	125	98	76	33	42	12	10	90	90	90	60	60	15	15
A15	118	103	82	12	51	20	12	90	90	90	60	60	15	15
A16	113	94	74	40	41	17	9	90	90	90	**150**	60	15	15
A17	42	87	75	41	32	13	7	90	90	90	**150**	60	15	15
A18	39			10	26	18	9	**180**			**150**	60	15	15

Explanations for missing data in Table 3: an author isn't involved in teaching anymore (last row for courses M2 and M3); the study curriculum has not been enrolled (several years for M4); the first generations of students had not started yet, (S1 started in A06, and S2, S3 in A09).

Correspondence analysis as a descriptive/exploratory technique designed to analyze simple two-way and multi-way tables containing some measures of correspondence between the rows and columns was used to explore the difference/similarity of number of students enrolled in the first year of three different Bachelor's university study curricula.

Data analyses for this paper, as well as tabular and graphical representations, were performed in Microsoft Excel and Statistics software packages.

3. RESULTS AND DISCUSSION

During the last 14 academic years an author was involved in teaching of 4865 students. Minimum of 102 students is recorded in this academic year 2018/2019 (A18), and maximum of 448 students in A13. The average number of students per academic year is 348, with standard deviation of 90 students, that leads us to 95% confidence interval from 295 to 400 students per year. The coefficient of variation for the number of students in an academic year is 0,26.

According to the number of courses in one academic year, an author was involved 1 year in 3 courses (A05), 2 years in 4 courses (A06, A07), 2 years in 5 courses (A08, A18), 4 years in 6 courses (A09-A12), and 5 years in 7 courses (A13-A17). The average number of courses per academic year is 5,7 with standard deviation of 1,3 (95% confidence interval from 4,9 to 6,5). The coefficient of variation for number of courses in an academic year is 0,23.

Distribution of students according to academic years and courses are shown in Figure 1. and Figure 2.

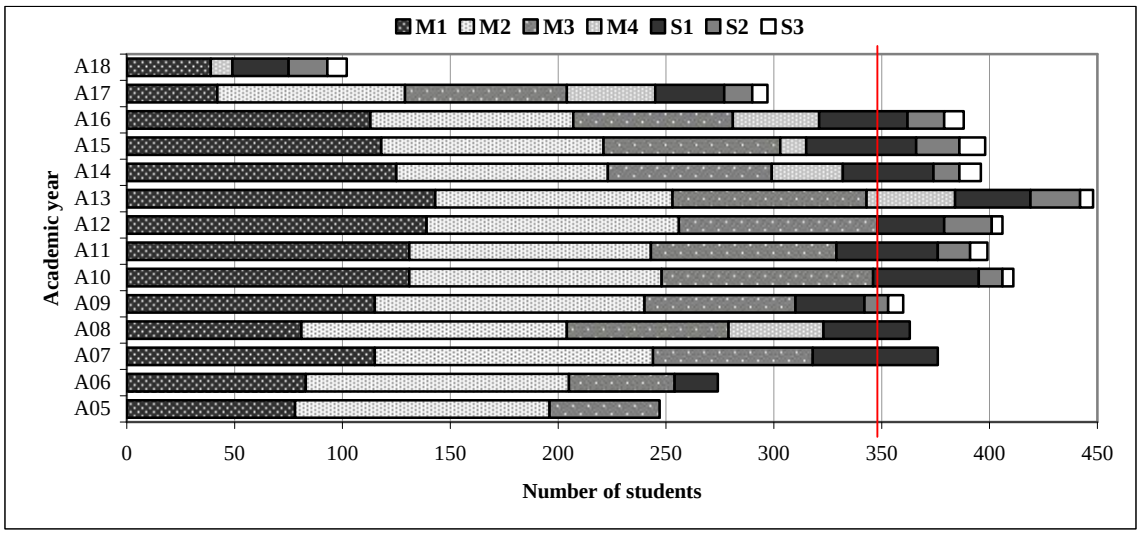

Figure 1. *Distribution of students according to Academic years*

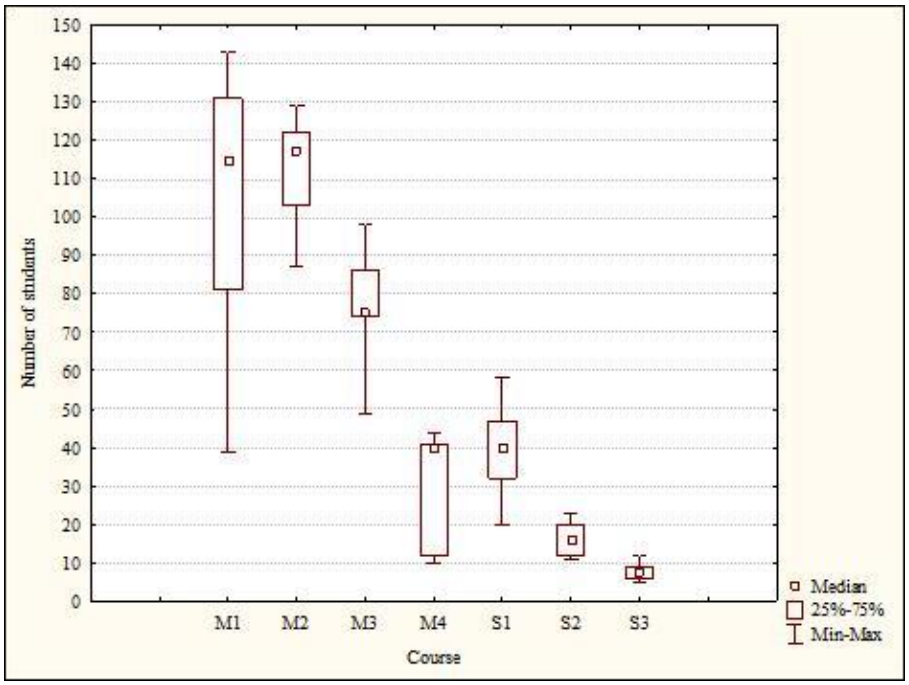

Figure 2. *Distribution of students according to Courses*

Descriptive and inferential statistics were determined for the number of students for all of the courses included in these analysis, from the 1st year of undergraduate Bachelor's university and professional study programmes (Y1) to the 2nd year of graduate Master's university programmes (Y5). The results are given in Table 4.

Table 4. *Statistics for the number of students according to Courses*

Variable	Valid N	Mean	Std.Dev.	Conf.L. -95%	Conf.L. +95%	Minimum	Median	Maximum	Coef. Var.
M1	14	104	34	84	123	39	115	143	0,33
M2	13	112	13	104	120	87	117	129	0,12
M3	13	76	14	68	85	49	75	98	0,19
M4	7	32	14	18	45	10	40	44	0,46
S1	13	39	11	32	45	20	40	58	0,28
S2	10	16	4	13	19	11	16	23	0,28
S3	10	8	2	6	9	5	8	12	0,29

According to the National qualifications frameworks for higher education in Croatia (Law on Scientific Activity and Higher Education, 2017), the criteria for engagement and workload of teachers and associates in teaching in undergraduate, graduate, postgraduate and specialist studies are: 150 teaching hours for an assistant, 225 teaching hours for a senior assistant, and 300 teaching hours for teachers elected to the scientific degree. For obligatory hours of teaching per an academic year we used the term *Norma hours* (an estimation of the time learners typically need to complete all learning activities such as lectures, seminars, projects, practical work, work placements, individual study required to achieve the defined learning outcomes in formal learning environments). Considering this criteria, we analized the author's teaching time in *Norma hours* since A05 (7 years as an assistant, 4 years as a senior assistant and the last 3 years as an assistant professor). The results of these analyses are given in Figure 3.

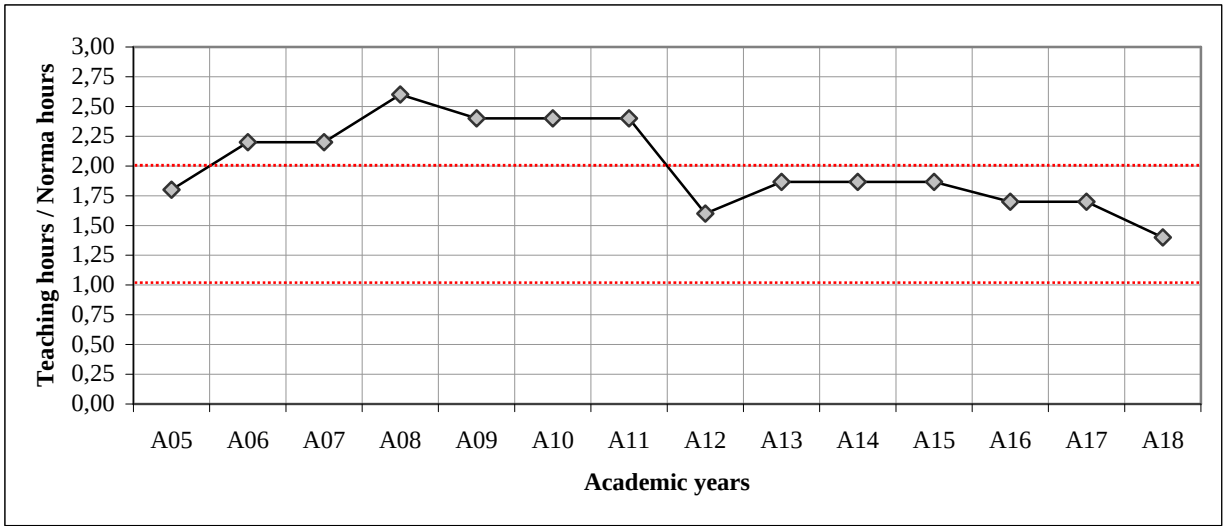

Figure 3. *Ratio of Teaching and Norma hours*

Analysing the ratio of an author's teaching hours with norma hours per academic year, we found that during the last 14 academic years an author on average taught exactly double norma, in other words, two full-time jobs. The minimum ratio of 1,4 was in A18 (40% more than norma), and the maximum of 2,6 in A08 (160% more than norma). The distribution of ratios has two modes: 2,4 (A09-A11) and 1,9 (A13-A15). The standard deviation of the ratio was 0,363 (95% confidence interval from 1,8 to 2,2). The share of standard deviation in average value (coefficient of variation) is 0,18.

Correspondence analysis was performed for a number of students (variable with frequences) enrolled in three mathematical undergraduate Bachelor's university curricula (column variables: M1, M2, M3) in the period A05-A17 (row variables). The results of this analysis are given in Figure 4.

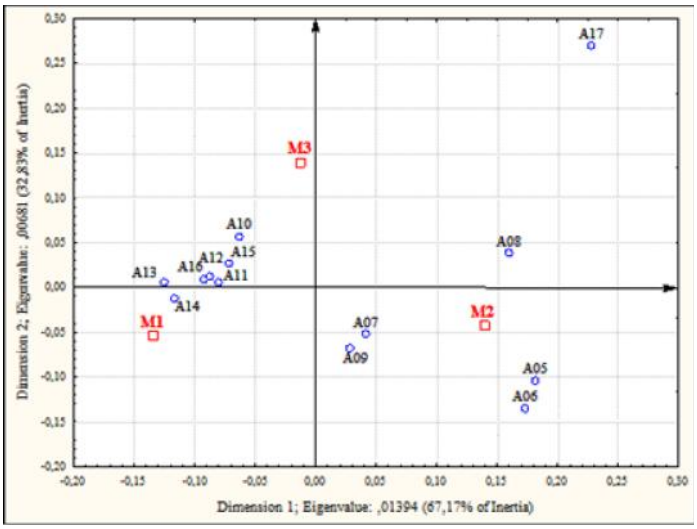

Figure 4. *2D Plot of Row and Column Coordinates*

This analysis shows that the difference between the number of students on three different mathematics Bachelor's programmes is statistically significant (χ^2=80,11 ; df=24 ; p<<0,01). The origin on the map corresponds to the centroid of each variable. Dimension 1 is represented by the horizontal axis, and Dimension 2 by the vertical axis. The closer a row profile's vector location is to the origin, the closer it is to the average profile. In our case, M1/A14, then M2/A05, and M3/A10 were closest to their respective average profiles and therefore closest to the origin. Along Dimension 2 we see that M1/A17, then M2/A17, and M3/A06 have the highest degree of importance. These results indicate that the most important differences or largest deviations from independence in the sample are between M1/A17 (only

42 sudents of M1 in A17, while the 14-year average was 104). The other responses being closer to the origin imply that the deviations from the expected proportions are relatively small.

The success of studying at the Department of Wood Technology was analyzed by comparing the transience from the first to the second year of the Bachelor's programme, as well as by comparing the transience in the second year of the Bachelor's programme to the fifth year of studies (the 2nd year of the Master's study). The percentage of transience of study compared to enrollment in the 1st year of studying is shown in Figure 5.

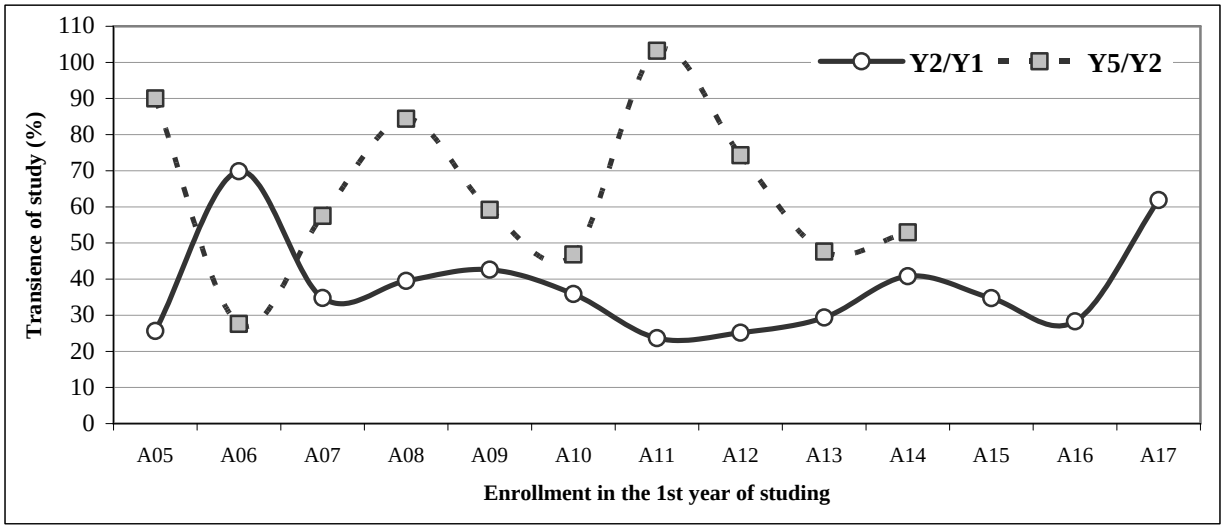

Figure 5. *Transience of studying Wood Technology*

Descriptive and inferential statistics were determined for transience from the 1st to the 2nd year (Y2/Y1), and transience from the 2nd to the 5th year (Y5/Y2), including the analysis of percentage of students involved in two Master's programmes (DP/S2 and DD/S3). The results are given in Table 4.

Table 5. *Statistics for transience of study*

Variable	Valid N	Mean	Std.Dev.	Conf.L. -95%	Conf.L. +95%	Minimum	Median	Maximum	Coef. Var.
Y2/Y1	13	37,9	13,9	29,4	46,3	23,7	34,8	69,9	0,37
Y5/Y2	10	64,4	23,1	47,8	80,9	27,6	58,3	103,2	0,36
DP/S2	10	67,0	8,1	61,2	72,8	54,5	65,3	81,5	0,12
DD/S3	10	33,0	8,1	27,2	38,8	18,5	34,7	45,5	0,24

According to the results presented in the table above, using the calculated 95% confidence intervals (Conf.L.) for the analized period, and the number of students involved in course M1 in A18, we predict that the number of students in the 2nd year of Bachelor's programme for the next academic year 2019/2020 for course S1 will be between 11 and 18 students. We also anticipate that the number of students in the 2nd year for both Wood Technology Master's curriculum in the academic year 2021/2022 will be between 12 and 21. Specifically for the Wood Techology Processe programme in course S2, between 8 and 14 students, and for the Design of Wood Products curriculum in course S3, between 4 and 7 students.

4. CONCLUSION

The results of this research indicate that drop-out rates for the students of wood technology at the Faculty of Forestry in Zagreb are the highest at the end of the first academic year. First-year students are particularly vulnerable to dropping out of higher education, since their expectations might drastically differ from what they actually encounter. Such mismatch can stem from the wrong choice of study

curriculum, poor foreknowledge from basic subjects, as well as the feeling of helplessness and failure at the start of higher education studies.

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