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IMPACT OF STUDENT INVOLVEMENT IN AN INTERDISCIPLINARY PROJECT TEAM ON THEIR ATTITUDE TOWARDS INTERDISCIPLINARY KNOWLEDGE

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Abstract:

The Erasmus + project Spationomy offered the opportunity to students from participating higher education institutions, to obtain the interdisciplinary knowledge from the field of Spatial geography and economics/business studies and to participate in the interdisciplinary and international students teams. This paper presents the results of a study focused on the development of students' attitudes towards interdisciplinary knowledge, before the start of the project and after their involvement in the project activities. The study includes assessments and perceptions of students from the University of Maribor, which is a partner in the Spationomy project.

Findings revealed, that all different viewpoints of perceived ease of use of spationomy interdisciplinary knowledge, perceived usefulness, attitude and intentions to use this knowledge, were assessed higher – more positively (or at least equally positive), after students finished the Spationomy learning cycle, as compared to their opinions before starting it. It is also crucial that they assess their future use of this knowledge, as more likely, after finishing the Spationomy learning cycle, as before it.

Since the importance of interdisciplinary knowledge for the economic activity and as the field of research as well, is increasing, we have also performed the bibliometric analysis, the results of which describe the development, publishing and focal topics within this interdisciplinary field.

Key words:

Spatial geography, economics and business studies, interdisciplinary knowledge acceptance model.

1 Introduction

The interdisciplinary field that combines several viewpoints from both, economics and business sciences on one side and of spatial geography, on the other hand, is a growing field of research. We think that there is a lack of systematic review of research results in this interdisciplinary field – therefore the first objective of our paper was to carry out the systematic review of this interdisciplinary field. As the results of the bibliometric analysis presented in this paper show, the focus of the interdisciplinary interaction of these two fields has been changing in the past, on general the researches have moved from the less interrelated to the multi related topics from both fields. Our paper aims to offer a clear picture of the sub-fields of this interdisciplinary field by conducting bibliometric research. With this, we identify the main streams in the literature, and we also try to identify the new relevant research topics.

The combined interdisciplinary approach of economics and business sciences and of spatial geography is also the focus of the project called Spationomy, that is the Erasmus+ strategic partnership project, starting in the year 2016 (for three years). The main challenge of preparing and running this project lies in the fact that economic data analysis is a very important part of decision-making process – nowadays the importance of the geospatial component inherent with the most economic data is rapidly increasing (Rae and Sener, 2016; Terhorst and Erkus-Oeztuerk, 2015; Agliari et al., 2014; Schulz and

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Bailey, 2014; Brouder and Eriksson, 2013; Hildreth and Bailey, 2013, etc.). Therefore, the high added value of bringing together geospatial aspects in economic data analysis is highly appreciated. The important aim of the Spationomy project is to improve students' interdisciplinary skills by interconnecting both fields, economy, business, management and business informatics on one side and geoinformatics and spatial geography on the other side. Participation of students in this project also offers the unique opportunity to study the important factors that contribute to the acceptance of interdisciplinary knowledge by students and factors that shape their intentions to use this interdisciplinary knowledge in the future.

Empirical research results, described in the present paper, are the continuation of the previous research (Tominc, Bobek, Paszto, Sternad-Zabukovšek, 2019), based on the expanded Technology Acceptance Model (TAM), that has shown and has proven that the interdisciplinary element of spatial sciences and economics sciences is crucial and more importantly, is perceived positively by the young generation of both geographers and economists. That was reflected in positive students' attitudes towards the use and integration of this interdisciplinary knowledge, which further shaped students' intentions to integrate and use the interdisciplinary knowledge of geography and spatial science in general, and economy. Research results confirmed that unique experiences and opportunities gained during the Spationomy project could contribute to building geographical knowledge of the young generation of economists and widen competences of their fellow geographers (and spatial scientists). The research also suggested that the future research efforts should be focused, among others, in analysing if the important differences regarding perceived usefulness, ease of use and attitudes among students, before and after participating in the Spationomy project, exist. This is understood as information enabling to test the appropriateness of learning and teaching approaches (based on blended learning and focused on simulation games) within the Spationomy project.

Within the present paper, the focus is on the research of the development of students' attitudes towards spationomy interdisciplinary knowledge. Therefore, the second objective of our paper is the analysis of the differences of students' perceived ease of use of spationomy interdisciplinary knowledge, perceived usefulness and attitudes and intentions to use this knowledge, after students finished the Spationomy learning cycle, as compared to their opinions before starting it. The research results are evaluated and the importance of educational institutions and curricula development teams are discussed.

2 Theoretical review

2.1 Bibliometric analysis and systematic search of the interdisciplinary field: spatial geography and economics and business studies

With the purpose to analyse the recent research results available in the literature and with the purpose to identify sub-areas of research within the interdisciplinary field of economics and spatial geography, the bibliometric analysis and systematic search of the literature has been conducted (Gundolf and Filser, 2013).

The analysis of the Scopus database was conducted. In the first phase, intended to give us the rough insight to the body of literature, the analysis of the Scopus database documents was conducted, based on the keywords »economics« and »spatial« »geography (in all research fields, except medicine). The search revealed 1390 documents.

In the second phase, two bibliometric analyses were conducted, based on the Scopus database publications in the time period until 2010 and for 2011 - 2017. Bibliometric analysis uses quantitative methods; Garfield (2009) is convinced that with bibliometric analysis, we can also examine the history and structure of a field, the flow of information into a field, the growth of the literature, the patterns of collaboration among scientists, the impact of journals, and the long-term citation impact of a work. The primary technique within the bibliometric analysis is mapping, aimed at producing different bibliometric

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maps that provide an overview of the structure of scientific publications in a specific research field. One of the most popular ways to use bibliometric mapping is to identify specific research areas within a selected science field, with the specific purpose of getting a view of the size of the field and relevant subfields and how they relate to each other (van Eck, 2011). Visualization of Similarities (VOS) is the newest mapping technique and has been used to create bibliometric maps in various studies. This technique has been implemented in a computer program called VOSviewer and used in our bibliometric analysis. To create a term map based on a corpus of documents, VOSviewer software distinguishes the following steps (van Eck, 2011; van Eck and Waltman, 2013). Identification of noun phrases, selection of the most relevant noun phrases, mapping and clustering of the terms, visualization of the mapping and clustering results.

In the bibliometric analysis for the time period until the year 2010, 1,153 documents were relevant, leading to the 11345 terms (words or phrases); those terms that occurred at least 15 times in the titles and/or abstracts of the documents, were identified (371 terms), and out of the 60% of the most relevant terms were used. We also manually excluded terms as »literature«, »article«, »researcher« and similar, that does not refer to the content of the researches.

The analysis performed for the years until 2010 led us to the map of terms, presented in Figure 1. There are three main clusters that are visually marked by colours. Cluster 1 (marked with red colour – right side of Figure 1) combines documents where terms economic (ea. activity, economics, ea. equilibrium), spatial (distribution, dimension, pattern), geography, new economic geography, theory, model, location etc. are most frequently used. This led us to a conclusion, that cluster 1 is named as “economic geography theory and research”. This cluster exhibits some connections (lines in Figure 1) with Cluster 2, while there are no connections between clusters 3 and 1. Cluster 2 (marked with green – lower left side of Figure 1) combines documents that are especially associated with different aspects of the population (population size, density, distribution, growth) and its migration, thus we named this cluster “population studies in spationomy”. Cluster 3 (marked with blue – upper left side in Figure 1) includes terms that are associated mainly with the demography and demographic statistics (women, household, fertility, mortality, child, housing); thus we named it “local community studies in spationomy”. There are some connections, represented by lines, between Cluster 2 and 3, but overall the net of connections is sparse.

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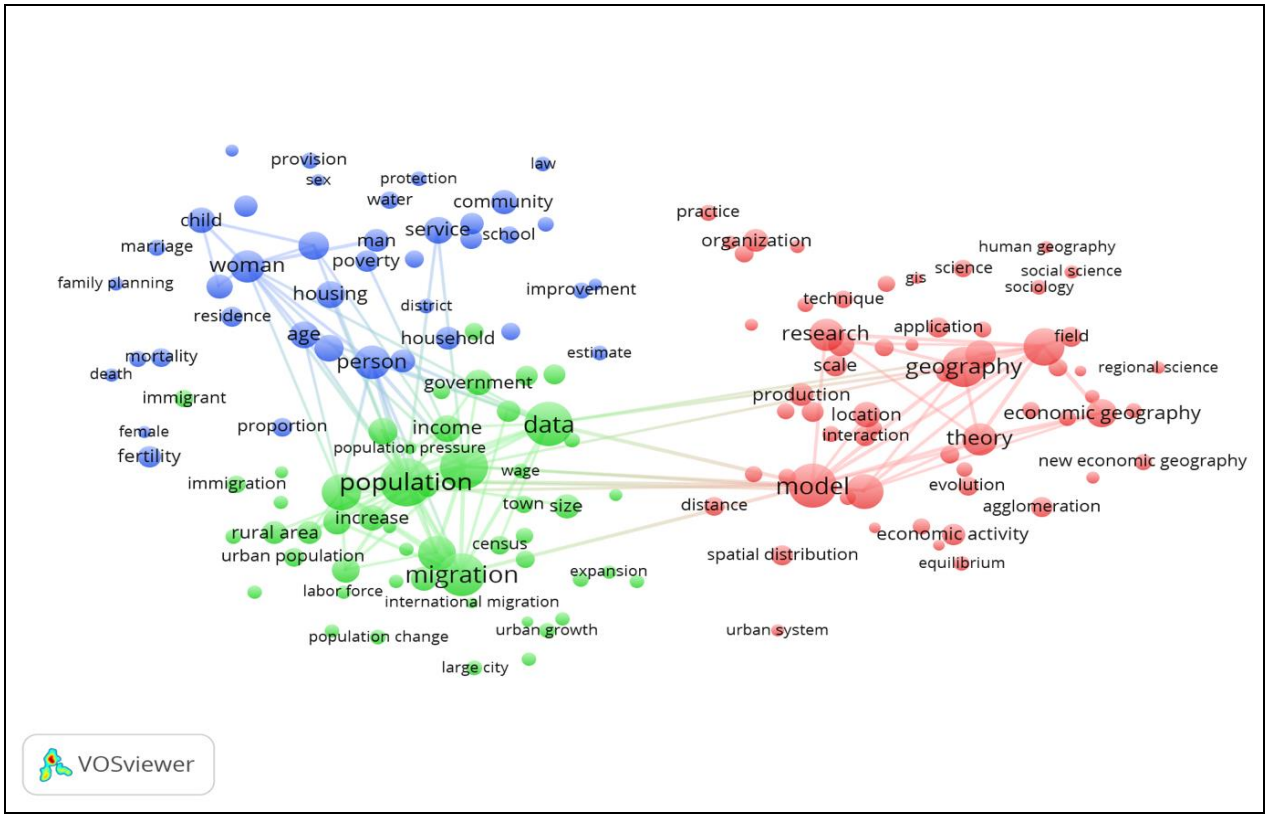
Figure 1: Bibliometric map of terms, up to the year 2010. (Source: Authors).



The bibliometric analysis for publications in the period from 2011 to 2017 reveals quite different map: while again the three clusters were identified, the net of lines – connections is much denser, showing that researches have moved from the less interrelated research topics up to 2010, to the multi-related topics from both fields after that year. The three clusters identified in 2011- 2017 are as follows:

- Cluster 1 (red – lower left side of Figure 2) is defined by 10 terms, with the most emphasised being a spatial pattern, data, society, application etc.
- Cluster 2 (green – lower right side of Figure 2), determined with the nine terms: model, location, distribution, spatial distribution and similar,
- Cluster 3 (blue – upper-middle place of Figure 2) with nine terms, including geography, economic geography, growth production and similar.

Clusters are presented in Figure 2.

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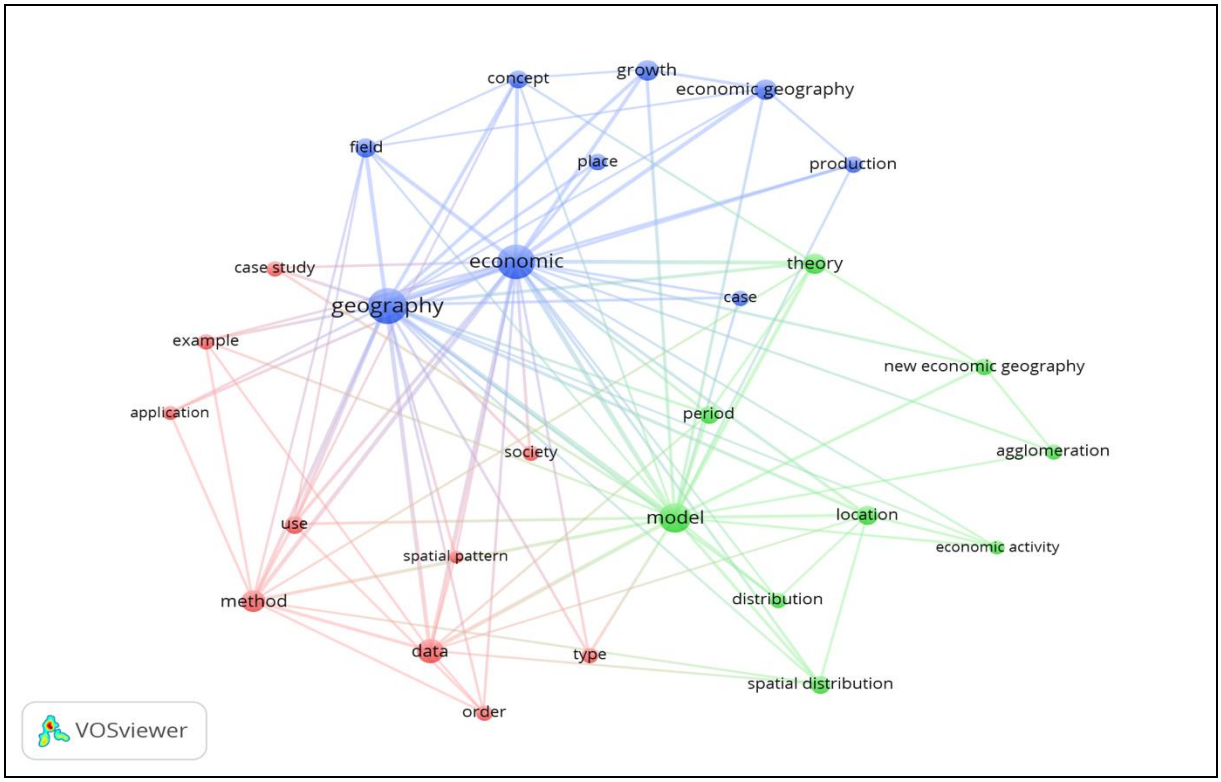
Figure 2: Bibliometric map of terms, 2011 – 2017. (Source: Authors).



The bibliometric analysis leads to the conclusion that the interdisciplinary field of economics and spatial geography in the last decade is associated with three main fields, that are reflected in the above -mentioned Figure 2. These three main fields form a quite dense net of connections, suggesting that linking and dealing with inter-related topics is a feature of the spationomy field research, thus also confirming the importance of interdisciplinary research. The items, that are included in these three clusters, do not form very different sets, again assuring, that the topics of economics and spatial geography are often addressed together.

2.2 Spationomy project and acceptance of interdisciplinary knowledge by students

In the previous research results (Tominc, Bobek, Paszto and Sternad-Zabukovšek, 2019) it was found out, that behavioural intentions of students to use the interdisciplinary knowledge of spationomy, are viewed as being jointly determined by the student's attitudes towards usage and by the perceived usefulness, of the spationomy interdisciplinary knowledge and attitudes towards its future use. Perceived ease of use and integration of spationomy interdisciplinary knowledge—shapes the perceived usefulness, as well as the attitudes toward using it. In their research, authors showed (Tominc, Bobek, Paszto and Sternad-Zabukovšek, 2019), that personal-level characteristics may be important when perceived ease of use and perceived usefulness of spationomy interdisciplinary knowledge are shaped by individuals.

Results using based on the conceptual model of research are presented in Figure 3 (Tominc, Bobek, Paszto and Sternad-Zabukovšek, 2019). These research results were obtained based on data of the first cycle of Spationomy project in 2017.

Results show that the Propulsiveness of students, as well as students' Involvement and persistence, both have a significant and positive effect on perceived Usefulness of integration and use of the spationomy interdisciplinary knowledge (β = 0.207 and β = 0.216 respectively). On the other

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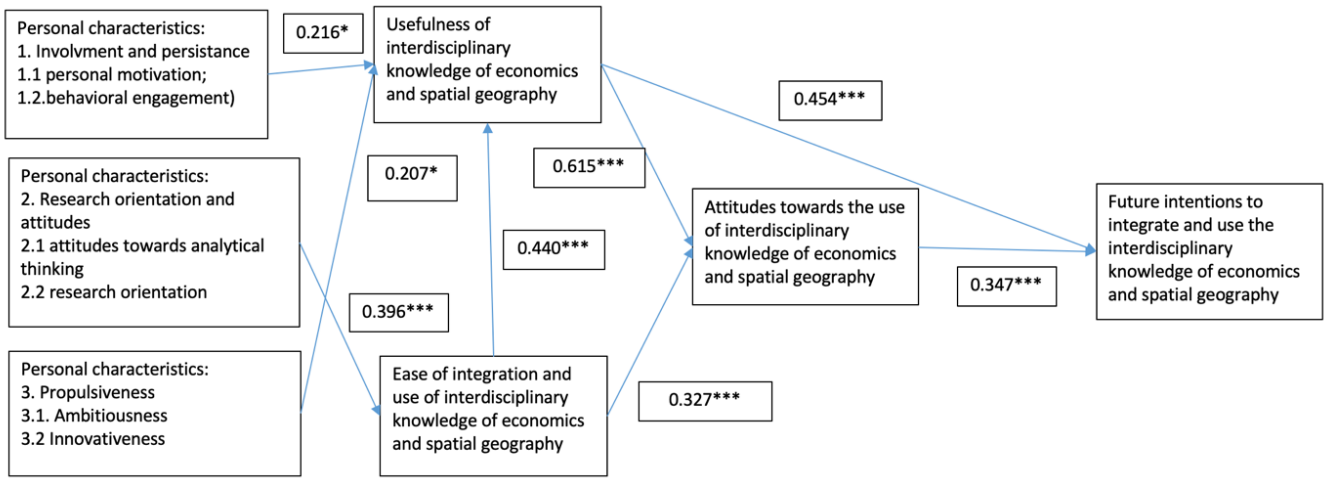
hand, the third construct of personal characteristics, Orientations and attitudes towards studies, has a significant positive effect on the students' perceived Ease of use (β = 0.396).

Perceived Ease of integration and use of spationomy interdisciplinary knowledge has a statistically significant effect on students' perceived Usefulness (β = 0.440), as well as on students' Attitudes towards the use of spationomy interdisciplinary knowledge (β = 0.327).

Figure 3: Behavioral intentions of students to use the interdisciplinary knowledge of spationomy in the future



Source: Tominc, Bobek, Paszto and Sternad-Zabukovšek, 2019

Results also confirm that students' perceived Usefulness of spationomy interdisciplinary knowledge has a direct effect on students' Intentions to use this interdisciplinary knowledge in the future (β = 0.454). However, perceived Usefulness also has an indirect effect on students' Intentions to use spationomy knowledge. Namely, perceived Usefulness has a significant positive effect on the students' Attitudes towards the use of spationomyl interdisciplinary knowledge (β = 0.615), and Attitudes have a direct effect on students' Intentions to use the spationomy knowledge in the future (β = 0.347).

The research results of the first cycle of Spationomy project, therefore, confirmed the importance of integration of economics/business and spatial sciences' knowledge, for graduates who nowadays have to think and act interdisciplinary. As presented in their paper, authors (Tominc, Bobek, Paszto and Sternad-Zabukovšek, 2019) showed that results of the study have important implications for higher education institutions, reforming and updating their study programs, as well as for educators in the field of spatial and economic/business sciences, in research and education.

Within the present paper, the main objective of the empirical research is to identify the significant differences of students' perceived ease of use of spationomy interdisciplinary knowledge, perceived usefulness and attitudes and intentions to use this knowledge, after students finished the Spationomy learning cycle, as compared to their opinions before starting it. Since the previous research results revealed positive attitudes of students towards the integration and use of the interdisciplinary knowledge of spationomy, we wanted to further explore the hypotheses, that Spationomy project activities contribute to the positive development of perceived Ease of integration and use, perceived Usefulness, Attitudes and Behavioural Intentions. The following hypotheses were formed:

H1: The students' perceived Ease of integration and use of spationomy interdisciplinary knowledge after students finished the Spationomy learning cycle is more positive, as compared to their opinions before starting it.

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H2: The students' perceived Usefulness of spationomy interdisciplinary knowledge after students finished the Spationomy learning cycle is more positive, as compared to their opinions before starting it.

H3: The Attitudes of students towards spationomy interdisciplinary knowledge after students finished the Spationomy learning cycle are more positive, as compared to their opinions before starting it.

H4: The students' Behavioural Intentions to use the spationomy interdisciplinary knowledge after students finished the Spationomy learning cycle are stronger, as compared to their opinions before starting it.

3 Data set and methodology

Within each cycle (an academic year), students from participating four higher education institutions, take a "drill" part – an intensive week of spationomy lectures and workshops, that takes place face-to-face at one of participating institutions, in February. That is the first time when students from all four institutions met. Before starting the lectures and workshops, students filled in the questionnaire about different perceived aspects: perceived usefulness of interdisciplinary knowledge of spationomy, perceived ease of integration and use, attitudes towards the use of interdisciplinary knowledge and about the future intentions to use and integrate the interdisciplinary knowledge of economics and spatial geography.

After this intensive week, students work virtually in teams, and at the beginning of summer, they again meet face-to-face in the one-week summer-school, where they attend lectures, workshops and use their obtained knowledge in the Spationomy simulation game. At the end of the summer school, students filled-in the questionnaire again.

We used the questionnaire, defined by Tominc et al. (Tominc, Bobek, Paszto and Sternad-Zabukovšek, 2019), where all items of the five multidimensional constructs were assessed by students, according to their level of agreement with the item – statement, on a 7-point Likert scale from 1 – completely disagree to 7 – completely agree.

In this paper, we focus on development and differences in students' opinions and assessments, for a group of 14 students from University of Maribor, Faculty of Economics and Business, E-business study field, who participated in the Spationomy project in 2018 and 2019. Therefore, the database for our research are two sets of n=14 students, who were interviewed before the start (set 1) and after the end of the Spationomy activities (set 2).

With the purpose to test the development of positive perceptions and attitudes among students towards the integration of use of interdisciplinary knowledge of economics/business and geography, by participating in the Spationomy project activities, the descriptive statistics and paired samples t-test was used, with the 5% significance level (Tabachnick and Fidell, 2013).

Statistical Package for the Social Sciences (SPSS) was used.

4 Analysis of differences among students' perceptions before and after participating in the Spationomy activities

The basic demographic statistics of students, representing respondents in the survey are as follows: in 2019 there were two boys and five girls, all students except one, who studied at the Master level, were studying 2nd or 3rd year of Bachelor level. In 2019 there were three boys and four girls, two of them at the Master programme and other 5 were in the 2nd or 3rd year of Bachelor level.

The descriptive statistics for all items within the five constructs (Ease of integration and use – 4 items; Usefulness – 6 items; Attitudes – 4 items; Behavioural Intentions – 3 items) is presented in Table1.

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Table 1: The descriptive statistics results

Statement	Before - 1; After - 2	Mean	N	Std. Deviation	Std. Error Mean
Ease of use					
1) EU1-Integration of interdisciplinary knowledge of economics and spatial geography is simple and easy to understand.	1	4.14	14	.949	.254
	2	5.64	14	1.082	.289
1) EU2- Learning and obtaining the interdisciplinary knowledge of economics and spatial geography is simple.	1	3.57	14	1.089	.291
	2	5.36	14	1.336	.357
1) EU3-Integration of interdisciplinary knowledge of economics and spatial geography is simple.	1	5.64	14	1.082	.289
	2	5.71	14	1.204	.322
1) EU4-I think it is easy to integrate the interdisciplinary knowledge of economics and spatial geography with the purpose to obtain the desired results.	1	5.29	14	1.069	.286
	2	6.36	14	.842	.225
Usefulness					
2) U1-Using interdisciplinary knowledge of economics and spatial geography enables me to accomplish learning activities and obligations more quickly.	1	4.29	14	.994	.266
	2	5.79	14	.802	.214
2) U2-Using interdisciplinary knowledge of economics and spatial geography helps me accomplish my studying effectively.	1	3.71	14	1.204	.322
	2	5.71	14	.914	.244
2) U3- Interdisciplinary knowledge of economics and spatial geography is beneficial knowledge.	1	4.07	14	1.328	.355
	2	6.57	14	.514	.137
2) U4- interdisciplinary knowledge of economics and spatial geography enables me to accomplish learning obligations more easily.	1	3.50	14	1.092	.292
	2	5.36	14	1.008	.269
2) U5-In my opinion, expertise obtained regarding interdisciplinary knowledge of economics and spatial geography at faculty, is useful in general.	1	4.64	14	1.216	.325
	2	6.36	14	.745	.199
2) U6-In my opinion usage of interdisciplinary knowledge of economics and spatial geography should be learned in all schools of economics and business/spatial geography of higher education.	1	3.86	14	1.099	.294
	2	6.07	14	.829	.221

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Attitudes					
3) AT1-I Overall, I have a positive opinion about the use of interdisciplinary knowledge of economics and spatial geography.	1	5.14	14	1.167	.312
	2	6.29	14	.825	.221
3) AT2-I believe it is a good idea to apply the interdisciplinary knowledge of economics and spatial geography while studying.	1	4.64	14	.929	.248
	2	6.14	14	.770	.206
3) AT3-I like the idea about the integration and use of interdisciplinary knowledge of economics and spatial geography.	1	4.43	14	.852	.228
	2	5.93	14	.997	.267
3) AT4-I support the integration and use of interdisciplinary knowledge of economics and spatial geography.	1	4.07	14	1.328	.355
	2	6.14	14	.864	.231
Behavioural Intentions					
4) IN1-I will try to obtain even more interdisciplinary knowledge of economics and spatial geography in the future.	1	4.50	14	.941	.251
	2	5.71	14	.726	.194
4) IN2-I will use interdisciplinary knowledge of economics and spatial geography more often in the future.	1	4.14	14	1.099	.294
	2	5.64	14	.842	.225
4) IN3-I will share my knowledge of interdisciplinary knowledge of economics and spatial geography and recommend others to use it.	1	4.36	14	.929	.248
	2	5.93	14	.917	.245

Descriptive statistics results show that students perceived all components of perceived ease of use, usefulness, attitudes and behavioural intentions, after they finished learning Spationomy cycle, on average higher as before starting the learning cycle. The highest average levels of agreement with the statements, after the Spationomy activities were completed, were obtained with the following statements:

- U3-Interdisciplinary knowledge of economics and spatial geography is beneficial knowledge (Mean = 6.57, Standard deviation = 0.514).
- EU4-I think it is easy to integrate the interdisciplinary knowledge of economics and spatial geography with the purpose to obtain the desired results (Mean = 6.36, Standard deviation = 0.842).
- AT1-I Overall, I have a positive opinion about the use of interdisciplinary knowledge of economics and spatial geography (Mean = 6.29, Standard deviation = 0.825).
- AT4-I support the integration and use of interdisciplinary knowledge of economics and spatial geography (Mean = 6.14, Standard deviation = 0.770).

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Results of the paired samples test are presented in Table 2.

Table 2: Test of significant differences of students' opinions and assessments before starting and after finishing the Spationomy activites.

		Mean dif.	t	df	Sig. (2-tailed)
Pair 1	EU1-Integration of interdisciplinary knowledge of economics and spatial geography is simple and easy to understand.	- 1.500	-3.496	13	.004**
Pair 2	EU2- Learning and obtaining the interdisciplinary knowledge of economics and spatial geography is simple.	-1.786	-5.095	13	.000**
Pair 3	EU3-Integration of interdisciplinary knowledge of economics and spatial geography is simple.	-.071	-.147	13	.885
Pair 4	EU4-I think it is easy to integrate the interdisciplinary knowledge of economics and spatial geography with the purpose to obtain the desired results.	-1.071	-3.019	13	.010**
Pair 5	U1-Using interdisciplinary knowledge of economics and spatial geography enables me to accomplish learning activities and obligations more quickly.	-1.500	-4.837	13	.000**
Pair 6	U2-Using interdisciplinary knowledge of economics and spatial geography helps me accomplish my studying effectively.	-2.000	-4.770	13	.000**
Pair 7	U3- Interdisciplinary knowledge of economics and spatial geography is beneficial knowledge.	-2.500	-6.431	13	.000**
Pair 8	U4- interdisciplinary knowledge of economics and spatial geography enables me to accomplish learning obligations more easily.	-1.857	-4.315	13	.001**
Pair 9	U5-In my opinion, expertise obtained regarding interdisciplinary knowledge of economics and spatial geography at faculty, is useful in general.	-1.714	-4.837	13	.000**
Pair 10	U6-In my opinion usage of interdisciplinary knowledge of economics and spatial geography should be learned in all schools of economics and business/spatial geography of higher education.	-2.214	-4.954	13	.000**
Pair 11	AT1-I Overall, I have a positive opinion about the use of interdisciplinary knowledge of economics and spatial geography.	-1.143	-2.511	13	.026**
Pair 12	AT2-I believe it is a good idea to apply the interdisciplinary knowledge of economics and spatial geography while studying.	-1.500	-5.140	13	.000**
Pair 13	AT3-I like the idea about the integration and use of interdisciplinary knowledge of economics and spatial geography.	-1.500	-3.859	13	.002**
Pair 14	AT4-I support the integration and use of interdisciplinary knowledge of economics and spatial geography.	-2.071	-5.025	13	.000**
Pair 15	IN1-I will try to obtain even more interdisciplinary knowledge of economics and spatial geography in the future.	-1.214	-3.465	13	.004**
Pair 16	IN2-I will use interdisciplinary knowledge of economics and spatial geography more often in the future.	-1.500	-4.007	13	.001**
Pair 17	IN3-I will share my knowledge of interdisciplinary knowledge of economics and spatial geography and recommend others to use it.	-1.571	-4.048	13	.001**

** - significant at 5% level.

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Results of paired samples t-test revealed, that students after the Spationomy activities, assessed all analysed items of all four constructs, on average significantly higher as compared with the assessments done before the Spationomy activities started. The only exception is the item – statement: EU3-Integration of interdisciplinary knowledge of economics and spatial geography is simple, where the students' average level of an agreement after the Spationomy project finished is higher as compared with the average level before they participated in the Spationomy project, but the difference is not significant.

Based on the results in Table 2, the hypothesis H1: The students' perceived Ease of integration and use of spationomy interdisciplinary knowledge after students finished the Spationomy learning cycle is more positive, as compared to their opinions before starting it, is partly confirmed.
Hypotheses:

H2: The students' perceived Usefulness of spationomy interdisciplinary knowledge after students finished the Spationomy learning cycle is more positive, as compared to their opinions before starting it,

H3: The Attitudes of students towards spationomy interdisciplinary knowledge after students finished the Spationomy learning cycle are more positive, as compared to their opinions before starting it,

H4: The students' Behavioural Intentions to use the spationomy interdisciplinary knowledge after students finished the Spationomy learning cycle are stronger, as compared to their opinions before starting it, are confirmed.

5 Discussion and conclusion

In this study, we examined the differences regarding students' perceived ease of use, usefulness, attitudes and intentions to use the interdisciplinary spationomy knowledge in the future. All based on the survey during the last two years (2018 and 2019) of the Erasmus+ Strategic Partnership Project Spationomy, for the group of students from the University of Maribor, Faculty of Economics and business, E-business study specialisation.

Findings revealed, that all different viewpoints of perceived ease of use of spationomy interdisciplinary knowledge, perceived usefulness, attitude and intentions to use this knowledge were assessed higher – more positively, after students finished the Spationomy learning cycle, as compared to their opinions before starting it. All differences, except one, were also statistically significant at a 5% significance level.

The results confirm that the learning approach used in the Spationomy project is effective since it confirms, that after the completion of the project activity, students perceive the interdisciplinary knowledge of spationomy as easily understandable. At the same time, as beneficial knowledge, which means that they have developed a more positive attitude to this multidisciplinary knowledge, as before their participation in Spationomy project activities.

The research results are important for education institutions and curricula development teams in higher education since it is revealed that the Spationomy project approach resulted in more positive attitudes of students towards the interdisciplinary knowledge of economic/business and geography. In a rapidly changing business environment graduates should be able to think and work in interdisciplinary contexts (Shen, Sung & Zang, 2015). There are several examples of importance of integrated economic and business knowledge on one side and geographic knowledge on the other, for example in natural resources management (Robinson, Genskow, Shaw & Shepard, 2012), when operating at the real-estate markets (Benson, Hansen & Schwartz, 2000), or when using the geo-analysis models for decision-making (Yue, Wen., Chen, Lu, Hu & Zhang, 2015).

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