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RESEARCH ARTICLE

Obtaining geographical competences through online cartography of familiar and unfamiliar urban heritage: lessons from student workshops

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ABSTRACT

In times of the COVID-19 pandemic, teachers on all levels have had to adapt to an online or hybrid teaching environment. People in geography, a discipline that traditionally values field trips to connect theory to practice, have had to find online alternatives for educational activities that normally would have taken place in the field. This has led to several innovative practices, which, however, have only to a limited degree been purposively tested for efficacy because of the ad-hoc, enforced nature of the required changes. This project deals with this issue by studying, through student workshops dealing with the creation of online didactic walking routes in two cities, how students can obtain specific geographical competences such as interpreting different historical layers that collectively shape the current urban fabric through online cartography. We found that students reported clear improvements in geographical reasoning skills, regarding both GIS and heritage interpretation. There were no clear patterns regarding the role of familiarity with the studied city for the quality of the produced story maps. On final reflection, we argue that online cartographic exercises are a valuable addition to the geographers' educational toolkit to bounce forward to a more resilient, reflective educational practice after the pandemic.

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Introduction

The COVID-19 pandemic sent shock waves through educational systems and programmes worldwide. With hardly any preparation time, teachers and lecturers from elementary schools to research universities had to come up with online or, at the minimum, hybrid educational formats for what had always been offline, face-to-face activities. Geographers had been particularly affected, not in the least because they deal with a discipline that traditionally puts a lot of emphasis on the value of field trips and

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field work to connect theory to practice (Holgersen, 2021). This situation has led to several innovative practices, including the more widespread use of online story mapping (Egiebor & Foster, 2019; Lee, 2020; Vojteková et al., 2022), individual field trips supported by personal handheld mobile devices with specific applications (Friess et al., 2016; Loopmans et al., 2021) and virtual field trips (Mead et al., 2019; Spicer & Stratford, 2001; Stainfield et al., 2000).

The worldwide drive to find online or digital alternatives for what had mostly been on-site field activities should not be misunderstood as a completely novel development in geography education (Schultz & DeMers, 2020). Geography education had already innovated with digital and online educational formats for a long time, not in the least because of the discipline's widespread adoption of spatio-technical means in the form of GIS and various other platforms, observation instruments and analytical aides. In this sense, one could argue that in principle, the discipline was relatively well-placed to shift to online alternatives after the outbreak of the COVID-19 pandemic, despite limited preparation and implementation time (Blanford et al., 2022).

However, one should not gloss over the widespread challenges that came along with the enforced shift to alternative educational formats in geography, not just to individuals but also in a systemic sense. Some of the issues include: a mismatch between spatial and institutional differences in attention to and experience with online and digital alternative didactic formats prior to the pandemic, which contrasts with the almost global necessity to implement changes during the pandemic; the changed role of digital and online formats, from supplementary activities to substitutes of often crucial learning activities; and digital divides enhancing already existing inequitable access to education (Hill & Lawton, 2018; Lembani et al. 2020). Simultaneously, the widespread adoption of alternative online methods also brought opportunities, not in the least the mainstreaming of educational formats utilizing spatial software (GIS/online cartography), also in curricula that otherwise may not have implemented field-based educational formats such as in teacher education.

It comes as no surprise that much research already exists on the educational value of online methods, both in pre-COVID times and during the pandemic. Zooming in, specifically, on virtual excursions, field trips and field work yields a burgeoning literature, already from before the pandemic. In general, this research highlights the possible complementarity of online platforms and educational formats to "real" on-site experience, for example, in terms of preparing students to improve their future fieldwork skills or to support ongoing on-site activities (Friess et al., 2016; Mead et al., 2019; Spicer & Stratford, 2001; Stainfield et al., 2000). Some studies have already reflected on the topic of online acquiring of geographical competences in various didactical formats, demonstrating that many tools from digital online cartography are useful for different kinds of spatial learning, like in landscape (De Lázaro Torres et al., 2017) or tourism education (Martínez-Hernández et al., 2021). Looking forward to post-pandemic times, there is an opportunity for further critical reflection on the efficacy of these online alternatives because of the widespread but mostly ad-hoc, enforced nature of the required educational changes in the context of the COVID-19 pandemic. Purposively studying the acquisition of geographical reasoning through conducting virtual field work assignments has taken on additional relevance in (post)COVID times, considering the quest to find innovative but also effective and efficient blended learning formats. One practical example of where

interesting inroads can still be made is the comparison between different spatial contexts, that is, between geographical competence acquisition regarding (urban) spaces that are known and unknown to the person who pursues the development of geographical skills.

This paper deals with these issues by studying how educational formats using online GIS can contribute to obtaining geographical competences. We consider the following research question:

> Do students acquire geographical competences through a workshop utilizing online cartography and which inferences can we make as to the educational value of online alternatives for geography education activities that normally take place in the field?

Specifically, we operationalize this research question by a threefold focus: (i) on a comparison between places people know well and more unfamiliar urban spaces, so as to compare how familiarity with spatial settings plays a role when reflecting on the value of online cartographic exercises for obtaining geographical competences; (ii) on the attainment of reflective capability towards urban heritage as part of the overall urban fabric, to give a clear thematic angle to the type of geographic competences we are studying (Ponce Gea et al., 2021); (iii) on extrapolating if online mapping activities can didactically complement on-site fieldwork (Friess et al., 2016; Spicer & Stratford, 2001). By doing so, our study contributes to the literature on online educational methodologies in geography not only by purposively studying the acquisition of geographical reasoning through formats that have been applied widely but ad hoc during COVID-19 lockdowns, thereby contributing to the lessons learned about post-pandemic educational methods. It also contributes, more specifically, to our understanding of the relation between the familiarity with spatial settings of participants and their obtaining of geographical competences through virtual exercises. Furthermore, our focus on urban heritage interpretations allows understanding not just if participants improved their geographical reasoning, but also in which respect. Finally, with our specific methodology, our study is useful for educational programmes such as teacher's education that due to time or money constraints would not have been able to physically go into the field, domestic and/or abroad, yet whose students still would benefit from acquisition of geographical reasoning skills.

Practically, we used self-evaluation questionnaires of teachers in training in Madrid, Spain, and Kraków, Poland – in both cases, people without specific prior geography or heritage training – before and after completing a workshop that had as the objective to design online didactic urban heritage routes in both cities. Combining the literature on online cartographic alternatives to field trips with our research focus, we hypothesize that virtual access to real urban spaces can indeed contribute to obtaining geographical and urban analytical skills, thereby complementing on-site activities, but will not be able to substitute the learning opportunities involved with real-life engagement with these places. In consequence, we expect that the level of engagement and reflection on urban heritage will be stronger in places with a higher familiarity. In the final analysis, our combination of objectives and methodology has taken on the call by Blanford et al. (2022) to not simply bounce back to pre-COVID educational formats but to learn lessons from pandemic-enforced innovation to reflect on what could be a better teaching and learning practice.

Literature review

COVID-19 lessons for online education

Unsurprisingly, since 2020, a significant part of the literature on geography education has focused on describing practical experiences and lessons learned during the lockdown-enforced move from on-site to online education. Much of this literature is particularly anecdotal in nature. Kidd and Murray (2020), using online questionnaires and interviews with educators, present a good summary of what many lecturers, teachers and instructors around the globe experienced first-hand and what is also the main message of many of the research reports on this topic: initially, feelings of stress, uncertainty and a focus on technical solutions to adapt to the new normal prevailed, driven by a necessity to get the required teaching done. However, over time and with experience, in many cases, flickers of a sense of awareness of innovation and opportunities that the new online teaching facilitated arose too (Kidd & Murray, 2020). Bryson and Andres (2020) argued that the rapid adaption to imposed limitations on face-to-face education could hardly build on accumulated insights from Distance Learning practices in geography because of fundamental differences in available time and resources to facilitate the move to online education.

In later phases of the pandemic, academic papers on what Schultz and DeMers (2020) called "emergency remote learning" shifted from reporting about past activities and coping mechanisms to more forward-looking reflections about lessons learned and educational practices after the pandemic. Signifying this shift from reporting to reflecting and learning, Blanford et al. (2022) called for not uncritically attempting to bounce back to previous education formats and activities but to bounce forward to a more resilient, reflective educational practice. In this sense, the pandemic provided an enforced opportunity for reflecting about what we cover with our education and how we organize it (De Lázaro Torres et al., 2017).

Schultz and DeMers (2020, p.143) argued that "well planned online learning experiences are distinct from courses offered online in response to a crisis or disaster". These authors pointed to the value of three interactions in online environments to facilitate reaching higher-order learning outcomes. These interactions are between learner and content, learner and learner and learner and instructor (Bernard et al., 2009; Schultz & DeMers, 2020). Attention to these interactions could help make the shift from COVID-enforced rapid online adaptions to proper, task-specific and learning outcome-oriented online or virtual educational formats (Bryson & Andres, 2020). Making use of formats practiced with during the pandemic can either complement (again allowed) on-site activities or add time-efficient, new formats such as (virtual) field trips to educational programmes where no such things were included pre-COVID (Geraghty & Kerski, 2020). The bottom line here is to make use of innovative practices from during the lockdowns to, this time, purposively include them in curricula to achieve learning objectives more effectively or add learning objectives that were not there before but which, in hindsight, can be extremely valuable. As described by Bryson and Andres (2020, p.609), "[t]he challenge is less about the synchronous/asynchronous dichotomy and more about a fundamental shift in approaches to providing students with experiences that enhance higher-order cognitive skill development."

In this context, it is interesting to shortly reflect on experiences from teachers' education. Placement education in schools for practical experience and learning-by-doing forms a central component of many curricula of teachers' education. This practice ground to a halt in early 2020. Literature on this topic (Kidd & Murray, 2020; La Velle et al., 2020) described not just innovative and student-motivating new practices such as "kitchen chemistry" exercises, but also renewed reflections on existing criticism in academic circles on the effectiveness of previous educational practices such as the dominance of placement education itself (Kidd & Murray, 2020). Experiences during lockdown can lead to individually interesting instruments and formats, like the kitchen chemistry experiments. In turn, these can raise awareness not just about the potential of new educational formats but also about possibly new learning objectives (Kidd & Murray, 2020). Having an open mind, thus, is crucial if one is to indeed "bounce forward" with our education after the pandemic (Blanford et al., 2022).

Online GIS and spatial reasoning as a learning objective

For geographers, the lockdown-enforced online educational experiences may provide opportunities to rethink formats for achieving learning objectives related to spatial thinking and reasoning. Considering the scope of our paper, we focus here on the value of (virtual) field trips and (web) GIS, which form key didactic instruments in geography (Kent et al., 1997). Ito and Igano (2021) showed that field trips can contribute to critical thinking, adaptability and problem-solving skills of students. A key question now is to what extent the benefits of field trips for geography education are transferable to virtual or online contexts? At the minimum, elements such as enhanced affective response of students (Hope, 2009; Ito & Igano, 2021) may not be easy to replicate. Stainfield et al. (2000) described the difference in learning experiences as interaction with people and places in "real" field trips and with time and space in virtual alternatives. In recent years, though, technological advances have resulted in opportunities for meaningful interaction in online field exercises too. Mead et al. (2019) posited that virtual field trips may not replicate the social environment and team building that is a central component of actual field visits. Nevertheless, the authors found that current online platforms allow developing immersive, interactive virtual field trips that facilitate active learning and even feelings of excitement among student populations regarding experiencing places they had not visited before (Egiebor & Foster, 2019; Mead et al., 2019; see also). Furthermore, virtual platforms such as online GIS environments present an opportunity to deal with what Holgersen (2021) identified as a key challenge with "real" field trips, namely properly integrating theory into practical interactions with everyday spatial environments (Carver et al., 2004).

In line with the lessons learned from education during the COVID pandemic, the bottom line of the literature on virtual field trips is that online activities are not a replacement but a welcome addition to on-site field trips. Already by the early 2000s, reflective accounts of potential benefits but also challenges of virtual field trips and web-based GIS exercises as educative tools were commonplace, with the value of such activities being highlighted especially for those with limited or no prior geography or GIS experience (Carver et al., 2004). In particular, web-based GIS has received several positive evaluations in this regard (Carver et al., 2004; De Lázaro Torres et al., 2017;

Henry & Semple, 2012; West & Horswell, 2018). Key bottlenecks of mobilizing GIS for educational purposes are technical requirements of educational staff, investments in hardware and software (Carver et al., 2004) and the perception among staff and students that GIS environments are complex and inaccessible (Henry & Semple, 2012; Summerby-Murray, 2001). For example, Summerby-Murray (2001) reported about a GIS exercise of students in a historical geography course. Students were able to engage with the topic of conservation of heritage landscapes more deeply in New Brunswick, Canada. Yet, a large proportion of students reported that technical problem-solving with the GIS platform was at the forefront of their learning experiences, notwithstanding a course design specifically constructed to facilitate critical heritage reflection rather than GIS techniques per se (Summerby-Murray, 2001). Web GIS can reduce some of these issues because of its flexible, task-specific nature leading to simpler interfaces, its emphasis on interactive GIS elements, and relatively limited investment costs (Carver et al., 2004).

A key takeaway is that web GIS is perfectly suited for facilitating spatial reasoning of students (Carver et al., 2004; Henry & Semple, 2012; Kim & Bednarz, 2013). Its relatively accessible nature lends itself for broad applications in education, also in programmes other than geography and GIS, leading to opportunities to move beyond an educational emphasis on GIS technologies. Whereas in the early literature several papers advocated creating task-specific, custom online GIS platforms for this purpose (Carver et al., 2004; Henry & Semple, 2012), in recent years off the shelf packages from major GIS providers have become simpler in interface and more interactive (Mead et al., 2019; West & Horswell, 2018). Therefore, they have become particularly useful for explorative exercises aimed at facilitating spatial thinking of pupils at high school or undergraduate levels, or in disciplines that traditionally did not incorporate spatial information processing exercises in the curriculum (De Lázaro Torres et al., 2017). For example, Carver et al. (2004) developed an exercise that dealt with finding an optimal location for nuclear waste disposal site in the UK using online GIS. Students reported a stronger engagement with the societal issue at hand, a better understanding of the problem and being able to make more informed decisions using the online GIS tool. In the final analysis, according to Henry and Semple (2012), the key success factors of utilizing online GIS for creating spatial reasoning skills are: (i) a GIS platform that does not appear intimidating to the untrained user; (ii) being able to get familiar with the basic features of the GIS environment in one to two hours; (iii) a system in which making the software work does not stand in the way of using it in terms of thematic content; (iv) pre-processed and integrated data in the GIS environment, and; (v) having access to practical technical support (Henry & Semple, 2012).

Materials and methods

Workshop design and participants

Considering our objective to reflect on the acquiring of geographical competences through a workshop utilizing online cartography, we designed and implemented a workshop with teachers in training in Madrid (Spain) and Kraków (Poland). These students need basic geographic, digital and heritage competences for their professional development, that is, general teaching in basic education, adapted to innovative

technological and critical trends in recent curricula. At the moment of the workshop, the students in question did not have specific training in geography, GIS, or (urban) heritage, making this workshop particularly suited for assessing the students' obtained geographical reasoning skills.

The students received an assignment to develop two didactic pedestrian routes using online cartography for a target audience of pupils of about 12 years old (late primary education, early secondary education). The maximum length of the routes had to be around 5 hours and they had to deal with own-selected heritage elements in the cities of Madrid and Kraków, hence, in one city that they knew well and a less familiar one (in line with our research objectives). The routes had to be designed as story maps using ArcGIS Online. The online mapping of (inter)national heritage locations for didactical purposes required the development of geographical competences and analytical skills regarding the position of heritage in the urban fabric.

The workshop had an online format, with a total duration of 10 hours. Students and mentors could interact orally and share their screens through an open-access videoconference platform. Before the students started with the assignment, they received two one-hour lectures, one dealing with content (regarding urban heritage) and one dealing with technical skills (regarding practicalities of web GIS). We focused on the role of heritage as part of the overall urban fabric as the thematic focus to give a clear angle to the type of geographic competences we are studying. Heritage and space are intrinsically related because all heritage takes place somewhere, but also because heritage is a key socio-political memory infrastructure and, therefore, important for sense of place generation (Graham et al., 2000; Ponce Gea et al., 2021). To foster a critical reflective attitude to the role of heritage in the urban fabric, the lecture dealt with key notions within the critical heritage studies literature (Smith, 2006), including understanding heritage as a selective, contested process of meaning creation, the construction of heritage values, the need to move beyond objectified, material notions of heritage and the concept of landscape biography as a practical tool to study heritage in spatial settings (Kolen & Renes, 2015). After these classes, the participants were able to explore different heritage approaches, locate coherent urban elements, think about an appropriate didactical approach, track a realistic pedestrian route, and design a well-suited story map website. The mentors were always online to solve any trouble, guide the process, and provide continuous educative and geographic discussion.

In total, there were eight participants in Madrid and seven in Kraków, resulting in 15 story maps for both cities. The contents of the workshop and the structure of the story maps are shown in Figure 1. Appendix 1 includes links to the interactive story maps produced by the participants.

The workshop was part of a European project about theoretical and practical challenges of technological innovations (see Acknowledgements). As Polish and Spanish researchers participated in the project, the two cities chosen as case studies were Madrid and Kraków. Both cities have historic centres, are cultural and financial hubs and high-profile international tourism destinations, and both host a UNESCO World Heritage Site (the Old Town with Wawel Royal Castle in Kraków and the "Landscape of Light" in the museums area in Madrid). Madrid and Kraków also have a large amount of open geographical data and online information about their territories available, which was beneficial for our workshop.

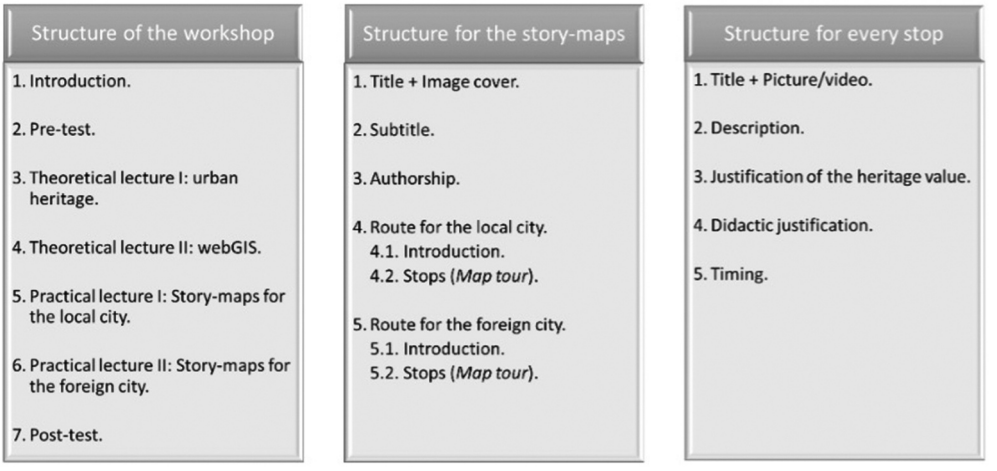

Figure 1. Structure of the workshop and the story maps.

Data collection tools

To assess the influence of the workshop on the students' geographical reasoning skills we used a self-assessed pre- and post-workshop questionnaire for participants as well as an evaluation rubric for the teachers. Three external scholars validated the data collection instruments before use. They evaluated the pertinence of the questionnaires according to a Likert scale [Excellent (10pt), Good (7,5pt), Sufficient (5pt), Insufficient (2,5pt), Not present/unacceptable (0pt)], regarding the following items: (i) instructions are clear enough so that participants can adequately respond to it; (ii) number of questions is correct; (iii) type of evaluation is adequate; (iv) questions adequately cover all research aims; (v) general impression. The validation was positive (Table 1). Cronbach Alpha was used to measure the level of reliability of the expert validation, with an excellent result: $\alpha = 0.912$.

The panel of experts also evaluated the general adequacy of every item in the questionnaires according to the same Likert scale. The average result was 9.3 ± 0.7. The reliability of the expert evaluation was also measured by Cronbach Alpha, again reaching an excellent level: $\alpha = 0.994$.The validators also suggested some improvements (Table 2), such as converting a 5-point Likert scale to a 7-point scale (independently suggested by two validators). We incorporated these suggestions into the final version of the questionnaires.

Table 1. Pertinence of the data collection questionnaires regarding the panel of experts.

Questionnaires	Number of items	Average	SD
Pre-test	5	8.5	2.5
Post-test	5	8.0	2.5
Rubric	5	9.8	0.7
Overall structure	1	8.3	2.9
Combined (overall assessment)	16	8.7	1.0

Table 2. Pertinence of the items in data collection questionnaires according to the panel of experts.

Questionnaires	N	Average	SD	Main suggestion for improvement
Pre-test	21	9.2	1.5	A more specific formulation for 1 item.
Post-test	28	8.9	1.9	Reorder items to facilitate longitudinal analysis.
Rubric	9	9.9	0.5	A more specific formulation for 1 item.
All the evaluation process	58	9.3	0.7	Change from a 5-points scale to a 7-points scale.

Table 3. Pre and post workshop self-assessment questionnaires. Answers to statements were recorded on a 7-point scale. Note: (*) Only for pre-test; (**) Only for post-test.

Theme	Code	Items(*) (**)	Assessed learning domain
General questions	1.1.	The competences I acquired in this workshop will help me become a better teacher.	Didactic transference
	1.2.	I felt motivated to participate in the workshop throughout the duration of the workshop.	Motivation
	1.3.	Working with webGIS (interactive digital cartography) is useful for didactical purposes.	Didactic transference
	1.4.	I feel motivated to use webGIS (interactive digital cartography) myself, also after the workshop.	Motivation
	1.5.	Pedestrian urban mobility should get priority over other urban polluting and not healthy mobility forms.	Critical thinking
	1.6.	Didactic activities with interactive digital cartographying (webGIS) are effective for dealing with unequal access to educational activities by students with different purchasing power.	Didactic transference
	1.7.	Participating in a workshop about the heritage of both a well-known city and an unknown one is effective for developing a feeling of European citizenship.	Critical thinking
	1.8.	The workshop helped me acquire the necessary skills to use of webGIS (interactive digital cartography) for designing a pedestrian route.(**)	Didactic transference
	1.9.	The lecture about heritage was clear(**)	Heritage framework
	1.10.	The lecture about heritage gave me sufficient methodological knowledge to complete the workshop.(**)	
	1.11.	The workshop instructions were clear.(**)	Logistics
Case studies	2.1./2.5	I was motivated to design the local/foreign route during the workshop.	Motivation
	2.2./2.6	I was motivated for researching heritage elements in local/foreign city for designing the route during the workshop.	
	2.3./2.7	On-site fieldwork would improve the quality of my local/foreign route.	Pertinence of online tools
	2.4./2.8	I know the local/foreign city well.(*)	City level of knowledge
	2.9.	Prior knowledge about the city is crucial to choose adequate heritage elements and design a good route.	Pertinence of online tools
Current knowledge and skills	3.1.	My GIS skills are …	Geo-digital
	3.2.	My ability to work with webGIS (interactive digital cartography) for didactical purposes is …	Didactic transference
	3.3.	My general understanding of what heritage is, is …	Heritage
	3.4.	My theoretical insights about heritage are …	
	3.5.	My skills to identify and interpret urban heritage are …	

The pre- and post-workshop questionnaires contained items for students to self-assess their knowledge and expectations (Table 3). Where possible we repeated questions between questionnaires to make longitudinal analysis of self-reported geographical reasoning skills possible. The post-workshop questionnaire also included five open questions dealing with the student's general impression, their newly gained insights and skills, the main strengths of the workshop, its didactical usefulness, and points of improvement. The evaluation rubric for teachers focused on the students' geographic

Table 4. Evaluation rubric for Madrid and Kraków routes.

Assessment	Code	Items
Geographic competences	1.1	The student places the chosen elements where they are actually located.
	1.2	The student uses an adequate visualization scale.
	1.3	The student elaborates a route sequence which is appropriate for the task's purposes (can be completed in real life in <5 hours, elements are located close to each other, . . .).
	1.4	The student adequately manages the timing for the configuration of the route.
Heritage learning	2.1	The student selects the heritage elements for the route in such a way that it shows that the designed route has a clear concept and storyline.
	2.2	The student links an adequate image/video to every heritage element.
	2.3	The student writes an adequate description for every heritage element in the route reflecting on the heritage values that appear in the chosen heritage element.
Didactic utility	3.1	The route would be didactically effective for a heritage learning by 12 years old children.
	3.2	The route is effectively linked to well-constructed learning outcomes.

competences, their heritage understanding and the didactic utility of their routes (Table 4).

Research variables and statistical analysis

Considering the purpose of this paper, we were particularly interested in: (i) a longitudinal analysis of geographical reasoning skills using the pre- and post-workshop self-assessment questionnaires. We used a Wilcoxon rank sum test to compare students' pre- and post-workshop scores. After checking for normal distribution, we opted for this non-parametric test considering the generally negative skewness of the data; (ii) comparison of the quality of the created story maps between familiar and unfamiliar spatial contexts, using the evaluation rubric. We again used a Wilcoxon rank sum test, for the same reasons as above; (iii) descriptive statistics and qualitative reflections of the students' overall assessment of the workshop format and clarity of its components, using the pre- and post-workshop self-assessment questionnaires.

We used SPSS v25 and Microsoft Excel software for the statistical analysis. The quantitative and categorical research data are shown in Appendices 1 to 4. The results from the inferential statistical tests are shown in Appendices 5 and 6.

Results

Longitudinal analysis of geographical reasoning skills

In general, students were positive in their overall assessment of the workshop and about the development of their geographical reasoning skills. Students were also positive about the workshop's didactic efficacy, considering that most of the post-test items scored on average around six out of a maximum of seven points, almost one point more than the pre-test average (Figure 2). In the pre-workshop questionnaire, students were most critical about: their GIS abilities (codes 3.1 and 3.2; average of 1.9 and 1.8 respectively on a 7-point scale) and their theoretical insights about heritage (code 3.4; average 3.9). Considering the generally high scores, the students were relatively pessimistic about the effectiveness of the workshop for developing a feeling of European citizenship (code 1.7; average 5.0). Their motivation for working online in an unfamiliar foreign city was also relatively low (code 2.5; average 4.4). Before the workshop, the students were most

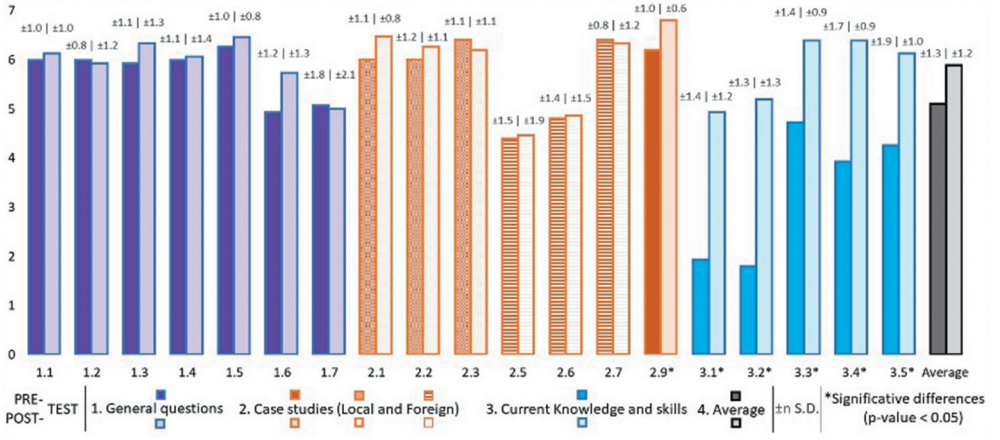

Figure 2. Students' assessment of the workshop before and after participating. Numerical codes are explained in Table 3.

positive about the value that additional on-site field work would provide in both the familiar and unfamiliar city (codes 2.3 and 2.7; average 6.4 and 6.4 respectively), their motivation to do the workshop (code 1.2; average 6.0) and their expectation about the usefulness of the workshop for their didactical development (codes 1.1 and 1.3; both average 6.0). The level of (un)familiarity with Madrid and Kraków also clearly showed in the questionnaires, with two clear clusters of answers appearing for Madrid (code 2.4; average 5.6 for local students and 1.1 for foreign) and Kraków (code 2.8; average 6.7 for local students and 1.3 for foreign). This indicates that our distinction between "familiar" and "unfamiliar" spatial contexts, respectively for the domestic and foreign city under study, was justified.

After the workshop, the on average low assessments disappeared, with in particular the students' assessment of the workshop's clarity (code 1.11; average 6.9) and their perception of importance of prior knowledge of a space before preparing a heritage route (code 2.9; average 6.8) resulting in very high average scores.

The overall change in scores between the pre- and post-workshop questionnaires is also highlighted in Figure 2. Only code 1.7 ("Participating in a workshop about the heritage of both a well-known city and an unknown one is effective for developing a feeling of European citizenship") scored lower after the workshop than before. In most cases, though, the increases were not significant. The only significant increase in an opinion item was code 2.9 ("Prior knowledge about the city is crucial to choose adequate heritage elements and design a good route"). Particularly striking was the very clear and significant increase in reported knowledge and skills of the students regarding GIS and heritage interpretation (codes 3.1 to 3.5), which were exactly the items on which the students scored quite negatively before the workshop. Although immediate questioning after the workshop can skew results in a positive direction considering that such a design cannot measure long-term change, the results are strong indeed, especially when compared to the more stable results for the other questions.

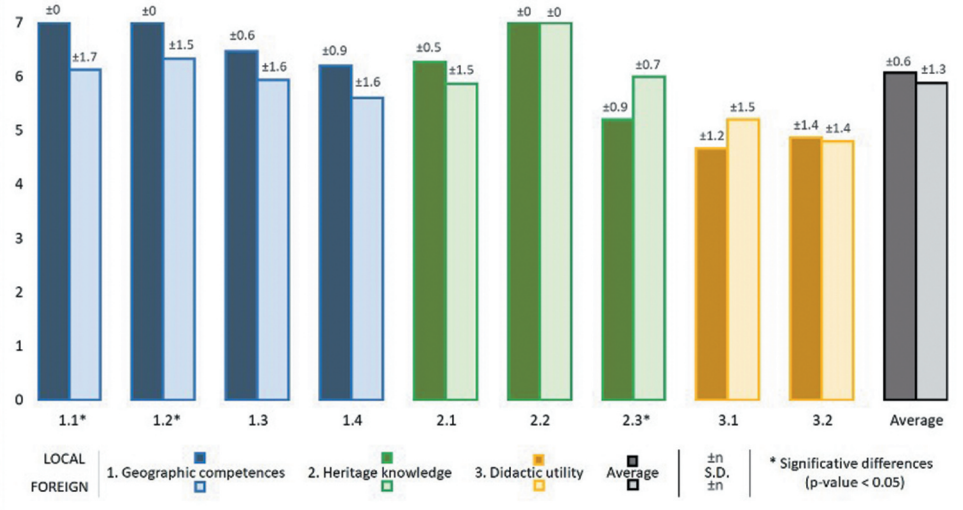

Figure 3. Evaluation of the story maps for the local and foreign cities. Numerical codes refer to the elements in the evaluation rubric, detailed in Table 3.

Comparison of the story maps in familiar and unfamiliar cities

The quality of the created story maps indicated that the workshop can be considered didactically effective (Figure 3). On average, students obtained around 6 out of 7 points for the assignment. The lecturers evaluated that the students indeed acquired sufficient geographic competences and ability to identify and discuss heritage, mostly above the average level of what can be expected from a short workshop. Most problems occurred with obtaining a clear didactic utility of the created heritage route. Not all the story maps showed an appropriate route for 12-year-old pupils. Especially the inclusion of some implicit heritage values without adequate explanation was sometimes problematic, resulting in story maps that had rather unclear intended learning outcomes. Some noteworthy examples are the story maps from: Student #K01 for Kraków, whose stops included "lanterns of death", which are rather sinister for primary students, especially without a didactic guide to contextualize the locations; or from Student #M06 for Madrid, whose stops did not follow a clear didactic pattern but just suggest isolated explanations of what each chosen element is. For more details, all the story maps can be accessed by the web links provided in Appendix 1. Consequently, the evaluation on the didactic utility scored around 1 point below the average.

No clear overall patterns could be detected regarding the role of familiarity with the spatial contexts when it comes to the quality of the story maps. The geographical accuracy of mapped heritage locations and the use of an adequate geographical scale were statistically better in familiar contexts (codes 1.1 and 1.2), which can be expected. Counter-intuitively, though, the description for every heritage element in the route was done better for the unfamiliar city (code 2.3). All other evaluations of the lecturers did not significantly differ between the familiar and unfamiliar urban contexts even though slightly lower scores appeared for the story maps in the foreign city.

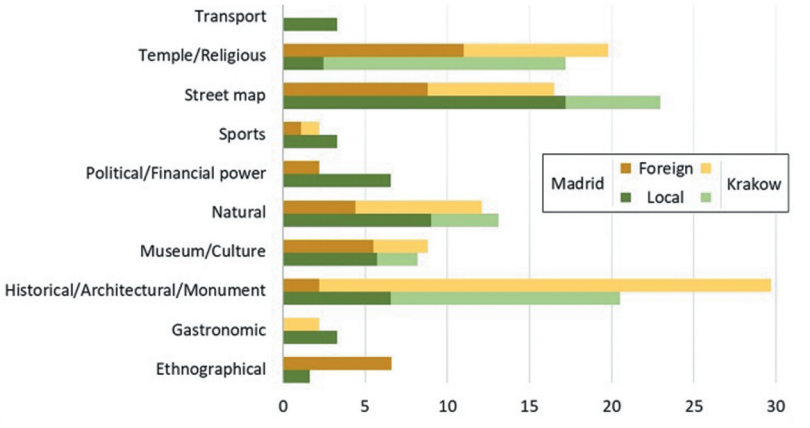

Figure 4. Percentage of the total quantity of mapped elements in the local and foreign cities according to heritage value categories.

The story maps revealed that the students highlighted different heritage values in both cities (Figure 4). The most represented values were related to: historical monuments or buildings, not surprising considering the tourist-historic centres of both cities, "street map heritage" (emblematic streets, squares and neighbourhoods), and religious themes. The first and third categories were mostly highlighted for the foreign city (30% and 20% of the total heritage elements which were mapped for the foreign city), again not surprising considering the easy visual accessibility of this heritage type in both cities. Especially Kraków scored high in this regard. The second category was mostly highlighted in the local city (23% of the total local heritage elements). The other heritage values were equally mapped for the local and the foreign city.

Students' overall assessment of the workshop

Figure 5 gives an overview of the students' answers to the open questions about their overall assessment of the workshop and the clarity of its components. Apart from a few individual negative reflections, most responses were remarkably positive or constructive. The students' reflection on the workshop's didactical usefulness resulted in less comments that the other categories, although most were still rather positive. A recurring frustration, albeit still rather limited, was the perceived difficulty of creating the route in the unfamiliar foreign city. These remarks are in line with the only item that was more negatively evaluated after the workshop than before, which was code 2.9 about the importance of knowing a place before being able to create a good didactical heritage route (see section 4.1). However, the lecturers' evaluations on this part did not systematically mirror these perceptions (see section 4.2). Particularly noteworthy is that the development of geographical and digital skills following the workshop was highlighted by 87% of the students. Furthermore, some students also mentioned that the workshop led to heightened curiosity and improved motivation to work on such topics, which is in line with the findings of Mead et al. (2019) who noted that interactive virtual field trips can indeed facilitate active learning and even feelings of excitement. The workshop's perceived value for bridging between theory and practice (Holgersen, 2021) and the ability to

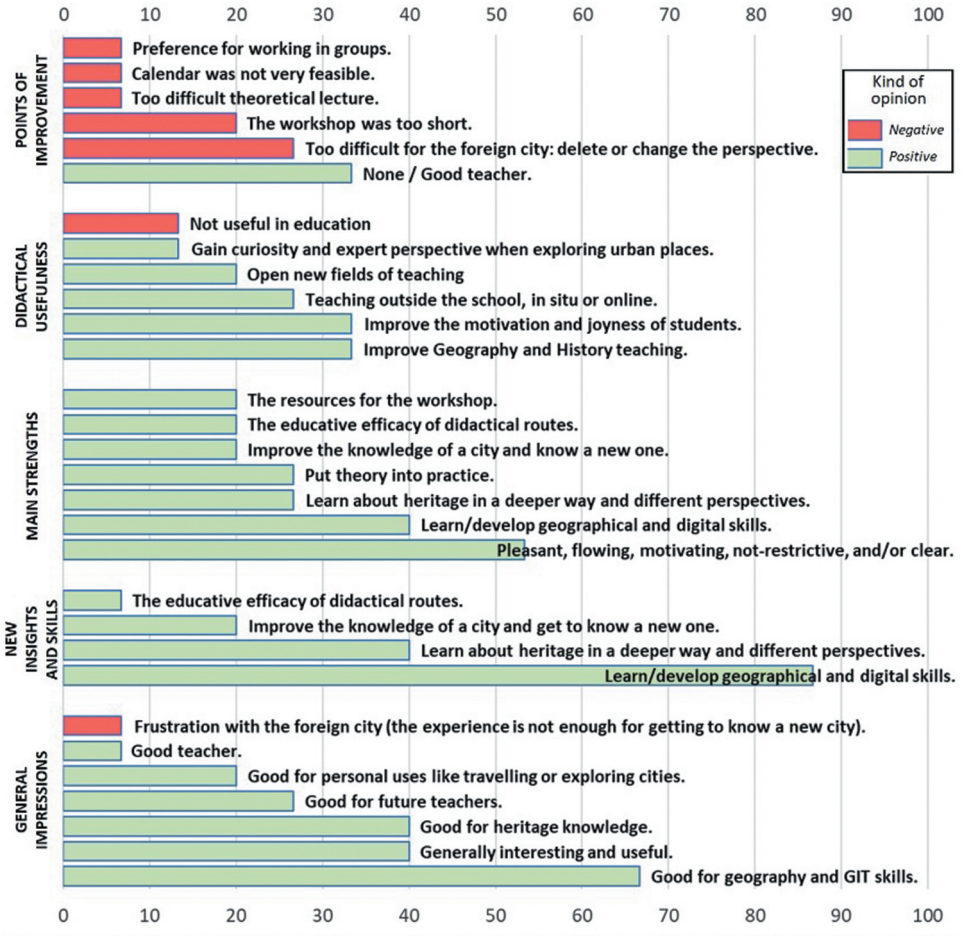

Figure 5. Impressions from students according to a posteriori categorization of opinions.

have deep learning experiences (Mead et al., 2019) with the online GIS environment and virtual field trip exercise are other notable and stimulating responses.

The most successful elements and outcomes of the workshop was therefore the efficacy to develop geographical and digital skills under a kind and motivating atmosphere, what was perceived by both the mentors and the participants. The failures noticed by the students were mostly related to the difficulties of working on unfamiliar cities, but the motivation and the didactical guide that the mentors provided during the workshop was strong enough to assure similar outcomes in familiar and unfamiliar cities. The weak educative approach of some story maps was probably another outlined failure, although few participants mentioned it.

Discussion

Previous studies into the utility of virtual field trips, web-based GIS and online story mapping for developing geographic and digital skills have indicated that such exercises

can indeed contribute to students' geographical abilities, yet without fully replacing the value of "real" field trips (Carver et al., 2004; Egiebor & Foster, 2019; Henry & Semple, 2012; Mead et al., 2019). Where our study distinguishes from the existing literature, however, is (i) the focus on urban heritage as a theme that gives students a specific scope to "read" the urban fabric; (ii) the comparison between geographical reasoning skills in familiar and unfamiliar spaces; (iii) the research design that was developed to make use of our experiences during the COVID-19 enforced lockdowns to, this time, purposively study the utility of online methodologies for fostering the geographical reasoning skills of a group of students who did not receive training in GIS or geographic reasoning yet.

The results from our workshop with teachers in training confirmed findings in the literature. We found strong support for the use of online story map exercises to develop basic geographical competences. This was clear for both basic digital (GIS) skills and being able to reflect on the position of heritage in the urban fabric. There was a clear improvement in self-reported geographical competences and higher-than-expected quality of the delivered story maps. Our expectation that the level of engagement and reflection on urban heritage would be stronger in places with a higher familiarity was not fully met, despite some qualitative remarks about the higher difficulty and lesser motivation to perform the exercise in the unfamiliar city.

Our workshop provides interesting material to reflect on the three interactions that are crucial to consider when pursuing deep learning experiences, that is, learner – content, learner – learner and learner – instructor interactions (Bernard et al., 2009; Schultz & DeMers, 2020). Regarding the interaction between learner and content, our workshop showed robust results. Students not only improved their technical and reflective geographical skills. The virtual format of the workshop also motivated the students to engage with the content, albeit to a slightly lower degree in the unfamiliar city than in the familiar location. In this sense, our study provides empirical support for Mead's et al. (2019) findings that virtual field trips can be immersive, motivating and inspirational, both in places students know reasonably well and in more unfamiliar spaces.

Learner – learner interactions did not appear crucial in our workshop, in the sense that only one student suggested changing the workshop into a group exercise. Nevertheless, considering findings from previous studies, this may be a useful suggestion knowing that "[g]roup work allows greater exploration of the problem and issues through role-play", also in online GIS explorations (Carver et al., 2004, p.431). A simple shift from individual to group work may not automatically deliver higher-order learning outcomes, though. Shifting to group work requires attention not just to possible positive cognitive impacts. It should also specifically attend to collaborative processes in the course design to generate teamwork skills, avoid free riding and social talks dominating over group tasks, and deal with different competences and status levels of students (Le et al., 2018). In any case, we did not find indications of limitations imposed by the individual set-up of our workshop, seeing that we found significant improvements in the participants' geographical reasoning skills after the workshop.

Practically all remarks about learner – instructor interactions in the evaluation of our workshop were positive. Combined with the fact that hardly any comments appeared around the limitations imposed by the students' technical GIS skills, despite very low self-assessments about their skills before the workshop, indicates that the preparatory lectures were well-received and beneficial to the students' learning experiences. We managed to

avoid the situation of Summerby-Murray (2001) where despite a conscious course design, GIS technicalities were at the forefront of students' learning experiences. The more accessible and interactive nature of contemporary online GIS platforms (Mead et al., 2019; West & Horswell, 2018) may play a role in this regard too. Referring to Henry and Semple's (2012) success factors of utilizing online GIS for creating spatial reasoning skills, we used a GIS platform that was not intimidating to the untrained user, of which the basic features could be familiarized with a one hour lecture, and which did not stand in the way of using it in terms of thematic content, in our case urban heritage. Considering the absence of critical remarks about practical operationalization issues in the students' workshop evaluation, it also appeared that access to practical technical support was sufficient (Henry & Semple, 2012).

The same tentatively positive reflections about learner – instructor interactions can be made about the heritage component of the workshop. Despite a singular remark about the perceived difficulty of heritage lecture, no other comments appeared around the lecturers' roles. We also observed a great increase in self-reported heritage reflection skills after the workshop. We do have to note that, not unexpectedly, students still mostly had a traditional conception of heritage as fixed and pertaining to historical monuments rather than a more critical reflection on heritage as a contested process of meaning and value creation (Smith, 2006). Despite technological advancements, the more distant, observational nature of web GIS compared to immersion in actual urban settings may be a fundamental limitation of online educational formats, hinting that these, indeed, may not fully replace on-site experiences (Spicer & Stratford, 2001). The students' perceptions that it would be of great help to also do on-site fieldwork, also after having completed the workshop, and the consideration that prior knowledge about a city is crucial to have a good heritage route design, back up this reflection. Nevertheless, the diversity of selected heritage elements, including some less directly visible ones, indicated that also in terms of content-wise geographical skills, the workshop had its effect.

Conclusions

This paper aimed to study (i) whether students acquire geographical competences through a workshop utilizing online cartography, and (ii) which inferences we can make as to the educational value of online alternatives for geography education activities that normally take place in the field. To this end, we developed a workshop with teachers in training using web GIS for virtual field trips in familiar and unfamiliar urban environments.

Regarding the acquisition of geographical reasoning skills, we found that the participants acquired both basic technical GIS competences and geographical content competences in the form of ability to reflect on the position of heritage in the urban fabric. The obtained basic skills in using an online GIS platform for creating story maps and urban heritage interpretation showed from pre- and post-workshop self-assessment questionnaires as well as from the quality of the delivered map products. Connecting these basic skills to creating a didactical product with clear intended learning objectives – a crucial task for the teacher-in-training participants – proved more difficult, which is not unexpected considering the higher-order

learning outcomes required for this element of the workshop. The same difficulties applied to moving beyond the traditional conception of heritage as fixed and pertaining to historical monuments to fully embrace a critical heritage interpretation, which also requires higher-order learning outcomes. Interestingly, familiarity with the spatial context under study did not have a very significant effect on the quality of the delivered maps, apart from some issues with mapping accuracy. In this sense, our study provided empirical support for the notion that online mapping activities are adequate didactic strategies to acquire geographical competences and reasoning skills, in diverse spatial contexts, not in the least also because of the self-reported motivational nature of the workshop.

Regarding the inferences we can make as to the educational value of online alternatives for geography education activities that normally take place in the field, we found that web GIS activities as a tool for virtual field trips are decent alternatives to "real" field visits considering our participants' clear acquisition of basic geographical competences, at least on basic levels. This may make the specific format particularly useful for educational programmes such as teacher's education that due to time or money constraints would not have been able to physically go into the field, domestic and/or abroad, yet whose students still would benefit from acquisition of geographical reasoning skills. However, compared to on-site fieldwork, it is unrealistic that the same level and depth of immersion can be found with a workshop such as ours. Participants reported that on-site field visits would be even more motivating and assist with achieving a deeper learning experience. The rather objectified nature of the mapped heritage also indicated that on-site immersive activities may generate richer learning experiences that are more in line with theoretical classroom activities (Holgersen, 2021). In this sense, hybrid teaching formats may contribute to obtaining deeper digital geographical and heritage learning outcomes.

Our study was clearly limited by the small, non-representative sample. Therefore, the results should not be generalized beyond its immediate context. Nevertheless, the diversity and complementarity of assessment, evaluation and reflection methods as well as the controlled, task-specific nature of our workshop lend creditability to our findings, indicating that replicating this study in other and larger settings may be useful.

On final reflection, our study gives tentative indications that using web GIS for virtual field trips in familiar and unfamiliar urban environments can be particularly useful also in post-pandemic times, now that online or hybrid educational formats have mainstreamed. This can even bring broader benefits in terms of sustainability (economic savings and reduction of the carbon footprint when complementing fieldwork offsite) and widening participation agendas (by training citizens in online expression skills which support a more universal access to democratic participation). Dealing with digital divides (Hill & Lawton, 2018; Lembani et al. 2020) is crucial in this respect, though. Nevertheless, online cartographic exercises may be a valuable addition to the geographers' educational toolkit to bounce forward (Blanford et al., 2022) to a more resilient, sustainable, open, and reflective educational practice after the pandemic.

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