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Using and measuring the impacts of geovisualisation on tourism education: The case of teaching a service management course

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ABSTRACT

Research about geovisualisation on education is limited. The paper develops a model based on the "Generative Theory of Drawing Construction" showing how to exploit geovisualisation in teaching. The applicability and educational impacts of the model were tested by implementing an experiment that used geovisualisation for teaching a tourism service management topic. Findings of students' performance demonstrate the better educational effects from learner-generated drawing instructions than the solely provision of geovisualisation material. The materialisation of the geovisualisation effects was conditional upon the provision of student support on drawing geovisualisations. Trends for effectively integrating geovisualisation in (tourism) education are also discussed.

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1. Introduction

Nowadays, the free availability and wide accessibility of web map services (e.g. google maps) and geodata have democratized the creation and dissemination of geographical content and services (Goodchild, 2007). According to mashable.com, more than 40% of mash-up applications use google maps' API. This is not surprising when considering that the 80% of all digital data generated today includes geospatial referencing (MacEachrean & Kraak, 2001). Consequently, more and more firms are developing geoapplications for enhancing their business operations and transforming their business models. The tourism industry is not an exception, because: geodata and digital maps are the lifeblood of tourism; tourism by nature involves the transfer of people to places away from home; and all tourism activities take place in certain geographical areas. Indeed, Geographical Information Systems (GIS) and currently, webGIS and geoportals are currently widely adopted in tourism for several purposes, such as (Sigala, 2010, 2012a, 2012b; Sigala & Marinidis, 2012; Zanker, Fuchs, Seebacher, Jessenitschnig, & Stromberger, 2009): trip planning, visitors' management, tracking tourists' behaviour, online bookings, location-based services, management and measurement of destinations' carrying capacity, crisis management and for providing localised personalised content to customers (e.g. SoLoMo marketing application combining social, local and mobile media). This wide application of digital maps requires tourism educators to incorporate the teaching of spatial skills and geodata manipulation into their curricula and educational practices in order to assist graduates with career options. Specifically, students would need to develop two major geospatial competencies, namely: how to use digital maps for information discovery, exploration and presentation; and how to design digital maps for enhancing their communication skills and collaboration with peers.

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However, although there is an advanced stream of research investigating the use of geovisualisation and geoportals in business applications (Brewer, MacEachren, Abdo, Gundrum, & Otto, 2000; MacEachren & Cai, 2006), very few studies have investigated the use and benefits of geovisualisation in education so far (Sigala, 2011, 2012c). Indeed, research investigating geovisualisation in education is limited and inadequate. Some studies (e.g. Jones, Blake, Davies, & Scanlon, 2004) have focused on analysing the educational benefits of digital maps, but without providing any empirical evidence. On the other hand, the ability of digital maps to influence the learning process and outcomes of students may be moderated by many factors including the type of the taught subject and various students' variables such as mental and cognitive processes, and learning styles (Sigala, 2011). Educational research has also failed to develop an instructional model for demonstrating how to best integrate geovisualisation applications into the teaching methods for maximizing its educational benefits. The potential benefits of using geovisualisation for enhancing the learning processes and outcomes are also justified by past research showing that digital maps and geovisualisation can significantly enhance the cognitive processes and capabilities of their users, as by using maps users can easier and faster understand spatial data and their inter-relations and so, cross-relate them to test relations and produce new knowledge (Davies, 1998; MacEachrean, 2005; Sigala, 2011, 2012b). Sigala (2012c) has also shown how geovisualisation can be exploited for supporting collaborative and constructive learning processes in tourism education. Hence, research investigating and providing evidence of the exploitation and the impacts of geovisualisation in education and specifically, in tourism education, is guaranteed.

The aims of this paper are twofold: to investigate how to best exploit and integrate geovisualisation in teaching methods for enhancing tourism education, in terms of optimising learning outcomes/benefits and cognitive learning processes; and to measure these educational impacts of the instructional methods incorporating geovisualisation. To that end, the paper first reviews the literature discussing the impacts of geovisualisation on cognitive learning processes and education. The literature is synthesised by developing an instructional model showing how to integrate geovisualisation into the teaching methods for optimising educational benefits and learning processes. To test the effectiveness of this instructional model, the researcher developed an experiment that involved the use and integration of geovisualisation in the teaching methods of a tourism management course. Data measuring the students' educational benefits and cognitive load experienced during the experiment was gathered for examining the educational impacts of geovisualisation. After discussing the findings and their implications, the paper concludes by providing suggestions and directions for further exploring the area of geovisualisation and education.

2. Geovisualisation and digital maps in education

2.1. Definition and evolution of geovisualisation

Geovisualisation refers to the external representations of data with geographical connotations on maps. In this vein, maps are the interface for presenting and visualising the location of geospatial data on the top of a map. Digital maps possess functionality that further advances the benefits of geovisualisation. For example, by introducing search engines, metadata, 3D visualisation and data layers, digital maps become very interactive and provide flexible geographical interfaces that in turn assist users to explore, analyse, synthesise and present complex spatial information. Hence, digital maps enable users to dynamically explore spatial-temporal data and to visually uncover their trends and anomalies by viewing the multi-dimensional display of complex datasets and/or by searching the sequencing and animation of spatial-temporal data. In geovisualisation environments, digital maps can stimulate the users' visual thinking about geographical patterns and help them recognize connections or disruptions and trends (Kraak, 2003). In other words, as Kwan (2000) showed, digital maps assist users to generate hypotheses, develop problem solutions and construct knowledge. In sum, geovisualisation aims to turn large heterogeneous data into information (interpreted data) and then, into knowledge (understanding derived from information) by integrating people, maps, processes, information technology and the acquisition of information and knowledge. Indeed, as MacEachren and Kraak (2001, p. 3) argued "*geovisualisation integrates approaches from visualization in scientific computing, cartography, image analysis, information visualization, exploratory data analysis and geographic information systems to provide theory, methods and tools for visual exploration, analysis, synthesis and presentation of geospatial data*". Consequently, digital maps and geovisualisation are widely used for supporting the decision-making of various location-based problems, [such as, logistics, transportation, location selection, crisis management, urban planning (e.g. Beaumont, Longley, & Maguire, 2005; Hernandez, 2007; Kwan, 2000)]. This led to the emergence of a new field namely, business geomatics, which refers to the exploitation of geovisualisation for business decision-making (Hernandez, 2007).

Traditionally, the development of digital maps relied on experts, representing a top-down authoritarian approach. Nowadays, internet advances empower citizens and communities to participate in maps' creation allowing bottom-up approaches (Beaumont et al., 2005; Sigala, 2012c). Indeed, web 2.0 tools [such as wiki-mapping, geovisualisation API (e.g. GoogleMaps, Open Street Map and YahooMaps), geo-tagging and geoblogging, i.e. blogs in which blog entries are tagged with the location whereby the blog content was created/written] enable Internet users to participate in the creation, use and distribution of geovisualisation applications. These participatory geovisualisation applications are developed and used for several purposes [e.g. decision-making, entertainment, e-democracy, activism such as grassroot activities, crisis management, trip planning (Goodchild, 2007; Rinner, Keßler, & Andrulis, 2008; Sigala, 2012b, 2012c)] and are found to support and enhance (geo) collaboration amongst their users (e.g. MacEachren & Cai, 2006; MacEachren & Kraak, 2001; Sigala, 2012b). Websites

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