# The use of weblectures in GIS-related courses: what do students think?

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**Abstract.** An initial set of weblectures was developed to support students following GIS-related courses. These weblectures contained software demonstrations and a series of short lectures on a theoretical topic. Feedback was obtained from the students, which provides vital information to be able to improve and extend these educational tools. We found that the existing weblectures were already strongly appreciated by the students, especially the fact that they could process the information at their own speed. However, they need to be encouraged more to use the theoretical weblectures. Students did not believe that these online videos could replace the traditional lectures, because of the lack of the social aspect (face-to-face communication, possibility to ask questions, etc.).

**Keywords:** education, weblectures, user feedback

## 1. Introduction

Teaching GIS to students in higher education involves a delicate balance between theoretical lectures and practical exercises. Students have to possess a strong theoretical background in Geographic Information Systems (i.e., data management, data structures, analyses, visualization, etc.) and in essential concepts from related disciplines (e.g., cartography, informatics, etc.). Over the years, teaching and learning strategies have evolved in both geography and higher education. Most recently, these evolutions can be linked to technological advancements, including the growing use of the Internet (e.g. Ward & Newlands 1998; Rafaeli et al. 2004; Day et al. 2005; Ketterl et al. 2009). Because GIS is linked to technological advancement, it is obvious to implement Internet-use as a teaching strategy in both theoretical and practical sessions. Recently, some initiatives have been undertaken in this regard (Frigerio & van Westen 2010; Harvey & Kotting 2011; McMaster et al. 2011), but the overall application of the Internet to GIS education is still underdeveloped.

This paper analyzes the applicability and usefulness of integrating new technological advancements into GIS teaching strategies, with a focus on weblectures. Based on previous research in this field, the following Research Questions (RQ) will be addressed:

1. Do students appreciate the use of weblectures in their curriculum?
2. Do students find that weblectures can replace "traditional" lectures?
3. How do students use weblectures?
4. Do students need to be motivated to use weblectures?

While some authors are convinced that weblectures will inevitably be implemented in higher education (Garrison & Kanuka 2004), others question their benefit to students (e.g. Eveland & Dunwoody 2001; Bernard et al. 2004; Sitzmann et al. 2006; Clark 2009; Chen et al. 2010). Weblectures come in many forms and are sometimes referred to as lectures on the web or multimedia lectures (Dori et al. 2003; Rafaeli et al. 2004; Ketterl et al. 2009). They usually consist of a combination of video, audio, and presentation slides (e.g., PowerPoint) streamed over the web (Day 2008). Weblectures can be created at minimum cost by recording a traditional live lecture and placing it online (Ketterl et al. 2009). Other authors recommend recording lectures out of class in order to keep them short (20-25 minutes maximum) or by splitting them up into multiple recordings (Day et al. 2005; Day & Foley 2006). Software demonstrations and simulations can also be included in these online videos (Poindexter & Heck 1999). Although these latter examples are not traditional lectures, all online videos that present course information (e.g., lectures, demonstrations, simulations) will be referred to as weblectures in this article.

## 2. Design of weblectures

### 2.1. Selected courses

A set of weblectures was created for three different GIS-related topics. Two were (practical) software demonstrations and one was a theoretical subject: (1) Demonstrations in Quantum GIS; (2) Demonstrations in AutoCAD; (3) Theory on map projections and coordinate systems

The weblectures containing software demonstrations (QGIS and AutoCAD) were created because a rather large group of students with different background knowledge tend to take these courses. This type of web lecture replaced the live in-class demonstrations, but interaction with the teacher was still possible. The idea was the same as suggested by Calverley et al. (1998), Day and Foley (2006), Day et al. (2005) and Rafaeli et al. (2004): more in-class time can be spent on individual guidance and active learning if web-

lectures replace in-class teacher presentations. Furthermore, students could process the demonstrations at their own pace, which helps to address the differences in students' knowledge. The topic of the initial theoretical set of weblectures—Map Projections and Coordinate Systems—was selected based on course materials (De Maeyer et al. 2012; Antrop et al. 2013; De Maeyer et al. 2013; De Maeyer & Ooms 2013) for the Bachelor and Master's programs. It was decided to use the weblectures as a complement to live lectures , or, as a refresher material in the advanced classes.

## 2.2. Recording the weblectures

We purchased the required material and recorded the weblectures in-house. Figure 1 (left) shows the office where the recording took place. The hardware we used included a desktop PC, a high-definition Webcam, and a microphone or headset. We used Camtasia Studio, a software which allows recording on on-screen activity, editing the contents and sharing the resulting video on nearly any device. Figure 1 (right) shows the software being used to edit one of the videos for Map Projections and Coordinate Systems (MC).

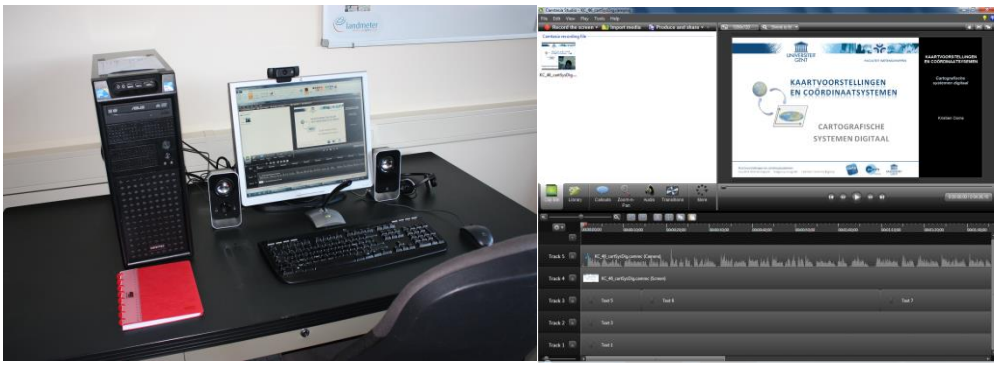


**Figure 1.** Weblectures' recording hard- and software

All weblectures were recorded in the same 16:9 format with a resolution of 1280 x 720 pixels. In accordance with Day's (2008) recommendations, the weblectures were kept short to retain students' attention. We opted for shorter videos (than 20 minutes) to even diminish this length to be able to distinguish between smaller topics, facilitating the selection of the appropriate web lecture for the students. Our QGIS demonstrations last 5-10 minutes, the AutoCAD demonstrations are somewhat longer at nearly 10 minutes on average. The majority of the theoretical weblectures take less than 5 minutes, with 5-10 slides each. Some "theoretical" weblectures were

recorded twice: a simplified version for students in the lower grades and those preparing for advanced courses and an in-depth version intended for students in higher grades. All videos are in Dutch, the official language at Ghent University and the native language of most students enrolled at the Department of Geography.

The weblectures were made available on YouTube with public visibility (e.g. Ketterl et al. 2009). This medium was chosen because anyone can access the videos from anywhere. However, the overview of the YouTube videos is usually presented in a rather haphazard way , as a list of topics. Therefore, a separate website was created to facilitate topic selection. This website contains direct links to the YouTube videos (see Figure 2). On the main page of this website, an overview of all currently existing main topics of weblectures is presented. For each topic, a separate page was created, which lists the associated weblectures in a structured way. The URL of this webpage (http://cartogis.ugent.be/weblectures/), was communicated to the students.

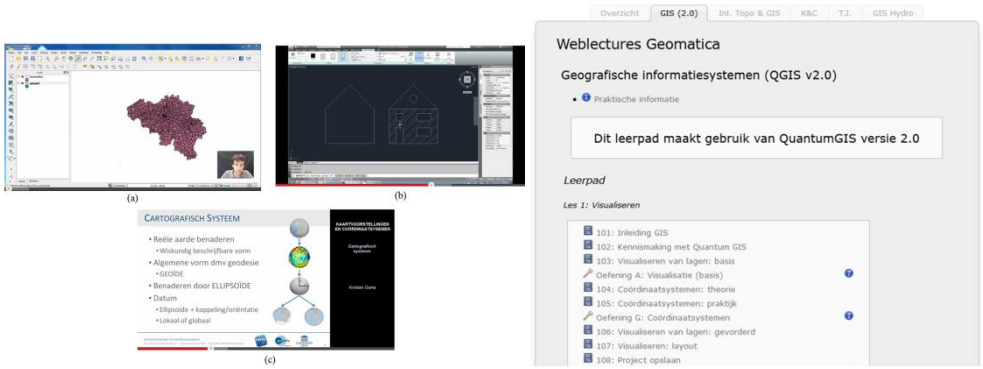


**Figure 2.** Design of the weblectures and associated website

## 2.3. Evaluating the weblectures

The success of weblectures is closely tied to how they are perceived by the students: i.e, perceived ease of use, perceived usefulness, students' motivation, etc. (Davis et al. 1989; Liu et al. 2009). We therefore decided to focus on the weblectures' usability. We did that by implementing the UCD lifecycle on the initial set of weblectures which are evaluated by end users. Based on their feedback, the weblectures will then be improved and extended. By involving students in the design process, their perception of the system can be taken into account before the system becomes operational. The process

and results of the initial evaluation are described in detail in the next section.

## 3. Feedback from the students

A two-page feedback form was handed out to students during the first semester's final exam of the courses for which weblectures were used. In total, 132 students filled out the feedback form. Two types of questions were asked: the first type were closed questions which required a Yes or No answer; the second type were open questions.

### 3.1. How did students use the weblectures?

On the feedback form, students had to indicate whether they had used weblectures associated with the course for which they were taking the exam. It was found that nearly all students used the practical weblectures, whereas the theoretical weblectures were less popular. To be able to explain this, students who had not utilized weblectures were asked to indicate why they chose not to. The most reoccurring reasons were that they did not know they existed or were not able to find them online.

The reasons students gave could be explained by a difference in motivation for using practical or theoretical weblectures, as was mentioned by Day et al. (2005). For each practical session, a number of weblectures were available, and students were reminded of this at the beginning of each session. The existence and location of the weblectures for theoretical topics were communicated at the beginning of the first lesson and through the digital learning platform. However, students had not been reminded about the theoretical weblectures in subsequent sessions.

The students who used the weblectures were asked how they employed them. The answers indicate that all of the practical demonstrations were used by the students. However, for theoretical explanations, students tended to select weblectures on those topics they found difficult to process.

### 3.2. What is appreciated and what can be improved?

Students were asked to rate the available weblectures on a scale from 1 to 10. The overall average was 8.17 which indicates highly favorable perception of weblectures. However, no clear distinction can be made between the favorability of theoretical and practical weblectures. In addition to scoring the weblectures, students could also indicate in an open question what they

found positive about them. Students particularly liked the structured nature of the weblectures. They also appreciated the possibility of going through the topics at their own pace and the ability to repeat the lectures if necessary. Compared with positive comments, remarkably fewer suggestions for improvement were given (46 vs. 87). Students commented on the need for the practical weblectures to give more examples, particularly in fields as Biology and Archaeology. Some students found the weblectures too fast, others suggested increasing their speed. Finally, students were asked for their opinion of the website that gives an overview of the available weblectures. Most students found the website well-structured and easy to use (59 out of 64). One student mentioned that the weblectures linkage to YouTube was seen as a positive element.

### 3.3. Should we extend the current set of weblectures?

Most students were in favor of an extension of the current offer of weblectures, both for theoretical and practical purposes. However, more than 50% of GIS students said they did not believe that weblectures should be extended for theoretical purposes. Similar results were obtained for practical weblectures when probing students in the Introduction to Geomatics class. These results may be linked to the (lack of) perceived usability of these types of weblectures (e.g. Davis et al. 1989; Liu et al. 2009). Students were asked for which subjects they would like to have weblectures in the future. Most students requested theoretical and practical weblectures about spherical trigonometry, ArcGIS, Topographic representations (theory) and topography (practical). Some students indicated that any topic would be welcome, or that the focus should be on the most difficult topics.

Students were asked to compare the value of weblectures against that of live lessons and whether weblectures could replace live lessons. They found both the theoretical and practical weblectures of great value. Nonetheless, most students thought that weblectures cannot replace in-person lectures. The majority of students gave the same reason: lack of interaction, and most importantly, inability to ask questions. “Need for guidance,” which was mentioned in relation to practical weblectures, echoes the need to be able to ask questions. Students also attach high importance to personal communication which is less effective or efficient through weblectures. Using weblectures as a complement to the traditional lectures is believed to be the best solution.

### 3.4. What is the influence of the students’ achievements

As important as students’ motivation and acceptance of weblectures are, the

level of student achievement also plays an important role in the development of weblectures. However, theoretical weblectures had only been introduced for one chapter of the course, and students indicated that they did not use them regularly. This suggests their exam results would not have been significantly influenced by weblectures. The practical QGIS weblectures have been used for several years, which makes it possible to compare between students' performance before and after the introduction of weblectures. Before the introduction of weblectures, the average score on the practical exam was 12.09/20 for the period 2008 to 2011. After the introduction of weblectures, the average score rose to 13.30/20 from 2012 to 2014. However, care has to be taken when interpreting these results because other factors also changed in this period, which could influence students' results (e.g., ArcGIS was previously taught with an examination on paper; QuantumGIS is now used with an examination on a PC).

## 4. Conclusion and Future Work

The initial set of weblectures was created for students who follow GIS-related courses at the Department of Geography at Ghent University. The evaluation of the lectures indicated that students appreciate the blended learning strategy because with weblectures complementing traditional lectures and practical exercises, more in-class time can be spent to address specific questions, to give feedback and for personal guidance. Students attached high importance to the social aspect of learning, which is missing when only weblectures are utilized. However, many students need to be motivated to use especially the theoretical weblectures. Through the application of User Centred Design, issues like this can be discovered at an early stage in the development of novel concepts, such as these weblectures. Consequently, this finding will be further investigated during the next phase of the User-Centered Design lifecycle. Few design issues were discovered at this initial stage, which means none of the existing weblectures need to be adapted. Future effort should thus focus on the development of additional weblectures based on a similar concept (layout, length, posted on YouTube, website with overview, etc.) as the existing weblectures, since this has been approved by the students. A priority list of topics can be constructed for which the highest need was expressed by the students. With every subsequent year, the students' perception towards the weblectures will be evaluated further.

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