

# Benefits and Challenges of eLearning in Central Asia

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## Abstract

*The importance of Geoinformatics (GI) is well established across natural and social science disciplines. This has led to a high demand for GI experts worldwide. Particularly, in developing countries the number of trained staff and students in this domain is very limited compared to current demand. To address this, eLearning is gaining increasing interest. This is particularly true for Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan). But what are the benefits and challenges of using eLearning in this region? Which recommendations can be given to foster the benefits and to meet the challenges of eLearning? To answer these questions, a survey directed towards teachers working at Central Asian universities was conducted. The results show that eLearning is seen to bring both advantages and disadvantages. Recommendations to increase the use of eLearning in these countries range from awareness-raising on the wide range of web-based tools available for this, to foster further education of teachers regarding the use of eLearning (concepts, tools, and materials), to focus on local topics to motivate self-study, and to pay attention to required computer resources and Internet connectivity as an essential basis for eLearning.*

## 1. Introduction and Research Question

Natural, technical and social science disciplines attach great importance to the domain of Geoinformatics (GI). GI has become widely accepted as a pivotal decision-making tool worldwide and in numerous fields such as natural resource management, spatial and landscape planning, disease mapping and monitoring, crime analysis, transport and distribution services planning, and emergency response (Gong et al., 2017, Mobaheri et al., 2014 and Oppong, 2016). This has led to a high demand for suitably educated graduates (i.e. experts with GI skills) not only in developed but also in developing countries (Bishop et al., 2002, Elsner 2005 and Gong et al., 2017).

In particular, in developing countries, the number of staff and students in the GI domain (incl. Geospatial Information System/Science, Remote Sensing, Photogrammetry, Digital Cartography, etc.) is very limited compared to existing demand (Gong et al., 2017 and Mobaheri et al., 2014). Reasons are, among others, that teaching GI requires especially skilled and trained personnel, adequate learning media and resources as well as lifelong learning opportunities - since especially the IT and GI sector are rapidly changing fields (Akbarov, et al., 2014 and Prüller et al., 2009). In developing countries these aspects are an impediment to carry out GI education (Bishop et al., 2002 and Oppong, 2016). To address this situation, eLearning is gathering increasing interest (Bishop et

al., 2002, Hennig et al., 2013, Mobaheri et al., 2014, Oboko and Omwenga, 2017, Oppong 2016). Briefly defined, eLearning is learning utilizing electronic and in particular web-based technologies to provide and access educational content outside of a traditional classroom setting. Numerous benefits are associated with eLearning. Thus, for instance, it allows for flexibility and individualization in learning (i.e. anytime and anywhere) and it serves different learning styles by being more learner-centered and self-directed (Dolphin 2015 and Pamfilie et al., Orindaru 2013).

In Central Asia (i.e. Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan) a high and increasing demand on GI experts and, in consequence, on GI education is well documented (Akbarov et al., 2014 and Prüller et al., 2009). While academic teaching GI in Central Asia has been supported, among others, by many initiatives such as the ERASMUS+ projects gSmart (<http://em-gsmart.zgis.net/>) and GE-UZ (<http://www.ge-uz.eu/> and Akbarov et al., 2014), eLearning has only recently gained interest (see, e.g. ERASMUS + project DSinGIS: <http://www.dsingis.eu/>; Hennig, 2018). But what are the particular benefits and challenges regarding the use of eLearning for GI education in Central Asian states (all being former Soviet Union republics)? Which recommendations can be given to enjoy the benefits and meet the challenges of eLearning in this region?

## 2. Background on eLearning

eLearning is an evolved form of distance education, i.e. learning remotely without being in (regular) face-to-face contact with a teacher. In initial instances of distance learning the postal system, radio, and television were used to deliver learning materials; later, CD-ROM, DVD, email, and video conference. Today, material is usually delivered online via the Internet (eLearningNC, 2019). Reflecting technical advances, meanwhile, three generations of eLearning are distinguished: The first generation is concerned mainly with the passive use of the Internet (e.g. online material with simple graphics, email); the second generation is characterized by more advanced technologies such as eAssessment and Virtual Learning Environments (e.g. using online material with interactive multimedia, access to internet resources); and the third generation is focused on collaborative learning environments paying attention to reflective practice through tools like ePortfolios, blogs, wikis, and interactive technologies such as games and simulations, and mobile learning technologies (Ally and Samaka, 2017 and Taylor, 2001).

All in all, the use of web-based tools allows delivering, supporting, and enhancing teaching, learning, assessment, and evaluation (Oboko and Omwenga, 2017). Since eLearning does not take place in traditional classrooms, learning can be

flexible in time and place. Moreover, it supports different learning styles due to the fact that by the use of web-based technologies a great variety of study material (e.g. multimedia content, tools for reflective practice, gamification elements) can be provided. This refers, in particular, to the use of interactive approaches which enable students to communicate, exchange and cooperate online with their teachers and other students, to contribute to community building, and to give and receive immediate feedback and recognition (Connolly and Stansfield, 2006 and Pamfilie et al., 2013). In doing so, eLearning relies on a variety of overlapping learning approaches such as learner-centered learning, active learning, social learning, as well as mobile and micro learning (Table 1).

## 3. Case Study Central Asia

A current shared understanding of Central Asia consists of several republics from the former Soviet Union which collapsed in 1991: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. These five countries differ, among others, due to territorial extent, demographic and economic factors, natural environment, and in bonds with other countries (Isaacs, 2014). A rough overview of these states (incl. the situation they currently face) is given by selected figures in Table 2.

Table 1: Learning approaches relevant for eLearning (based on Ally and Samaka, 2017, BSU n.d.; Felix, 2017, Gogos, 2012, Kissima, 2017, Morrison, 2012 and Timothy, 2015)

Approach	Description (keeping learners engaged and ensuring effective learning by)
<b>Learner centered learning</b>	<ul style="list-style-type: none"> <li>allowing for high level of active participation (e.g. assignments and tests)</li> <li>focusing on collaborative practice</li> <li>providing of user-centered tools and materials</li> </ul>
<b>Active learning</b>	<ul style="list-style-type: none"> <li>demanding to think critically or creatively (e.g. in terms of the the topic, of the learning material and process)</li> <li>fostering communication and exchange with others (with selected students, the entire course, teachers, experts etc.) incl. the possibility to give and receive feedback</li> <li>requiring expressing ideas through writing and exploring personal attitudes and values</li> </ul>
<b>Social learning</b>	<ul style="list-style-type: none"> <li>observing others' behavior and its consequences and modify one's own behavior/ attitude accordingly</li> <li>focusing on collaboration and interaction (impact on teamwork skills etc.)</li> <li>expanding the course of learning in terms of time, space, and situation</li> </ul>
<b>Mobile learning</b>	<ul style="list-style-type: none"> <li>using electronic learning materials with built-in learning strategies for delivery on mobile devices to allow access from anywhere and at anytime</li> <li>providing flexibility to learners so that they can learn and interact with other learners from anywhere, and at any time to share information and expertise, complete a task, or work cooperatively while they are mobile</li> </ul>
<b>Micro learning</b>	<ul style="list-style-type: none"> <li>providing small, very specific, well-planned chunks of learning and/ or training material or learning experiences (so called micro-content)</li> <li>interacting with small and easy to process pieces of information at a time, in an informal, self-directed manner</li> </ul>

Table 2: Key figures of the Central Asian states (UNDP, 2016 and Worldometers, n.d.;

	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
<b>Area [km<sup>2</sup>]</b>	2 715 976	199 340	142 410	471 428	445 711
<b>Population (2019)</b>	18.6 Mio.	6.2 Mio.	9.2 Mio.	5.9 Mio	32.8 Mio.
<b>Median age [years] (2019)</b>	29.6	25.5	22.6	25.9	26.7
<b>Education Index (2015)</b>	0.805	0.721	0.658	0.629	0.74
<b>Gross Domestic Product / capita [US \$] (2017)</b>	8.948	1.251	801	6.587	1.557

Table 3: Questionnaire items

Items	Type
Sociodemographic data: age, gender	Closed question
Name of university, faculty, faculty chair	Closed question
Teachers' language skills: national language, Russian, English, other	Closed question
Use of eLearning: own further education activities, HEI teaching activities	Open question
Reasons for using eLearning	Open question
Recommending eLearning to the students and reasons for this	Open question
Use of tools	Open question
Use characterization of different tools	Closed question
Advantages and challenges	Open question
Particular problems (internet, language, syllabus)	Closed question
Student language skills: national language, Russian, English, other	Closed question
Personal data: email	Open question

The need for sustainable and economic development, as well as climate change impacts on these five Central Asian states (e.g. changes in water distribution, natural hazards, loss of biodiversity; Prüller et al., 2009 and UNEP, 2017), creates a demand for GI experts in the different Central Asian countries. Due to this, GI education is an emerging topic in Central Asia (Prüller et al., 2009). This is as true for classroom teaching as well as eLearning.

#### 4. Methods

To characterize the situation of eLearning in Central Asia - with a focus on GI education and to understand benefits and challenges - a questionnaire was administered towards teachers working at Central Asian Higher Education Institutes (HEI). The questionnaire was implemented as an online questionnaire using the online survey tool SurveyMonkey ([www.surveymonkey.com](http://www.surveymonkey.com)). In order to obtain enough reliable answers, recommendations on (online) questionnaire design were taken into account (see, e.g., Callegaro, et al., 2015). Thus, for instance, not to discourage teachers from participating in the survey it was key to keep the questionnaire as short as possible. A further focus was to avoid questions that imply the answers (i.e. suggestive and leading questions) or questions that

have an effect of social desirability regarding the responses.

In addition, to assure the best possible insight into certain aspects, they were addressed not only by one but by several questions. The final questionnaire included 20 questions (average answering time 20 minutes). Table 3 provides an overview of the items focused by the questionnaire.

The questionnaire was distributed in early spring 2019. The URL under which the questionnaire was available was sent to teachers working at HEI (primarily universities) in the different Central Asian countries using email and messenger chat (e.g. Facebook). Due to a long history of collaboration with different Central Asian HEI (e.g. research and educational projects, teacher and student mobilities), the Department of Geoinformatics, Salzburg University maintains extensive contacts to numerous Central Asian HEI. Besides, the questionnaire was also promoted by the network ACA\*GIScience (<http://acagisc.blogspot.com/2019/04/elearning-in-central-asia-benefits-and.html>).

Before analysis the submitted responses were validated (e.g. deleting invalid questionnaires: not from Central Asia) and preprocessed. This includes statistics for closed question answers and the coding of open-ended question answers (i.e. assigning one or more codes to responses: e.g. regarding benefits and challenges generally

attached to eLearning). Further, data from answers given to different questions were combined to be used together to be presented and discussed.

## 5. Results Regarding Use, Benefits and Challenges

### 5.1 General Results

The number of returned and valid questionnaires is 86, with a completion rate of 69 %. The number of responses from the different states varies considerably: Most replies were received from teachers working in Kyrgyzstan (44 %; 38 responses) and Uzbekistan (36 %; 31 responses); from teachers working in Kazakhstan and Tajikistan eight questionnaires were returned each (9 %), and from Turkmenistan only one teacher participated in the survey. Teachers from different disciplines (attaching different importance to the use of GI) participated in the questionnaire. The majority of the questionnaires were answered from teachers working in fields that give great importance to the use of GI (58 %; 50 responses). This includes disciplines such as geoinformatics per se, geodesy, cartography, geography, hydrology, geology, (bio-)ecology, agriculture and melioration, tourism, water resource and land management. Other respondents (41 %; 35 responses) came from disciplines such as information technology, engineering, economics, language, history, and pedagogy. One person did not answer this question.

Regarding sociodemographic data, i.e. gender and age, the situation looks as follows: 43 % of the answers came from female (37 responses), 56 % from male teachers (48 responses); one person did not answer this question. With respect to age, 23 % of the respondents were younger than 30 years (20 responses), 50 % between 31 and 45 years old (43 responses), 22 % between 46 and 60 years old (19 responses), and 3 % older than 60 years (3 responses); one person did not answer this question.

### 5.2 Use of eLearning

With respect to the use of eLearning, a distinction was made between using tools and materials for one's own further education purposes and in the context of HEI teaching activities. Here, 76 % of the respondents (67 teachers) stated to use eLearning for own continuing education, 3 % answered to not use it (3 teachers), and 20 % did not answer this question. From the 67 teachers who outlined to pay attention to eLearning for their lifelong learning activities, only 13 teachers (15 %) specifically mentioned eLearning tools and materials used by them. This refers, for instance, to

videos, presentations and lectures available online, webinars and online courses, as well different types of material available on websites and platforms focusing on GI topics (ESRI, GIS Lounge), or learning platforms (Coursera, Udemy).

Regarding HEI teaching activities, 78 % of the teachers surveyed explained to use eLearning in their lectures and seminars (67 teachers), 82 % stated to recommend eLearning tools and materials to their students for self-study (70 teachers). These numbers are comparable to the number of teachers using eLearning for their own further education activities. Compared to own continuing education the number of teachers mentioning material used for HEI teaching activities, is higher (62 teachers; 72 %). This refers mainly to material such as entire online courses incl. massive open online courses (MOOCs), videos, online presentations and lectures, ebooks, and (learning) platforms. Other types of material have only been listed by few teachers (e.g. tutorials and manuals, wikis, or classes in chat).

Even though teachers named only selected eLearning tools and materials used by them (open-ended question), asked directly for knowing and using certain tools (closed question) a more detailed picture on the role of different eLearning tools and materials was delivered: It revealed that the different possibilities available and used for eLearning are known and employed by the teachers to different degrees (Table 4). While passive elements are well received (e.g. videos, slideshows, audio files), this does not apply to (inter-)active, collaborative, and reflective elements (e.g. games, collaborative wikis, learning diaries, blogs) to the same extent.

### 5.3 Benefits and Challenges

Asked for the benefits they attach to the use of eLearning, in total 61 teachers (71 %) mentioned one or more benefits (Table 5). Thus, for instance, several respondents outlined that it is a clear advantage to have different types of material and information available and accessible (34 %; 29 teachers); 23 % (20 teachers) underlined the possibility to improve the quality of learning (i.e. education, training) by the use eLearning; 22 % (19 teachers) see a benefit in the flexibility given to the students by eLearning. But, only 5 % of them (4 teachers) see an advantage in the opportunity to foster students' self-paced and self-driven learning practice. A number of challenges were listed by 53 of the teachers surveyed (59 %; Table 6). Challenges refer, for instance, to the missing possibility to leverage classroom atmosphere and the direct contact between teachers and students.

Table 4: Share of teachers knowing as well as knowing and using eLearning tools and materials (N=86)

Tools & Materials	Known - relative number (absolute number)	Known & used - relative number (absolute number)
Slideshows	66 % (57)	51 % (44)
Videos	70 % (60)	45 % (39)
Animations	63 % (54)	35 % (30)
Audio file	62 % (53)	26 % (22)
Social media	59 % (51)	23 % (20)
Messenger chat	53 % (46)	21 % (18)
Games (e.g. quizzes, flashcards)	48 % (41)	17 % (15)
(Collaborative) Wikis	40 % (34)	16 % (14)
Online communities	51 % (44)	14 % (12)
Storymaps	43 % (37)	14 % (12)
Data/ information sharing (e.g. Dropbox)	50 % (43)	10 % (9)
Mindmaps	37 % (32)	8 % (7)
Forums	53 % (46)	7 % (6)
ePortfolio	47 % (40)	7 % (6)
Bookmarking tools (e.g. delicious)	31 % (27)	6 % (5)
Learning Diary	40 % (34)	5 % (4)
Blogs	48 % (41)	3 % (3)

Table 5: Benefits attached to eLearning by the teachers surveyed (open-ended question; N = 86)

Benefits	Absolute Number	Relative Number
Accessibility/ availability of information/ material	29	34 %
(Improving) the quality of education/ training/ new methods	20	23 %
Flexibility	19	22 %
Saving time	16	19 %
Meeting different learning styles (easy, convenient etc.)	15	17 %
Saving money	8	9 %
Benefits for organization, account, control	7	8 %
Self-driven work/ learning of students	4	5 %
Supporting lifelong learning	4	5 %
Others	3	3 %

This is emphasized by the respondents as a particularly important issue. Moreover, internet connectivity and language skills are highlighted to pose problems for the use of eLearning. Especially problems related to language skills are further highlighted: Even though only a limited number of teachers did identify language skills as a challenge for eLearning (open-ended question on challenges from teachers' point of view; Table 6), directly asked (closed question) 44 % of them (51 teachers) see difficulties in students' language skills. The results show that teachers assume that in average 67

% of the students have sufficient Russian skills to use the according eLearning material, and that only 30 % have sufficient English language skills for this. Here, it has to be highlighted, that eLearning material is usually available in English and some as well as in Russian language.

## 6. Discussion and Recommendations

The survey provides comprehensive results regarding the use of eLearning at Central Asian HEI. In the following only selected aspects will be discussed and also only selected recommendations

to increase the use of eLearning in these countries will be presented.

### 6.1 Generations of eLearning and Use of Tools

The questionnaire findings show that the teachers surveyed stress benefits that are generally attached to eLearning (i.e. in the literature; section 1). Importance is given to the accessibility and availability of information and material as well as to the possibilities opened by the employment of new methods and tools (i.e. for improving teaching quality, increasing students' level of education; Table 6). But the results also show (Table 4 and Table 5) that teachers do not use fully the existing potential at present.

Teachers' perspective on eLearning, currently, seems to focus primarily on the first generation of eLearning (i.e. passive use of the Internet; Taylor, 2001). Possibilities opened by web-based tools for interactivity, collaborative work, and communication (i.e. second and third generation of eLearning; see section 2) receive less attention. However, even though web-based tools can, for sure, not replace face-to-face contact between teachers and/ or students as well as classroom atmosphere – highlighted as a pivotal issue and challenge by the questionnaire respondents (Table 6) and by the literature (see, e.g., Cerba et al., 2012) –, they allow for new and alternative ways of collaboration, exchange, and communication (Alam and McLoughin, 2018). In today's information and digital society this is well-received and plays an important role. Especially, younger people (so called digital natives who are screen-based and information-/ communication focused; Elkind, 2003) make extensive use of web-based tools for exchanging, collaborating, and communicating (Hennig and Vogler, 2016). This is

a great change compared to older generations, who differ from the younger ones in the sense that they must learn what digital natives grow up perceiving as normal in terms of using technology (Cornu 2011 and Downey et al., 2007). In this context, awareness rising on existing possibilities (i.e. tools, materials) can be considered key. This is also underlined by statements given by some of the questionnaire respondents who underlined the relevance and need to further educate teachers in order to make (more) use of eLearning. Due to the rapid advance of information and communication technologies and its impact on eLearning, further education and lifelong learning play an important role in the field of eLearning (see, e.g., Dumont et al., 2005). This can also be fostered by the implementation of (e-)learning networks (i.e. across the individual Central Asian states and the region) which promote the expansion and use of eLearning at universities and HEIs (Muradkhanli and Atabeyli, 2012).

### 6.2 Learning Styles and Students' Motivation

The teachers surveyed not only see advantages from the amount of information and material available as well as from the fact that students need to work self-driven and self-paced but they also mention disadvantages (Table 4 and Table 5). Especially for teaching GI, the taking into account of local and/ or regional topics and data can motivate students for self-driven and self-paced work and intensify their learning experience. This is as true for the consideration of situation-based learning approaches (Prüller et al., 2009). This relies on the fact that personal relationships and interest in a topic are seen as key motivational factors for people to get involved in whatever activity (Clary et al., 1998).

Table 6: Challenges related to eLearning by the teachers surveyed (open-ended question; N = 86)

Challenges	Absolute Number	Relative Number
Missing classroom atmosphere incl. direct contact between teachers and students	15	17 %
Internet connectivity	14	16 %
Efforts related to course development: time	5	6 %
Language skills (e.g. English)	3	3 %
Amount of material	3	3 %
(Low) level of education of students	2	2 %
Computer resources	2	2 %
Efforts related to course development: costs	2	2 %
No interest/ low acceptance	2	2 %
Self-study/ self-paced learning	2	2 %
Particularly skilled teachers	2	2 %

Moreover, eLearning tools and materials should be designed and implemented to be user-centered as it generally refers to web-based and digital applications (e.g. user-friendly interface, easy to use). Besides, there is a need for cultural sensitivity when developing and/or providing eLearning tools and materials (Elsner, 2005 and Prüller et al., 2009). This refers for instance to the need to take into account students' language skills. Questionnaire results as well as literature underline that Russian language proficiency is quite high across Central Asian states. The Russian language is a lingua franca at HEIs in these countries (Ahn and Smagulova, 2016, CIA n.d. and Issacs, 2014). In terms of English language skills, situation looks different: As underlined by the questionnaire results English language skills are lower, but a wide variety of eLearning tools and materials is available in English language. Thus, eLearning can contribute to improve students' English language skills, but selection and combination of tools and materials must be sensitive to this fact – to not scare students away and discourage them.

### 6.3 Internet Connectivity and Computer Resources

Internet connectivity is often a problem in the region with respect to eLearning. This is not only highlighted by the respondents, but also underlined in the literature (Akbarov et al., 2014). This should be taken into account when providing tools and materials (e.g. reduce file size, compress files, and use only relevant sequences of material such as videos). Further, the fact that, today, mobile phones are owned by a large proportion of people worldwide (incl. developing countries) together with high Internet user penetration rates (i.e. mobile Internet) can liberate eLearning developers to worry too much about Internet connectivity focusing to a certain extent on mobile and micro learning approaches (Table 1). Allowing students to make use of their mobile devices meets the preferences of this user group (i.e. digital natives) and, thus, can increase their acceptance towards eLearning

GI is generally related to the use of substantial computer resources including software and spatial data (Akbarov et al., 2014 and Prüller et al. 2009). Here, open source software is appropriate for sustainable teaching (incl. self-study), due to minimum costs for licensing (i.e. available for free) and great community based support (Prüller et al., 2009).

## 7. Conclusion and Outlook

In the context of education eLearning is gaining importance. This is particularly true for GI

education in the Central Asian states Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. A questionnaire directed towards HEIs' teachers revealed that the respondents see several benefits as well as challenges in elearning. Thus, for instance, it is an advantage to have available and accessible different types of material and a great amount of information. This can contribute to improve the quality of learning (i.e. education, training), and it can give flexibility to students learning. Challenges are the missing possibility to leverage classroom atmosphere and the direct contact between teachers and/ or students. Computer resources, Internet connectivity, and language skills are seen to pose problems for eLearning as well. Recommendations to increase the use and success of eLearning refer to raise teachers' awareness on web-based tools for exchange, collaboration, and communication, to foster further education on eLearning incl. the building of eLearning networks, to consider students' motivation in terms of self-study (e.g. local topics), to address the demand for Internet connectivity (e.g. mobile and micro learning: students using their mobile phones) and computer resources (e.g. freely available software). More work is required to allow developing more user-centered and culturally sensitive eLearning solutions that better meet the needs of GI education in Central Asia focusing, e.g., on building soft skills (e.g. English language skills).

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