GUIDE – A WEB-BASED INFORMATION SYSTEM PROMOTING LEARNING SOFTWARE IN PHOTOGRAMMETRY, REMOTE SENSING AND GIS

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ABSTRACT:

Life-long education is essential in an increasingly faster changing and complex world. Challenges arising from social, economic, technological and ecological changes require an appropriate response. These new requirements of a global knowledge society will be faced by everyone and even increase in the coming years. Participation in computer-based self-learning programs or learning opportunities in the Internet is driven by the interests of learners and therefore may create greater motivation to finish successfully.

In order to gain an overview on existing learning offers a web-application named GUIDE was set up that supports students in querying for material of interest. This tool allows evaluating and rating of the lessons by users who have worked through the learning material. This will help anyone interested in selecting suitable information or courses. Grading is based on a criteria list that focuses not only on aspects of content, level and didactic approach, but also on design, quality of instruction, quality of implementation, usability, accessibility and availability, up-to-dateness, and completeness. To keep evaluations as objective as possible, reviews are weighted on participants' experience.

This paper presents the development and usage of the web-application and encourages participants to assess attended courses and possibly propose new training material not yet listed on the web pages.

1. INTRODUCTION

Web-based learning is regarded to be one of the most important tools to face the demands of the so-called 'society of life-long learning' to which we have moved in recent years. During the last decade experts from universities or companies involved in Photogrammetry, Remote Sensing or GIS have developed a pool of learning material that is accessible on the web. This includes data sets, training material, podcasts, webinars, MOOCs, etc. Although these learning materials are open to the public, their existence is often unknown - even in our own community. Further, content and design vary in quality, but up to now no recommendations are given to people who are interested in using courses for gaining valuable, easy to handle, and up-to-date knowledge in our fields.

ISPRS has recognised this challenge and granted the short-time study "Analysis of E-Learning software and guidelines for quality assurance in Photogrammetry, Remote Sensing and GIS" (Katterfeld, Koenig, 2008) aimed at bringing transparency in terms of these issues. A variety of learning tools was introduced on a web-platform, combined with a questionnaire that allowed attendees to grade these courses. After initial interest subsided, participation decreased and the website became more and more obsolete. In the meantime usage of the Internet has changed and many users recommend purchases from a warehouse (or the warehouse itself) rank hotels they have booked or participate in successful projects like OpenStreetMap. Following the crowdsourcing idea a new attempt is started to offer GUIDE as a tool for assessing learning material, which raises hope that interest and participation will increase again. This paper puts attention to the website and explains its usage.

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2. SELECTION OF WEB-BASED LEARNING OFFERS

A considerably wide range of learning material is available on the web. Using search engines for detecting suitable learning resources in general results in a high number of irrelevant references. In order to get or keep the overview ISPRS Commission VI's promotes educational training material and lists information about educational sites, tutorials, soft- and hardware on its webpages (http://www.isprs.org/education/). Unfortunately these links don't give further information about usability and quality. The newly updated pages posted on the Internet by WG VI/2 support additional guidance (http://www.igg.tu-berlin.de/ISPRS/GUIDE/).

Learning offers cover a broad spectrum of different kinds. To give users a more precise decision aid that facilitates selection of the desired learning materials, a classification of products is expedient. Based on the classification given by Anderson & McCormick (2006) and extended by newer developments GUIDE implementation distinguishes between different settings:

- Text / with interactive assets / with tests and feedback
- Power Point Presentation
- Animation/ model/ simulation
- Software for online / off-line use
- Map exercise
- Virtual Landscape
- AR-Environment
- Mobile application
- Podcast
- Webinar
- MOOC

GUIDE lists titles, creator, and references of learning resources that are known to the system after initiating an overview query.

3. QUALITY OF WEB-BASED LEARNING

Learning in networks has become an integral part of higher education and therefore the question on how to measure quality has to be addressed. Web-based learning can be evaluated from different points of view:

On the one hand technical standards are crucial for a valuable approach in terms of quality. A high level of *interaction* and *dynamics* and use of *communication* tools should be considered and implemented. For some time now web 2.0 technologies are available to meet these requirements. More and more educational scenarios are developed utilizing blogs, wikis, podcasts, and e-portfolios and allow learners to easily access, create, share or reuse their personal learning materials and enable social learning networks that bridge the border between formal and informal learning (Bates, 2010).

Secondly, focus must be put on didactics, since text or multimedia based resources are not enough for securing learning success reliably. Besides a didactically meaningful preparation of the learning material it is to ensure that the relevant learning processes are activated. This can be achieved by tasks that confront students with goal- or practice-oriented learning scenarios and clear learning objectives that stimulate competence rather than sheer knowledge transfer. During the last years the ideal of learning has moved from the rigid teacher-student knowledge transfer to a dynamic learner-centred vision. This conforms to a shift from behaviouristic to constructivist learning theory. In this case the focus is not set on the plain delivery of material but rather on tools of interaction, communication and collaboration (Koohang et al., 2009). Teachers act as tutors, comparable to guides in the learning process. Consequentially resources should cover the needs of *constructivist learning*, giving learners the chance to consider various information sources and tools in order to successfully solve the tasks.

Cultural diversity is a significant factor that also influences perception of learning material. It affects the assessment of quality, caused by differences in the everyday experiences, immediate living environment, language, socialization, social integration, and ideological orientation. Culture including ethnicity, religion, gender and socioeconomic background and learning are connected in important ways (Guild, 2001).

The result, or *outcome quality*, gives probably the best information on quality of resources. Admittedly it is hard to assess the outcome since it highly depends on the learners' pre-knowledge, their expectation, motivation, and determination. Whether learning success has been achieved, however, can only be seen in application situations, in which the acquired skills are adapted to the situation according to specific requirements. Pure knowledge tests, for example, using multiple-choice tests, as they are commonly found in e-learning scenarios, can in principle only prove that acquired knowledge could be reproduced, but not whether it can be transferred flexibly and successfully to practice.

Any overall definition of quality in web-based learning we might wish to consider runs the risk of constraining people's vision of what quality means and its significance in the particular context (Dondi et al., 2006). Thus quality remains a negotiable, not a clearly to define issue.

4. METHOD USED TO EVALUATE QUALITY

Quality assessment approaches in education are often based on benchmarking, audits, accreditation and certification as well as quality marks awarded by special organizations. Another relevant, popular and easily to handle alternative is the adoption of a c*riteria checklist*. The choice of quality criteria used for GUIDE is oriented at the Reference Quality Criteria (RQC) catalogue, DIN PAS 1032-1 annexed to the ISO Standard ISO/ IEC 19796-1, and the Framework for E-Learning Quality by Anderson & MacCormick (2006). Detailed information about the criteria selection is described in Katterfeld/ König (2008). Table 1 gives an overview of the criteria selected for following categories:

- Content
- Didactics
- Economical Aspects
- Learner requirements
- Organisational Aspects
- Software Ergonomics
- Technology

Content is of course a core issue. But the mode of imparting knowledge is often neglected. A serious mistake in web-based learning is the lack of students' differentiation, which goes back to an insufficient analysis of the target audience and the choice of a learning model that doesn't allow for a learner-centred studying. "All too frequently, even innovative institutions fall back on a one-size-fits-all approach [...], forgetting that students are different and have different needs" warns Carol Twigg (2001). Although nobody can expect individual customisation, learning resources should keep different learner-types in mind. Ehlers (2006) for example has identified four groups that mainly differ in their demands for communication and tutor support and their requirements for group activities and social contact.

These types are:

- *the individualist*, who is mainly interested in content. Since he is used to learning self-directed he demands for individual and well-structured offers. Presence lessons, communication and interaction are less important.
- *the result oriented* learner is very independent and goal-driven. His working approach is learning by doing, preferring standardised and not individual offers. He has good media skills but tries to avoid attending in-class lectures.
- *the pragmatist* follows his needs. He demands for topic-oriented information, advice and tutor support, and has high demands on didactics.
- *the avant-gardist* is interaction orientated and hence uses virtual learning groups intensely. He demands for tutor support, has high media competence and appreciates didactic variety.

Category	Criteria	Description
Content	Correctness	Is the content correct
	Completeness	Is the content complete
	Relevance of the used material	Is the used material relevant to the issue
	Presentation within a wider context/ motivation	Has the content been described in a wider context, at least within an introduction to motivate the tasks
	Appropriateness of material	Does the material illustrate the content in a helpful way and is the use of the material (media) adequate to the content
	Composition and organisation	Is the content/ material composed and organised in a meaningful and understandable way
	Qualification of Author/ Tutor	Are authors and tutors qualified in an appropriate way
Didactics	Definition of the learning goals	Is the learning target defined
	Definition how learning goals should be achieved	Is defined, how the learning target should be achieved
	Level of didactical concept	Is an (advanced) didactical concept apparent (are e.g. behaviouristic, cognitive and/ or constructivist principles applied)
	Possibilities for interaction	Are (advanced) functionalities for interaction (not only navigation!) available
	Exercises/ Tests	Are exercises and tests available in a meaningful way
	Assessment	Is assessment given to exercises and tests
	Individual learner support	Is individual learner support assured (e.g. by possibilities for (regular) contact and/ or individual assessment)
	Possibilities for communication	Are communication options to the tutor and/ or to other learners available
	Design of instructions	Are meaningful instructions for use of material and exercises given
	Qualification of Tutor	Are tutors qualified in an appropriate way
Learner Context	Learner Context	Is the learner context (target group, learner type, motivation, previous knowledge/ skills, preferences for interaction) relevant
	Possibilities for personalisation/ adaption	Are possibilities for personalisation/ adaption given
Organisational Aspects	Fit to curriculum	(In case of students as target group:) does the content of the offer fit to a curriculum
	Certification	(In case of successful accomplishment:) is a kind of certification provided
	Maintenance	Is the maintenance assured
	Quality assurance	Is the quality of the material assured
	Description by metadata	Does a description by standardised metadata in terms of technique, content and organisational aspects exist in a good quality
	Documentation and manuals	Is the material well documented (in terms of organisational aspects, learner orientation and technical use)
Software Ergonomics	Graphical Design	Does the graphical design contribute to comprehensibility and is pleasant in general
	Content Design	Does the design of the content contribute to comprehensibility and is pleasant in general
	User Guidance	Is the user guided in a clear way
	Help Functions	Are help functions (in terms of content, guidance and technique) available
Sustainability resp. Economical Aspects	Cost-Effectiveness	Is the learning environment developed and operating under cost-effective circumstances
	Funding Strategy	Does a sustainable funding strategy exist
	Sustainability	Have actions for sustainability been taken
	Conformance in terms of (interoperability) standards	Is the environment conform to interoperability standards
Technology	Technical Setting/ functionalities	Is the technical setting (including the provision of functionalities) appropriate to the content resp. are the technical potentials for teaching the issue exploited
	Infrastructure Requirements	What kind of infrastructure (server-/ client applications, peripherals) is provided and/ or required
	Documentation of technical use	Are documentation for the technical environment given (if necessary)
	Ease of use	Is the environment easy to use and plain
	(Technical) Quality of assets	Is the quality of assets well
	Up-to-dateness	Is the environment up to date
	Availability	Is the environment available anytime anywhere
	Qualification of Producer/ Designer	Are producers qualified in an appropriate
Learner's Reaction	Learner's reaction	How the learner felt about the training or learning experience

Tab. 1: Criteria list

5. GUIDE – INFORMATION SYSTEM PROMOTING LEARNING MATERIAL

GUIDE was designed as a web-based tool allowing interested persons to retrieve information on learning opportunities in our fields, but also to participate in a collaborative evaluation of these materials.

5.1 GUIDE - Collaborative Assessment

Recommendations given by the authors only would lead to a highly subjective expert ranking. Following the idea of crowdsourcing a more objective rating could be expected involving members of our community. Hence an online questionnaire was developed allowing users who are familiar with the learning resources to share and integrate their rating. Dependent on the amount of active participants a more reliable result can be expected. A further improvement is achieved since experience of reviewer and intensity of use are considered in the assessments score. This is guaranteed by weight factors listed in table 2.

Level of Experience	Factor		Intensity of Use	Factor
Interested Public	0		produced/ designed the material	0
Student in this field	1		skipped over the material	1
Experienced in this field	3	X	worked with some parts of the material	2
Expert/ Professional in this field	5		worked with all parts once	3
			worked with all parts multiple times	5

Tab. 2: Factors for weighting users' knowledge

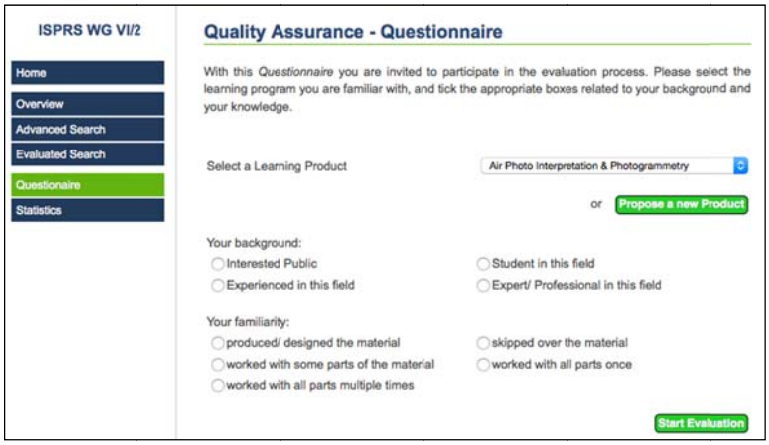

Fig. 1: Questionnaire page

Users who intend to participate will find the form at http://www.igg.tu-berlin.de/ISPRS/GUIDE/questionnaire.php. As seen in figure 1 the reviewer is invited to select the learning material he intends to evaluate, describe his pre-knowledge, specify how intensely he has worked on the material, and press the *Start Evaluation* button to fill the questionnaire.

With regard to the different learner types also weight factors are introduced and assigned for each of the 42 criteria listed in table 1, and included in the calculation. Table 3 lists the weight assignment: the more stars are visible, the more influence the criteria have on users' query..

Category	**Criteria**	**Content Orientation** Individualist Learner	**Didactical Orientation** Pragmatist Learner	**Result Orientation** Result oriented Learner	**Technology Orientation** Avant-gardist Learner	**Economic/ Sustainability** Provider, Institutional Level, Investors
Content	Correctness	*****	*****	*****	*****	*****
	Completeness	*****	*****	*****	*****	*****
	Relevance of the used material	*****	***	***	***	***
	Presentation within a wider context/ Motivation	***	***	***	***	***
	Appropriateness of material	*****	***	***	***	***
	Composition and organisation	*****	*****	***	***	***
	Qualification of Tutor	*****	***	***	***	*****
Didactics	Definition of the learning goals	*****	*****	*****	***	*****
	Definition how learning goals should be achieved	*****	*****	*****	***	*****
	Level of didactical concept	*	*****	***	*****	***
	Possibilities for interaction	*	*****	*	*****	***
	Exercises/ Tests	***	*****	***	*****	***
	Assessment	***	*****	***	***	***
	Individual learner support	*	*****	*	*****	***
	Possibilities for communication	*	*****	*	*****	***
	Design of instructions	*****	*****	*****	*****	***
	Qualification of Tutor	*****	*****	*****	*****	*****
Learner Context	Learner Context	*****	*****	***	***	***
	Possibilities for Personalisation/ Adaption	*****	*****	*	*****	***
Organisational Aspects	Fit to curriculum	*****	*****	***	***	*****
	Certification	*	*	*	*	*****
	Maintenance	***	***	***	***	*****
	Quality assurance	***	***	***	***	*****
	Description by metadata	*****	*****	***	*****	*****
	Documentation and manuals	*****	*****	***	*****	***
Software Ergonomics	Graphical Design	*****	***	***	*****	***
	Content Design	*****	***	***	*****	***
	User Guidance	*****	*****	*****	*****	***
	Help Functions	*****	*****	*****	*****	***
Sustainability resp. Economical Aspects	Cost-Effectiveness	*	*	*	*	*****
	Funding Strategy	*	*	*	*	*****
	Sustainability	*	*	*	*	*****
	Conformance in terms of (Interoperability) standards	*	*	*	*	*****
Technology	Technical Setting/ functionalities	*	***	*	*****	*****
	Infrastructure Requirements	***	***	***	*****	*****
	Documentation of technical use	*****	*****	***	*****	***
	Ease of use	***	***	***	*****	***
	(Technical) Quality of assets	***	***	***	*****	***
	Up-to-dateness	***	***	***	*****	*****
	Availability	***	***	***	*****	*****
	Qualification of Producer/ Designer	***	***	***	*****	*****
Learner's Reaction	Learner's reaction	*****	*****	*****	*****	***

Tab. 3: Relevance of criteria in terms of different quality approaches

5.2 GUIDE, Advanced and Evaluated Search

Once a learning unit is evaluated, GUIDE is ready for retrieving information about its quality. Counselees have the choice to obtain a quick overview of all material known to the tool, or choose between an advanced or evaluated search. The advanced search allows to find courses for a selected field (Computer Vision, GIS, Photogrammetry or Remote Sensing) following a special setting (Text with tests and feedback, Power Point Presentation, Animation/ model/ simulation, …, Webinars, MOOCs) that are relevant for a specific target group (all, interested public, students, pupils). With the evaluated search users will receive a coloured list dependent on the score that was calculated by users' reviews (see figure 2).

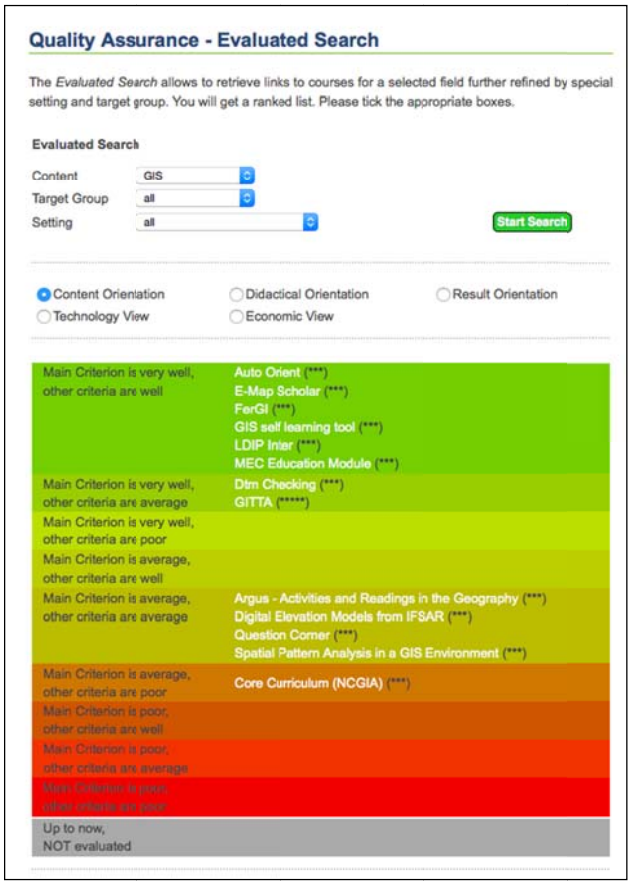

Fig. 2: Presentation of the evaluation result

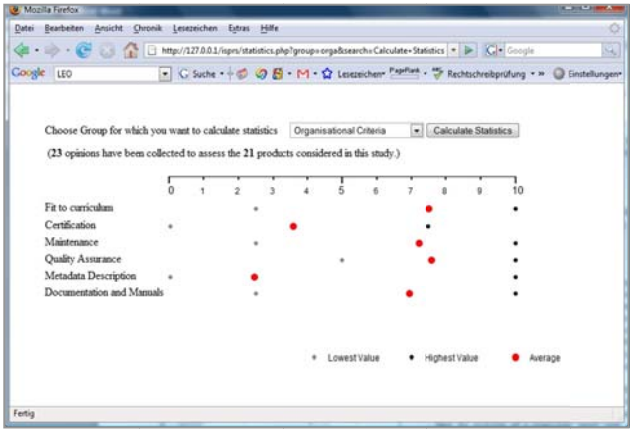

Fig. 3: Online statistics for the various criteria

The retrieved learning material is highlighted in different colours, representing good results in shades of green, average ones in orange and non-satisfactory courses in shades of red. The following classes can be distinguished:

- good to very good results in the content category,
- average to good results in the didactics category,
- poor to average values in the learner context category,
- heterogeneous, but mainly good results with the organisational aspects
- good results in the software ergonomic category,
- average values for sustainability and
- good to very good results in the technical section.

Resources, which are not marked until now, are identified with a grey background. Stars complete the link to the learning material. One star (*) implies, that less than 3 reviewers evaluated the course. If the product name was followed by three stars (***) at least 3 reviewers or one expert have made an assessment. Products with five stars (*****) have been evaluated by at least 3 experts.

Up to now the individual score of each offer is not published. As an additional feature, a *Statistics* tool was implemented. (See figure 3, or check http://www.igg.tu-berlin.de/ISPRS/GUIDE/statistics.php). All submitted questionnaires are analysed and lowest, highest and average values for the 42 evaluation criteria are calculated and presented graphically, selected and structured by its category. This provides an insight into the current status of E-Learning products.

5.3 Summary and Outlook

Reliable statements based on the statistic tool concerning quality could not be made so far since the amount of samples is too low. But several trends are discernible: technical and content categories are rated as good to very good – that's not surprising since content is mainly provided by members of universities, research institutes or specialised companies. Since many criteria in the didactic section only reach average or poor values, the lack of didactical concepts must be mentioned. Hence a more intense discussion about didactics theories and its integration is required. Elaborated design of instructions and implementation of feedback is crucial. More differentiation within the material would be helpful to suit diverse learning needs and would help to better focus on the individual. Options for assessment and support are missing in many cases. This also applies to other topics: Web 2.0 technology is still not used effectively and metadata embedding is rare. So there are plenty of challenges and open problems to solve.

The authors invite everybody to actively participate in this project and to make many suggestions - only in this way the success of this tool can be ensured.

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