FROM CO-CREATED LEARNING RESOURCES TO PERSONALISED ONLINE COURSES FOR BLENDED LEARNING

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Statistics, numeracy and quantitative literacy are being taught at many levels and disciplines. Ideally, each teacher would have their own personalized course materials, matching the level and discipline of their group. However, currently teachers are often forced to prescribe one-size-fits-all materials or create their own course materials from scratch. We present a novel online platform that allows statistics teachers to collaboratively create and share learning resources, including simulations, visualizations, questions and interactive exercises. This allows teachers to build upon the work of others, by re-using or changing the materials, and easily combining them into a personalized course. The system is being piloted. In this paper we present the preliminary design of this repository for open educational resources.

INTRODUCTION

In this paper, we present a newly curated repository for online open educational resources on statistics: www.grasple.org. First, we introduce relevant literature on open education resources and repositories. Based on these sources, we demonstrate the need for a new type of platform for creating and sharing open educational resources. We then review challenges that have been identified in the past and discuss which requirements a viable repository website should adhere to. We conclude by presenting the preliminary design of the platform.

RELEVANT LITERATURE

The dream of open and free educational resources for everyone to use has been around for many years. For instance, in the 1880's, mister Carnegie funded 1.689 libraries in the USA so that anybody, poor or rich, could have access to a library full of educational content. Carnegie's vision was that anybody who was willing to study hard and diligently would be able to learn new things and thrive in society. (Stamberg, 2013)

The internet has made the creation and distribution of learning resources much easier. This has spurred renewed interest in free and open accessible, high quality learning resources, demonstrated by initiatives such as Wikipedia and MIT's Open Courseware initiative.

Since 2002, the term Open Educational Resources (OER) is being used to identify resources that are open in access and license. (UNESCO, 2002). Digital OER can be found anywhere on the internet. However, to facilitate the discoverability for teachers and students, OER are often being collecting in specialized repositories. These Repositories for Open Educational Resources are commonly referred to in literature as ROER. By now, hundreds of ROER are in existence. (Santos-Hermosa, 2017) Yet in a survey of 218 faculty members of US universities, the biggest barriers to OER use were reported to be *'a lack of awareness'* and *'lack of discoverability'*. (Belikov, 2016)

When there are already hundreds of repositories and teachers still state that they are not aware of OER, it is clear that there is a problem in either the marketing of ROER or the ROER are not sufficiently equipped to facilitate a positive word-of-mouth.

We believe both issues are present. Therefore, we will attempt to take on both challenges: create a new ROER for statistics, as well as engaging in the necessary activities to make statistics teachers all over the world aware of it. However, when so many attempts have already been made to achieve these aims, one must carefully study lessons from the past. Therefore, we proceed by first reviewing the main challenges researchers have identified regarding the adoption of OER.

CHALLENGES TO THE SUCCESSFUL ADOPTION OF OER

We have reviewed four relevant papers that have studied the challenges and barriers for the adoption of OER:

In M. A. Sorto, A. White, & L. Guyot (Eds.), *Looking back, looking forward. Proceedings of the Tenth International Conference on Teaching Statistics (ICOTS10, July, 2018), Kyoto, Japan.* Voorburg, The Netherlands: International Statistical Institute. iase-web.org

1. In a report for the OECD, Hylen (2005) identifies as main challenges for the adoption of OER: a) Lack of awareness among academics regarding copyright issues; b) how to assure quality in open content and c) how to sustain OER initiatives in the longer run.
2. Belikov (2016) reports a lack of awareness and lack of discoverability as the two biggest challenges to OER adoption. 3)
3. In a survey among OER experts conducted by Atenas (2014a), the top four features experts considered can make ROER successful are: a) collaboration b) searching c) repurposing and d) translation. A good ROER should aim to tackle the challenges above and implement the suggested features.
4. Finally, Hassall and Lewis (2017) provide a recommendation to aid the successful adoption of OER, which states: "Our results suggest that OER use may be enhanced [..] by the ongoing curation of a variety of high-quality and flexible resources that can be incorporated into specific teaching cases."

We have followed up the recommendation made by Hassall and Lewis (2017) by creating a curated platform that lists high-quality digital open learning resources on statistics that can be flexibly incorporated into teaching cases and adapted to suit the needs of individual teachers and students.

DESIGN CONSIDERATIONS

In the design for a new platform for searching and sharing open learning resources on statistics, we have tried to learn from the challenges identified in the previous section. This amounted to creating a system that adheres to the following criteria:

1. Open licensing for all publicly listed resources
2. Find relevant resources quickly
3. Quality assurance
4. Easy editing of existing resources
5. Facilitate collaborative translations
6. Facilitates active learning

1) Open licensing for all publicly listed resources

As there exists a lack of awareness regarding copyright issues (Hylen, 2005) and teachers report to lack time to evaluate applicability of resources, let alone check copyright issues (Belikov 2016), a main design consideration is to ensure that all publicly listed resources providing clear and understandable open licenses. This allows anybody to reuse, redistribute and - depending on the specific license - revise and remix - all listed resourced, without having to worry about copyright issues.

2) Find relevant resources quickly

As the second biggest barrier to OER adoption is a lack of discoverability (Belikov 2016), a good ROER needs to have a good search function to help teachers quickly find relevant resources. This is echoed by Atenas (2014a): "a good search facility, some pleasant browse options; in fact it is particularly important to offer discipline/subject based browse options."

3) Quality assurance

Another fundamental design consideration must be quality assurance. As teachers report to have limited time and teachers report that existing OER lack quality in certain cases (Belikov 2016), it is imperative to help teacher assess the quality of the offered OER.

4) Easy editing of existing resources

A key insight has been that teachers often do not wish to use resources as listed, but rather adapt them to fit their particular needs. Belikov (2016) quotes one of the teachers they interviewed: "I particularly like to be able to adapt materials to my course or to the styles of teaching compatible with my own." A viable ROER must offer learning resources in such a way that they can be edited and adapted easily.

5) Facilitate collaborative translations
Atenas (2014b) lists the development of resources in multiple languages as one of six key criteria for successful ROER.

6) Facilitates active learning
The last key consideration in designing this platform has been to facilitate active learning. Current repositories often include static documents. This does not facilitate active learning, which means the students is less likely to engage with material and deeply understand it. We believe that a platform should make it easy for learners to actively engage with the material.

With these design principles in mind, we have created a novel curated repository of digital open educational resources for statistics.

REPOSITORY FOR OPEN STATISTICS RESOURCES: GRASPLE

Grasple (www.grasple.org) is a curated, open platform where statistics teachers and students can find, edit and share statistics learning materials. Integrated are a search engine, editing system, a learning environment and learning analytics engine that are all topic-oriented. The aim of this platform is to support teachers in providing blended learning courses.

Grasple: from 'grapple' to 'grasp'
The name Grasple is a combination of the words "*to grapple*", which means "to struggle/to overcome" and "*to grasp*", which means "to understand".
We believe this nicely captures the experience of learning: often difficult and frustrating at first, exhilarating and powerful when one suddenly grasps the eluded concept.

Curated Knowledge Graph
What makes this platform unique is its topic-oriented knowledge graph. This is a manually created and curated graph of learning goals in statistics. (Figure 1) The knowledge graph contains two types of relations: *hierarchical* (i.e.: confidence interval is part of inferential statistics) and *prerequisites* (i.e.: to understand the concept confidence interval, you need to understand the concept sampling variation).
Using a knowledge graph to relate resources to specific learning goals is well grounded in literature. It is frequently mentioned in the ITS field as being a key characteristic of a tutoring system. (Sottilare, 2015) It is highly granular, meaning that one can point very precisely to a specific learning goal.
The knowledge graph allows us to help the users navigate the repository. We will now touch upon the different ways it helps users find and judge relevant materials.

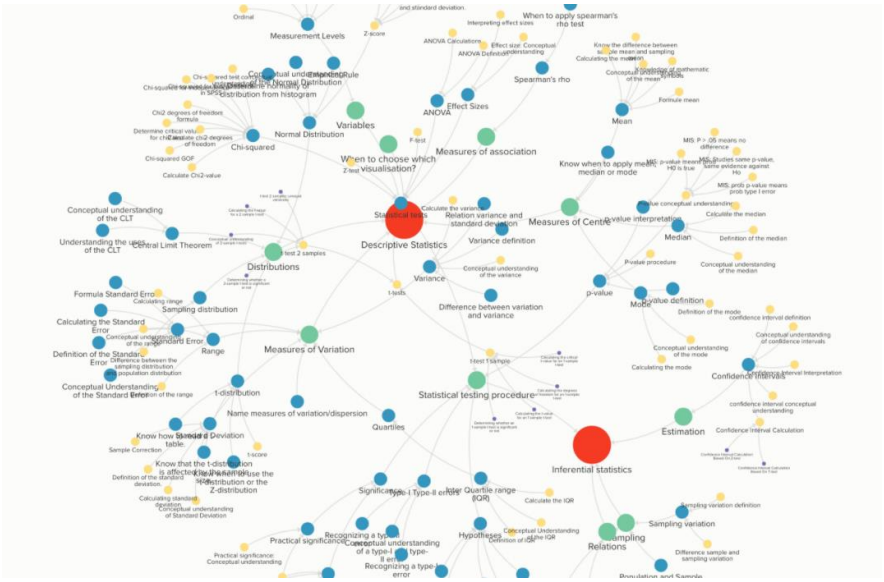

Figure 1: visual representation of part of the knowledge graph's hierarchical relations

Starting point: Search

Quickly finding what you are looking for as a teacher is one of the most important features of the platform. The search functionality is structured around an open input. A screenshot is shown in Figure 2.

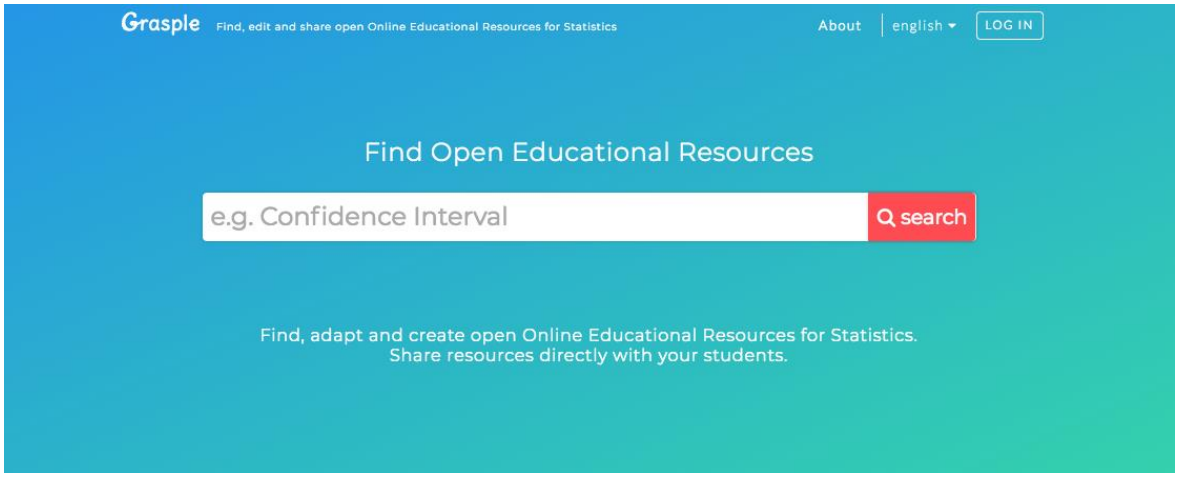

Figure 2: search screen, which by design contains lots of empty space to increase clarity

Judging relevance: suggested learning goals

Once a teacher has inserted a general search term, the system helps the teacher quickly find relevant resources. After providing an initial search term, results can be filtered on specific resources, such as lessons, visuals, datasets, practices or exercises. In addition, the system suggests more specific learning goals the teacher may be looking for.

This is how the suggestion functionality works: when a teacher has typed in a search term, for instance "confidence interval", the system will attempt to ask the teacher exactly what she means. In this case, it will show all resources related to confidence intervals, yet it will also prompt the teacher: "are you specifically looking for: *'conceptual understanding of confidence intervals'* or *'calculating a confidence interval by hand'*?

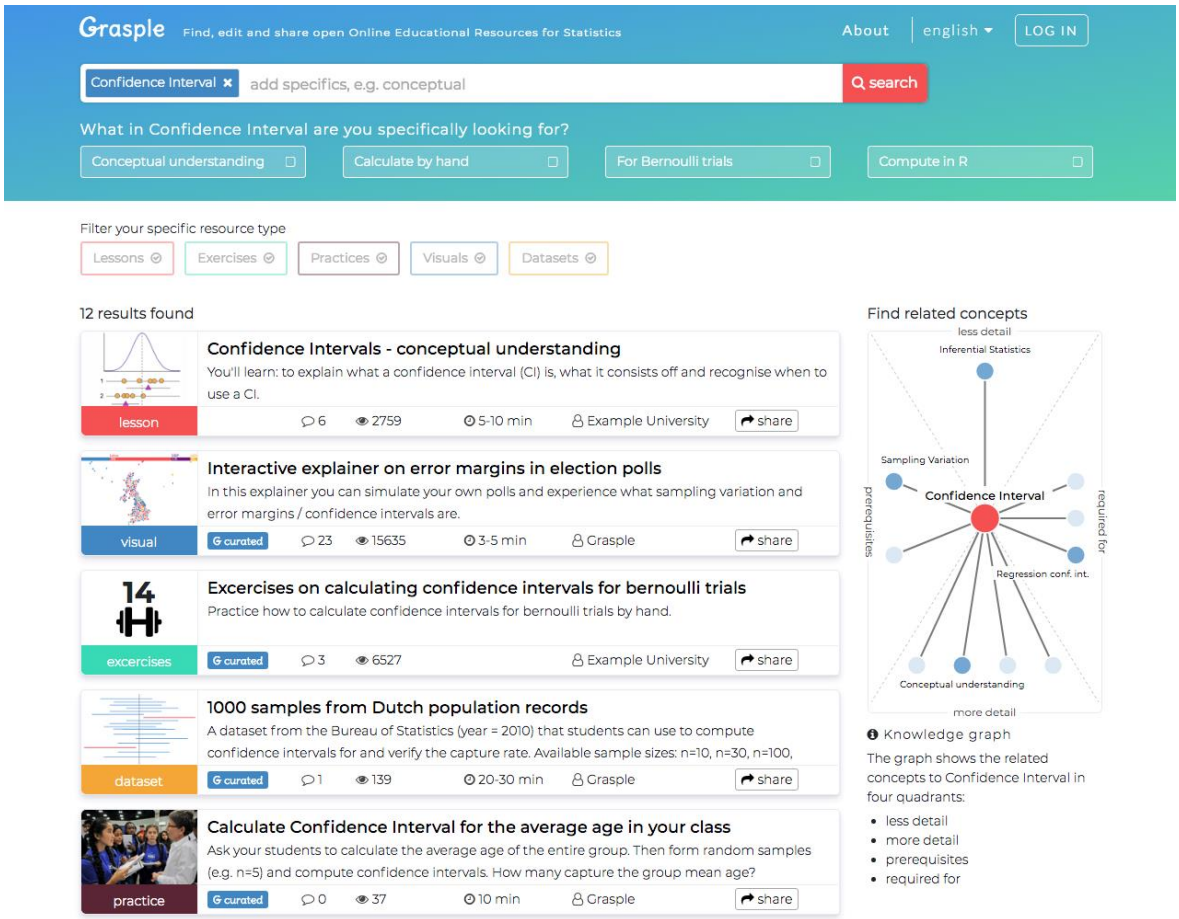

Figure 3: results page, showing the suggestions at the top and graph navigator at the right

Quality assurance: manual curation and user voting
The main method for judging quality used is expert-driven curation of resources.
In the future, curation may increasingly become more community-driven. We will evaluate implementing functions that allow users to comment on and up- and down-vote resources so that the curation can be scaled by crowdsourcing (parts) of the process.

Sharing resources: urls, LMS integration and personalised courses
It is key that teachers can easily share materials with their students. Currently Grasple provides three methods for sharing resources: 1) Sharing one resource via a direct url 2) Integration into LMS 3) A personalised course in Grasple.

Editor: create, adapt and translate materials
The editor enables three functions:
1. Create new materials*:* It is possible for any teacher to create new materials. Every teacher has a personal repository. In here, she can create a new resource, for instance an exercise. The editor is What You See Is What You Get (WYSIWYG). This enables rapid creation of exercises and lesson. Math/symbolic support is integrated.
2. Adapt existing materials*:* teachers can also adapt existing materials. In the software development field, this process is also known as '*forking*'. The teacher can copy an existing resource, adapt it and then share it back to students and the community.
3. Translate materials*:* another benefit of the editor is that it can be used to easily translate materials to different languages.

Facilitates Active Learning

A key characteristic of Grasple is that it facilitates active learning by allowing students to engage with the material right away. This is most evident for the 'exercise' resources. Students can get immediate feedback on their answers.

FUTURE WORK

A preliminary version of this platform is currently being piloted by statistics teachers. We welcome any teachers who are willing to try out the platform. We will evaluate the experiences and feedback to improve the platform.

SUMMARY

This paper has presented the need, criteria and the design of a novel curated repository of digital open educational resources for statistics. We hope it will enable teachers all around the world to find and create open materials on statistics and share it with their students, so more people will be able to learn and master data and statistics.

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