Educational Resource Search in Scottish Schools

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ABSTRACT

This project investigates the needs and challenges of school teachers in Scotland involved in finding, using, and sharing educational resources online. The first exploratory stage comprises interviews with primary and secondary school teachers, teacher trainees, and other school staff to define the processes involved and how these processes are situated in teachers' work context. The second stage is a review of existing tools that facilitate these tasks. The third and final stage consists of user centred iterative design and prototype evaluation studies, experimenting with potential improvements to online resource discoverability.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in interaction design**; *Computer supported cooperative work*; *Social content sharing*; • **Information systems** → *Information retrieval.*

KEYWORDS

Search, Relevance, Education, Metadata, Repository, OER, Linked Data, Design-Based Research, Information Seeking and Retrieval

ACM Reference Format:
Vidminas Vizgirda. 2024. Educational Resource Search in Scottish Schools. In *Proceedings of the 2024 ACM SIGIR Conference on Human Information Interaction and Retrieval (CHIIR '24), March 10–14, 2024, Sheffield, United Kingdom.* ACM, New York, NY, USA, 4 pages. https://doi.org/10.1145/3627508.3638320

1 INTRODUCTION

School teachers play a key role in every modern education system. Research shows that, second only to children's own families, teachers are the most impactful people in children's learning [13, p. 19]. They inspire, coach, and help children prepare for life, so that the new generation of today can be the successful leaders of tomorrow.

Teachers' time is precious. There are many areas where technology is under-utilised in education, as teachers still spend hours on tasks that could be automated or made easier with the right software. Appropriate applications could save teachers time on mundane tasks, which they could instead reallocate to providing personalised support for students who need it most.

This project's goal is to investigate how teachers find, use, and share online education resources, and how technology could be used to facilitate these tasks. The target audience are primary and secondary school teachers working with the Scottish Curriculum for Excellence.

CHIIR '24, March 10–14, 2024, Sheffield, United Kingdom

ACM ISBN 979-8-4007-0434-5/24/03.
https://doi.org/10.1145/3627508.3638320

2 MOTIVATION

Teachers' work is complex and includes many tasks beyond classroom instruction, such as preparation for classes, assessment and feedback, student coaching and advisement, professional development, administrative paperwork, and many others.

In 2017, researchers from McKinsey Global Institute and Microsoft conducted a survey with 2172 teachers from Canada (N=501), Singapore (N=134), United Kingdom (N=509), and United States (N=1028) [11]. The survey results showed that, on average, teachers work about 50 hours per week, but only half of this time is spent with students. The second most time-consuming group of activities fall under lesson preparation, taking about 10.5 hours per week. McKinsey estimated that already existing technologies could be used to reduce preparation time by up to 5 hours per week [2]. This is more than any other area, like evaluation and feedback (where up to 3 of 6.5 hours per week could be saved) or administration (up to 2.5 of 5 hours per week).

In a 2021 survey with primary and secondary school teachers in Australia (N=5442), the policy think tank Grattan investigated teachers' working time [8]. Their main findings were that teachers feel they do not have enough time for marking students' assessments and lesson preparation, and that government and school policy could be reformed to help teachers have more time for this. Supplementing policy change, software can also help teachers save time. It does not necessarily have to reduce the overall time teachers spend on preparing for lessons as the McKinsey report suggests, but rather, it could help teachers spend less time on creating and finding content, and more time on adapting and personalising the content to their students' needs.

In the Grattan survey, for the question "Imagine that changes have been made to your schedule such that you now have one extra hour of time. Where would you be most likely to spend your additional time? Please select your top three", 56% of the respondents (N=4430) chose preparing, marking, and analysing student assessments as one of their top priorities to spend additional time on. Planning effective classroom instruction was a close second choice (chosen by 52%). This provides additional support for the choice to focus software research on lesson preparation, where potential time savings are the greatest.

Covid-19 caused a shift to online teaching with long-lasting impact even post-lockdown. Many pre-existing digital resources were made available online publicly and many new resources were created and published too. More recently, Large Language Models like ChatGPT and generative AI models have gained lots of popularity, but with issues like hallucination and superfluous information, their application to educational resource generation does not obsolete

search for human-created resources. In this context, discoverability of high-quality relevant resources is an especially pertinent topic.

There are numerous collaboration platforms that let teachers find, reuse, and share materials with peers. Some of the most well-known ones worldwide are TES Resources[1], OER Commons[2], and MERLOT[3]. However, most teachers in the Grattan survey (88%) responded that they could save time if common high-quality resources were available, which shows that the problem is still far from solved. Many barriers to using such platforms have been identified in the literature – copyright concerns, reusability issues, difficulty of finding high-quality materials, and others [12, 5, 6, 16].

This is where this project comes in – my aims are to investigate to what extent these issues apply in Scotland, how teachers in Scotland perceive and experience finding, using, and sharing online educational materials, evaluate existing software solutions, and experiment with improved proof-of-concept prototypes.

3 RELATED WORK

Much of the previous research on online educational resource sharing focuses on Open Educational Resources (OER). The defining feature of OER is that these resources are available under open licenses for anyone to retain, revise, reuse, remix, and redistribute [19]. Most recently, the 2019 UNESCO OER Recommendation was made to promote investment in and improvement of OER.

The European Union have been funding successive projects for improving OER access for over a decade, such as the European Schoolnet Learning Resource Exchange[4] (LRE; 2008-2012), Open Discovery Space[5] (2012-2015), and X5GON[6] (2017-2020). There have been hundreds of other national and decentralised initiatives around the world (indexed by the OER World Map[7]). In practice, however, teachers have limited awareness of and interest in OER despite all the initiatives in this area [7]. Some reasons for this are a lack of training accompanying introduction of new tools and lack of teacher education about copyright law. An alternative approach is to focus on improving mainstream tools that teachers already use.

A common approach in prior research is leveraging (automated or manual) resource metadata to improve keyword-based search in specialised repositories [20, 1, 10, 14]. This is supported by several metadata initiatives like the IEEE Learning Objects Metadata (LOM) standard [9] and the Dublin Core Learning Resource Metadata Initiative (LMRI; now integrated into `schema.org`[8]) [4]. However, this takes for granted that repositories of educational resources are the way to go. In practice, the top places where teachers go to for resources tend to be Google and YouTube [6, 3], which are not specialised for educational resources. Quantitative survey insights from these studies can tell us what teachers use, but not why – a qualitative study is required to gather more detailed findings.

Some studies advocate for decentralised search approaches, using linked data to better describe and filter distributed resources in common search engines [21, 17]. However, requiring educational resource authors to add additional metadata to their resources imposes a time burden that most do not have time for. Combining automated metadata generation approaches with linked data has yielded limited success so far [15].

Cortinovis et al. [3] targeted the topic of discoverability of open educational resources in schools. The authors built on Information Foraging Theory to distinguish two main search strategies used by teachers: lookup (keyword search, finding something with a concrete goal in mind) and discovery (also known as exploratory search). Cortinovis et al. [3] argued that discovery is not well supported by existing tools and used a design-based research cycle to prototype a browser plug-in "Discoverer", which allows users, starting from a Google search results page, to find similar open educational resources to selected search results. This received positive feedback in the final evaluation with 29 educators and 7 OER experts. Participants especially liked that the tool was integrated with Google, instead of replacing familiar tools with new ones. Some participants challenged the relevance of the tool to their context. Discoverer's functionality was closely tied to learning outcomes, which are less prominent in Italy, where most participants were from.

In a domain other than school education (academics using exploratory search to find material for literature reviews), Soufan [18] notes that there have been many previous efforts to design interfaces that support exploratory search, but usually these are more cognitively demanding to use than current popular search engines. I propose that focusing on a domain-specific target audience could help create less overloaded interfaces by including only the information most pertinent to the chosen audience.

This project builds primarily on the work by Cortinovis et al. [3], but focusing explicitly on the context of the Scottish education system and primary and secondary school settings.

4 RESEARCH METHODOLOGY

The main contribution to knowledge of this project will be a greater understanding of teachers' granular tasks involved in finding, using, and sharing educational resources, how this is influenced by the context of the education system, and how these tasks can be supported by software.

The project plan is a three-stage process with the following high level research questions:

Stage 1: Interviewing and observing primary and secondary Scottish curriculum school teachers about how they find, use, and share educational materials online.

- **RQ1:** How do primary and secondary teachers in Scotland **search** for online educational resources?
- **RQ2:** How do primary and secondary teachers in Scotland **use** online educational resources?
- **RQ3:** How do primary and secondary teachers in Scotland **share** online educational resources with peers?
- **RQ4:** To what extent are the processes of finding, using, and sharing resources dependent on the context of the education system Scottish teachers work in?

[1] https://www.tes.com/teaching-resources
[2] https://www.oercommons.org/
[3] https://www.merlot.org/merlot/index.htm
[4] http://lreforschools.eun.org/
[5] https://portal.opendiscoveryspace.eu/en
[6] https://platform.x5gon.org/
[7] https://oerworldmap.wordpress.com/
[8] https://schema.org/

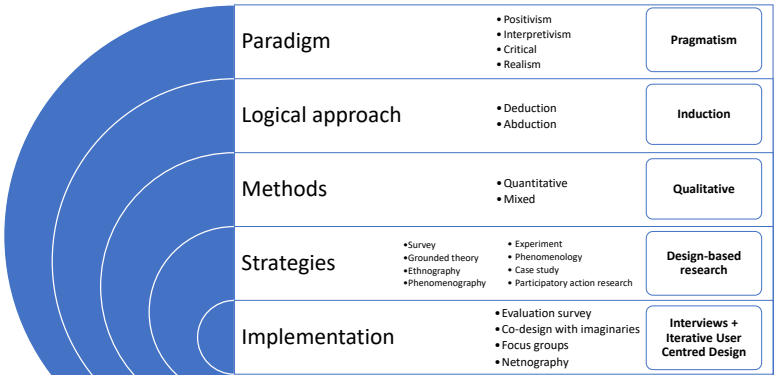

Figure 1: Chosen research approach and potential alternatives

Stage 2: Analysing and reviewing tools that teachers commonly use for finding, reusing, and sharing online educational resources, comparing their pros and cons, and contrasting with other already existing solutions.

RQ5: To what extent do the tools that teachers in Scotland use support the strategies that teachers employ for finding, using, and sharing resources?

RQ6: Are there other already existing tools that would better support teachers' tasks in finding, using, and sharing resources? What are the barriers to their use?

Stage 3: Designing improved solutions, developing prototypes, and evaluating them in multiple User Centred Design iterations.

RQ7: How can successful approaches from multiple existing tools be combined into software solutions that still integrate well into teachers' existing workflows?

RQ8: How might functionality gaps of popular existing tools be supplemented?

RQ9: How can usage barriers of potentially well-suited but unpopular existing tools be overcome?

More granular sub-questions to investigate are omitted for brevity.

I chose the Design-Based Research approach to avoid "solutionism" (building technological solutions without considering whether they are needed) and to base prototypes on schoolteachers' needs and work context. Due to time and resource constraints, I could not opt for participatory action research, although this would provide the best opportunity for evaluating effectiveness of solutions in practice, nor co-design which would require too much time from teacher participants. Iterative prototype design and evaluation seemed like the next best option. This and other potential approaches I considered for this project are illustrated in Figure 1.

5 PROGRESS SO FAR

During August-December 2022 (stage 1), I emailed over 2000 public schools in Scotland and several educational organisations. Following up with those who responded, I interviewed 15 schoolteachers and 10 relevant experts (from organisations like Education Scotland, SSERC, Cetis, Open University and others) about how teachers find, use, and share online educational resources. From these conversations, I learned that many teachers are pressured for time, and rarely consider sharing or publishing resources unless directly asked by colleagues. There are numerous subject- and level- specific sharing groups on Facebook and X/Twitter, as well as specialised mailing lists for teachers. As found in previous literature, the first go-to's for resources in most areas are Google and YouTube, supplemented by subject-specific sites. Twinkl is very well known among primary school teachers, but there are mixed opinions about it. Licensing plays a minor to non-existent role in what resources teachers choose to reuse. Broad General Education (BGE) and Senior Phase teachers have very different requirements and I have decided to proceed into next stages focusing only on BGE. Several public organisations (like Scottish Book Trust, National Trust Scotland, and Data Education in Schools) are also interested in this research, because they have resources to share with teachers and would like to know how to make them convenient to find and reuse.

During December-June 2023, I qualitatively analysed the interview data using abductive coding. I refined and merged resulting codes, until they corresponded to particular steps in finding, using, and sharing resources. The findings helped to define a holistic information search process incorporating relationships between finding, using, and sharing online materials, which is more informative than previous exploratory search theories focusing solely on the search itself. I also condensed the observed teacher behaviours to a set of requirements for educational search tools. I used the requirements to informally evaluate the most popular tools Scottish schoolteachers currently use (stage 2), identified the main gaps, and came up with 10 paper prototype ideas to address them.

Over the last two months, August-September 2023 (stage 3), I obtained further ethics approval for evaluation studies and permission from a few schools to visit and ask for teacher feedback on the paper prototypes. So far, I managed to arrange visits to 2 schools, where I spoke with several teachers. This feedback will help choose which ideas to develop into more sophisticated interactive designs using Figma or Miro.

Presently, I have successfully reached the halfway point of the project, transitioning from the exploration (stage 1) and ideation (stage 2) to implementation (stage 3). All the study plans have been certified according to the University of Edinburgh School of

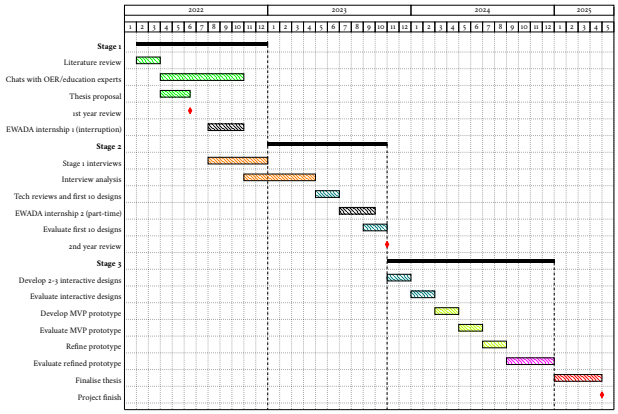

Figure 2: Project plan timeline

Informatics Research Ethics Process, reference number `2022/42906`. Additionally, I have had the privilege of presenting my project plans at OER22, sharing preliminary findings at OER23, and conducting a design feedback workshop at the OE Global 2023 conferences. I am now directing my focus toward translating obtained insights into impactful publications.

A timeline of my whole PhD project is shown in Figure 2. It is a best-case scenario if everything goes smoothly, but my maximum end date is in February 2026, so there is leeway if I need extra time.

6 NEXT STEPS AND LONG-TERM GOALS

During year 3 of my PhD, my plan is to complete prototype development and evaluation. The plan relies on three more feedback cycles: formative feedback on interactive designs with 5 participants in January-February 2024, formative feedback on an MVP prototype with 5 participants in May-June 2024, and summative feedback on a refined prototype with 20 participants between August-December 2024. After this, I expect to need around 4 months up to half a year to analyse all the results and write up the thesis.

If the final prototype is successful, I would like to make it widely available for schoolteachers by creating a commercial start-up around it. Otherwise, there will be good reasons why more efficient technology-facilitated educational resource discovery is either not possible or practical, and this will inform future research directions.

ACKNOWLEDGMENTS

I am very grateful to my supervisors Dr Fiona McNeill and Prof Judy Robertson, the Data Education in Schools team, Edinburgh Community Engagement Forum, Global OER Graduate Network, and all the teachers, friends, and colleagues who contributed to this project through their advice or participation.

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