

X Modal X Cultural X Lingual X Domain X Site Global OER Network

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X5gon Discovery Pilot: Conclusions



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Abstract

The main objective of WP5 is to pilot successive versions of project components developed in WP1–WP4. D5.2 is to report the work done in Task 5.1 (M6–M24) and Task 5.2 (M13–M36) from M13 (September 2018) to M24 (August 2019). It is mainly focused on the scenarios posed by the three official pilots of the project (VideoLectures.Net, poliMedia and virtUOS).

1 Introduction

Work Package 5 (WP5) was planned to carry out a series of piloting studies to link the automatic analysis undertaken on the data with the experiences of groups of learners. Generally speaking, these studies are expected to contribute significantly in revealing the factors that hold user engagement, make learning enjoyable and rewarding, and help in developing a rounded understanding of different disciplines.

The main objective of WP5 is to pilot successive versions of project components developed in WP1–WP4, namely:

- **X5oerfeed:** The project will deploy a technological pipeline for content understanding that is based on wikifier, dmoz and other services developed by JSI, and video transcription and translation services developed by UPV.
- **X5analytics:** The project will track data of users and their progress and use that to drive an analytics engine driven by state-of-the-art machine learning that can improve recommendations through better understanding of users, their progress and goals, and hence their match with knowledge resources of all types.
- X5recommend: Cross-site and cross-lingual recommendation.

The above does not include evaluating the use of the X5gon platform in practice, or the coordination of a network of European OER repositories, which are main objectives for WP6 and WP7, respectively. Instead, WP5 can be seen as a primary source of feedback for WP1–WP4, and also for the non-technical WP6 and WP7.

WP5 runs from March 2018 (M6) to the end of the project (M36, August 2020), and consists of two main tasks:

- 1. Task 5.1 Piloting on individual components (M6-M24, Leader UPV). Small in-house groups will be established to assess successive versions of project components developed in work packages 1 to 4. JSI will pilot individual components from WP2 and WP4, whereas UPV and Nantes will focus on WP3 components.
- 2. Task 5.2 Piloting on integrated components (M13-M36, Leader UCL).

UCL, JSI, UPV, UOS and Nantes will pilot integrated components in the social network. In M13-M24, they will start piloting advanced analytics and social context meetings both virtual and physical. In M25-M36, advanced cross-lingual and cross-modal features will be piloted for the social network to be prepared for different cultures.

This deliverable, D5.2 – Second report on piloting, is to report the work done in Tasks 5.1 and 5.2 in Year 2 (Y2), that is, from September 2018 (M13) to August 2019 (M24). It is mainly focused on the scenarios posed by the three official pilots of the project, VideoLectures.Net, poliMedia and virtUOS; which are considered in Sections 2, 3 and 4, respectively. For each of them, the initial plan and work done in Year 1 (Y1) is first summarized, and then a Y2 update is provided including relevant decisions and actions taken over Y2. It is worth noting that these decisions and actions have been





taken in accordance with the experts' comments made on D5.1, as provided in [1, Annex 1], which are copied here for convenience:

Maybe more elaborated conclusions of the results might have been included, but since it is an annual deliverable, next year it is expected the deliverable been more elaborated. Among other issues, it is recommended that next version focus more on the main objective of WP5, which is to pilot successive versions of project components developed in WP1–WP4.

Following these comments, each Y2 pilot update has been divided into the following Subsections:

- 1. Y2 update on the X50erfeed component.
- 2. Y2 update on the X5recommend component.

The X5analytics component, however, can be hardly evaluated individually, and thus we decided not including a separate Subsection on its individual evaluation. In this regard, it is important to note that the X5analytics component consists in an API allowing access to multiple analytics and models, and a graphical interface allowing their representation. The evaluation of the first is through usage in final front-end products: the X5gon dashboard, learning paths design, etc. Evaluation is thus through the products which make use of this API. The visualization tool is developed for internal purposes: it can be seen as a visual documentation allowing to understand if a particular model is of use in a particular case. Therefore, as indicated above, we decided not to include a separate Subsection on the individual evaluation of the X5analytics component on pilot sites. On the other hand, in the case of VirtUOS (Section 4), apart from the two Subsections on the X50 and X5 recommend components, four additional Subsections are included to cover the main parts of its X5gon Discovery Pilot proposal, which is an update on its Y1 **OER** Recommender for Lecturers piloting plan. As in D5.1, the three Sections on X5gon's official pilots are followed by Section 5 on additional pilots under study. Then, and new in D5.2, Section 6 discusses the work carried out in Y2 on Task 5.2 about piloting on integrated components through the so-called X5gon dashboard developed at UCL. Finally, the main conclusions drawn in Y2 and some considerations for Y3 are reported in Section 7.

2 VideoLectures.Net

2.1 Y1 summary

In the first year VideoLectures.Net integrated the X5gon Connect Service (previously known as the X5gon snippet) on the official repository page. By doing so, VideoLectures.Net has provided a large amount of user activity data to be used by other technical work packages in order to analyze and build the different models and services being developed within the project. In addition, transcription and translation quality evaluations were carried out through the Transcription and Translation Platform, providing WER and BLEU figures involving English and Slovenian.

2.2 Y2 update

2.2.1 Y2 update on the X50erfeed component

The X50erfeed comprises a set of models and tools to process the OER contents that are ingested to the X5gon platform to extract relevant information from the materials. In particular, transcription and translation systems are used to generate textual information from audiovisual (ASR and MT) or textual (MT) OER materials that serve as input to other models and tools being developed within X5gon.







The assessment of the performance of these tools is carried out in WP5 for the different pilots considered in the project. In particular, here we show accuracy figures for VideoLectures.Net test sets, both for automatic speech recognition and machine translation involving VideoLectures.Net languages (english and slovene).

During the second year there has been an special effort in ASR and MT developments involving slovene language (WP3). The slovene and english ASR systems provide now significantly better accuracy for VideoLectures.Net audiovisual OER contents (as can be seen in Figure 1). The english to slovene MT system has also been significantly improved in terms of BLEU thanks to the last developments. A new slovene to english system is now available for translating slovene contents into english. Figure 2 shows the accuracy metrics of both systems in VideoLectures.Net test sets. More details regarding ASR and MT developments can be found in D3.4.



Figure 1: X5gon ASR systems performance in Figure 2: X5gon MT systems performance in VideoLectures.Net test sets (WER) VideoLectures.Net test sets (BLEU)

2.2.2 Y2 update on the X5recommend component

The dataset that stores the transitions has 233,221 transitions showing users have been navigated from one page to another through the recommended items. The users are usually provided with around 20 items in the recommendation list. According to the statistics, the users tend to choose the item ranked 8.89. Around 5 to 7 items could fit into the recommendation window. Therefore, the users usually scroll down in the recommendation window and choose one of the items rather than clicking on the first recommended item.

According to the statistics, the users have chosen an item from the first page 88,914 times (38%) and have scrolled down to choose an item 144,291 times (62%) in the scenario where 6 items are shown at once in the recommendation window.





Figure 3: Navigation between the providers through selected item amongst recommendations

Directed from	Directed to	Frequency
VL	VL	176,594~(76%)
VL	UPV	14,212~(6%)
VL	UOS	553~(0.2%)
VL	Nantes	8 (0.0034%)
VL	MIT	$8,854\ (3.8\%)$
VL	Bologna	32,882~(14%)
UPV	VL	14~(0.06%)
UPV	UPV	92~(0.04%)
UPV	UOS	0 (0%)
UPV	Nantes	0 (0%)
UPV	MIT	0 (0%)
UPV	Bologna	12~(0.005%)

Table 1: Frequency of Navigation amongst OER repositories

Since the recommendations are cross-domain, it is possible for the users to move from one OER repository to another. Because of the data sharing policy among the providers, we can track the directions from VideoLectures.net (VL) and UPV to any OER providers. The Sankey diagram in Figure 3 shows the navigation among the OER repositories. Table 1 shows the exact number how many times a user is directed from one repository to another.

These results can be concluded as:

- When a user is on a particular material, most probably they choose the next material from the same domain so they prefer to stay where they are already.
- The users have mostly chosen the next item from the VL, Bologna, UPV and MIT respectively.
- All transactions to Nantes, UOS and MIT were directed from VL.
- There is at least one transition from the VL to each of the OER repositories listed, but none between UPV and UOS, Nantes, and MIT. The reason could be that the content of the resources is not similar on these particular repositories so they are rarely shown to the user.



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3 poliMedia

3.1 Y1 summary

The first year (M6-M12) covered, on the one hand, the integration of the X5gon snippet (now Connect Service) into the official poliMedia repository; and on the other, the transcription and translation quality assessment on the poliMedia OER contents. All poliMedia OER contents (around 4000 video-lecture pills) were automatically transcribed and translated. The transcription and translation quality evaluations were carried out through the UPV's Transcription and Translation Platform.

The initial integration steps also led to meaningful legal discussions with the UPV media services involving the X5gon Connect Service. They have been particularly concerned about sharing data that might violate any privacy policy or legal agreements of its students. They stressed the fact that the user data needs to properly comply with the recent GDPR constraints.

With the successful integration of the X5gon Connect Service into the official poliMedia repository, we are able to collect user activity data and statistics that are used by the technical work packages in order to build, adapt or improve the different models and services (quality assurance, recommendation, learning analytics) being developed within X5gon.

3.2 Y2 update

3.2.1 Y2 update on the X50erfeed component

During the second half of Y1 we accomplished the installation of the X5gon Connect Service into the official poliMedia repository. From then on, the X5gon platform has been collecting OER materials and anonymized user activity data from poliMedia. This data is being used by other technical WPs (1-4) to build/adapt the systems and tools that will be developed within X5gon.

One important piece of the X50 erfeed is the transcription and translation platform that is meant to provide accurate textual data from the audiovisual OER materials. This is crucial for other components (X5 analytics, X5 recommend) since they are built based on this textual representation of the contents, as well as for more obvious reasons like providing subtitles for the hearing impaired and to help breaking language barriers. For Y2, we are updating the accuracy figures of these systems by evaluating how well they perform on the poliMedia test sets (see Figures 4 and 5).

3.2.2 Y2 update on the X5recommend component

The X5recommend component has been integrated into the official poliMedia repository. The idea is to provide cross-lingual, cross-modal, cross-site recommendations to poliMedia students to collect and analyze their interactions with the X5gon recommendations. This data can be used to further improve the recommendations, to infer advanced learning analytics models, and also to assess how students can benefit from having these related OER materials available.

The first testbed will show X5gon recommendations one out of two times a student accesses an OER material in poliMedia. The recommendations will appear next to the learning object, on the right side of the screen (see Figure 6). For the other 50%, the current poliMedia recommender will show recommendations of other related poliMedia contents. This way we will be able to measure the impact of showing such recommendations to poliMedia students.

For the second testbed (starting in Y3), we will shuffle current poliMedia recommendations with X5gon recommendations and provide them randomly sorted to the students (keeping the order in which each recommender provide the materials).

The total number of user clicks logged for each of the recommenders is 129 for the UPV's, 80 for the X5gon's. These numbers correspond to logs from March to July 2019. We initially expected a









Figure 4: X5gon ASR systems performance in Figure 5: X5gon MT systems performance in poliMedia test sets

Recommender	Hits	Percentage
UPV	129	61.7%
X5gon	80	38.3%

Table 2: Recommendation hits comparison: UPV vs X5gon recommender.

higher number of user interactions with both recommenders. The feedback we had from UPV's Media Services is that most UPV students consume OER contents from the UPV's internal LMS, instead of visiting the official poliMedia repository website where recommendations are shown. This means poliMedia students show a particular interest only in OER contents directly related to their assigned courses, and this fact should be taken into account when drawing conclusions from the available user activity data.

First, we will show a simple comparison on the usage of both recommenders (the official poliMedia recommender versus the X5gon recommender) in terms of user clicks. Table 2 shows how poliMedia students are slightly more attracted by the UPV official recommendations, which only contain other poliMedia OER as possible recommendations. Apart from the recommendations themselves, the presentation of these are different from the two recommenders: UPV recommendations show a thumbnail of the recommended videos while the X5gon recommender shows an icon that indicates if the recommender object is a video or a document. This could also influence the users to be more attracted in favor of the UPV official recommendations.

Next we will provide some numbers and figures regarding cross-events from the poliMedia repository. We want to analyze the impact of having X5 recommendations suggested to poliMedia students.

First, we focus on cross-lingual events. Figure 7 shows the distribution of poliMedia students following recommendation links in different languages. As we can see, more than 75% of the rec-









Figure 6: X5gon recommendations in poliMedia



Figure 7: Cross-lingual hits from poliMedia.



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ommendations followed by students are from Spanish/Catalan OER to Spanish/Catalan OER. The majority of the cross-lingual events are from Spanish/Catalan to English. We think two important factors are playing a role in these numbers. First, poliMedia students might find other poliMedia OER resources more suitable for a particular topic they can be interested in. Second, we should consider the language barrier. Spanish students might find more difficulties to consume OER in a language they do not master. Nevertheless, the size of the X5gon network at this stage is rather small (there are only 5 OER providers), and the lack of diversity in OER contents makes it difficult to draw more solid conclusions.



Figure 8: Cross-modal hits from poliMedia.

In X5gon we consider different OER formats (videos, documents, web pages, etc). In the recommendation frame that is shown to poliMedia students, the recommendation links are presented with different icons depending on the document format of the suggested OER. We find it interesting to analyze the recommendation events that commute between formats (for example, accessing a related PDF document while following an OER video lecture). Figure 8 shows that cross-modal events are less than 10% of the total, two thirds of them being from a poliMedia video to an external PDF document. We should consider that the poliMedia repository only contains video lectures and has no OER PDF documents available.

Finally, we would like to show numbers regarding cross-site events (students going from/to poliMedia to a different site). In the first case (jumping from poliMedia to a different site), Figure 9 shows that almost 85% of the recommendations followed by poliMedia students point to other poliMedia OER contents. As for the second case (jumping from other sites to poliMedia), all of the visitors come from the VideoLectures.NET portal (11K hits so far).

It will be interesting to further analyze these numbers once the size of the X5gon network grows substantially and the lack of availability of related contents for particular topics or domains can be minimized.









Figure 9: Cross-site hits from poliMedia (UB="University of Bologna").

4 virtUOS

4.1 Y1 summary

During Y1 (M6-M12) and the begining of Y2, UOS finalized the integration of the X5gon Connect Service into its virtUOS institutional repository. All the OER contents from virtUOS were automatically transcribed and translated. Evaluation sets were defined in order to carry out the transcription and translation quality evaluations through the UPV's Transcription and Translation Platform.

UOS prepared an updated pilot proposal so as to be more focused on a *OER Recommender* for *Lecturers*, where the X5gon services were meant to provide recommendations of additional OER resources to the teacher before passing them to their students.

4.2 Y2 update

The **OER** Recommender for Lecturers pilot proposal has been updated to X5gon Discovery **Pilot** due to the prototype state of the X5gon OER search engine in terms of content availability. Further details are given in the following sections.

4.2.1 Y2 update on the X50erfeed component

The German ASR systems have not been updated since last year, so the performance on the virtUOS test sets remains the same (Figure 10). Details on the test sets are given in Table 3. For virtUOS we defined two different ASR test sets according to the two main type of media objects being recorded in the repository: one for the screencast recordings, and one for the classroom recordings (with lapel microphone). We have no labeled data from virtUOS for MT evaluations involving the German language, so only ASR evaluations are performed.





Language	Set name	Videos	Hours
German	virtUOS (screencast)	19	5.3
German	virtUOS (classroom)	2	2.4

Table 3: Details on virtUOS ASR test sets.



Figure 10: X5gon ASR systems performance in virtUOS test sets







4.2.2 Y2 update on the X5recommend component

The evaluation of the X5recommend component have been carried out under the *X5gon Discovery Pilot* proposal. All the details, results and conclusions are given in the following sections.

4.2.3 X5gon Discovery Pilot: Goal and description

X5gon Open Educational Resources (OER) recommendation and search engine is in a prototype state since 2018. To achieve long-term goals and to get potential users to use the search engine, it is necessary that the search engine provides valuable results. Searchresults have to be related to the search query and should also be relevant for the users' search goal or learn goal. If users are not able to find OER related to their search topic or if it's too hard to get a useful result out of it, the users won't be willing to use the X5gon search engine in future.

Based on data provided by Google Search Console-API, J. Beus ([2]) analysed the click probability (not the CTR "Click-Through-Rate") of Google search results. It shows that 99,1% of the analysed 124.086.615 organic clicks relate to result position 1 to 10. Of these clicks, 60% were performed at position 1 and 15% at position 2 of the search results list. The first ranking on page 2 (position 11) receives only 0.17% of all organic clicks.



Klickwahrscheinlichkeit nach Rankingpositionen je Geräteklasse

Figure 11: Chart "Click probabilities by device class" (Beus, 2015)

In the paper "A review on an approach to infer user search goals for optimize result", Ingale et. al. ([3]) analyse different approaches to make search engines more effective and the results more valuable for users. They describe an increase in the use of the Internet to gather information and see a need to provide search results with more relevant information in a faster time.

"Inferring search goal is very promising solution in order to get the relevant information to user







query. Use of feedback sessions gives more reliable output, instead of taking only search results or clicked URLs in the process of inferring search goal. Feedback sessions will reflect user information desires more efficiently and increase the performance of search results." ([3]).

X5gon Discovery should therefore be designed in such a way that users can quickly access relevant information or reach their desired search destination. For this purpose, a qualitative analysis of the search results, as described by Ingale et. al., is necessary. Since 99% of the users view only the first 10 search results ([2]), these should be the focus of the evaluation.

4.2.4 X5gon Discovery Pilot: Method

University Osnabrück (UOS) will use course data from Stud.IP (UOS Learn-Management-System) like title and description and feed the X5gon Discovery API with that data. The top 10 results of that search query will be saved and evaluated by members of the target group (lecturers or students in higher education context).

They will get asked the following questions:

- The search result matches the content of the lecture/course.
- How sure are you of your evaluation?
- (optional) Result is a duplicate (no evaluation needed)
- (optional) Comment

The scales are used in accordance to Likert. Survey results will be saved per lecture and per result in JSON format to ensure sufficient evaluation potential. For the evaluation process, a web application with a corresponding backend was developed by UOS. This tool meets all requirements of the "X5gon Discovery Pilot" regarding the evaluation of search results and is easy-to-use for the target group.

Web application and technical details

The Web UI is split roughly into two columns. On the left are data about the course such as title, description and institute. On the right side, stored search results for the selected course are displayed.

- 1. "Random event" button: automatically selects a random event mouse
- 2. Description of the selected course
- 3. Translation of the course data into English to overcome language barriers such as French, Italian or Spanish
- 4. Navigation of search results (the "unanswered" button jumps to the next search result not yet rated by you)
- 5. Description of the selected search result (the link "open in new window" leads directly to the resource)
- 6. "Translate" button: opens title and description in Google Translator
- 7. Comment field: here is space for short comments and remarks, which help to evaluate the data. Any other symbols, formatting etc. in the title and the description of the search result should be entered here. Comments refer to the currently selected search result. (Please English!) Example: "unintelligible symbols in description". Example: "html-tags in title"







Veranstaltung ID: 2	Suchergebnis 1 von 10
Uni Osnabrück SS 2019 Institut für Erziehungswissenschaf Digitalisierung in der Frühpädagogik	VIDEO Videolectures.NET Beschreibungslosigkeit oder Entwürfe medialer Künstlerexistenzen: Der Fall Andy Warhol Keine Beschreibung vorhanden
>> autom. Übersetzung von de zu en (Service: deepl.com)	übersetzen (Google Translate)
Digitisation in Early Childhood Education	Das gezeigte Suchergebnis passt inhaltlich zur Vorlesung/zum Kurs. trifft nicht zu trifft eher nicht zu trifft eher zu trifft zu Wie sicher sind Sie sich in Ihrer Einschätzung? sehr unsicher eher unsicher eher sicher sehr sicher Anmerkung/Kommentar (wenn möglich, bitte in englisch) Absenden 9

Figure 12: UI draft of X5gon Discovery pilot (Screenshot)

- 8. "Duplicate" button: if a search result has already been listed, a duplicate can be reported here.
- 9. "Submit "button

Sample JSON structure for stored lecture and search results data:

```
{"lectures": [{
    "type": "lectures",
    "id": "1",
    "attributes": {
        "title": "Title in original language",
        "title_translated": "Title translated to en",
        "description": "Description in original language",
        "description_translated": "Description translated to en",
        "course_number": "3.210",
        "language": "en",
        "semester": "SS 2019",
        "faculty": "Faculty name",
        "results": [*CONTAINS \rec_materials" FROM X5 API*]
    }]
}
```

Sample JSON structure for a survey data submits:

```
[{
    "uuid": "<generated UUID string>",
    "lectureId": 3,
    "resultId": 3,
```



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Test set data

Courses sum	22
Search results per course	9,77
Possible survey results per course per participants	215

Table 4: Quantities and percentages of course languages

Languages			
German	12	54.5%	
English	$\overline{7}$	31.8%	
Italian	1	4.5%	
French	1	4.5%	
Spanish	1	4.5%	

Table 5: Quantities and percentages of course languages

```
"localStorageKey": "x5pilot-l3-r3",
"submitDate": "2019-04-29T09:39:12.749Z",
"radioFit": 3,
"radioSure": 3,
"textComment": "<possible user comment>",
"urlClickCount": 0,
"language": "en"
```

Test set structure

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The following tables and plots show the structure of the used course test set. A total of 22 courses from the current semester "Summer 2019" were selected and the corresponding dates such as title, description and language were saved. The structure of the test set is based on the course mix of the University of Osnabrück. Notable characteristics of the course informations like included html-tags, included references or unusable description lengths were documented (see Figure 3). This enables a subsequent analysis of possible error origins or sources of inaccuracies in OER recommendations.

Table 5 shows the language mix of the test set courses. In total there are five different languages included. 54.5% of the courses are in German, 31.8% in English and 4.5% each in Italian, French and Spanish. This roughly represents the language structure of the courses offered at the University Osnabrück.

Selected courses of the test set belong to the following departments of the University of Osnabrück (see Table 6). In total, the test set covers courses from 15 departments. Most courses come from the Institute of Educational Sciences with 26.7% and the second most from the Romance Studies department with 20.0%. 13.3% of the courses are extracted from the Institute for Computer Science and 13.3% from the Institute of Art History. One course (6.7%) from each of 11 other subject areas is included in the test set. The distribution of the departments is partly representative for the UOS, e.g. the educational science share, but no more concrete statement is possible because the distribution is high.

Recommendation Engine state and language structure

With the aim of comparability in further evaluation phases in the future, the data of the Recommendation Engine was extracted at the time of the search result name. All data in this section originates





id faculty (translated)	title (translated to en if other lang)	has-description	lang-origin	lang-reqest	results	specs/comment
1 Institute for Educational Science	Difference and diffusion of educational childhood and family childhood	yes	de	de	10	
2 Institute for Educational Science	Images of the Holocaust - Visual Media as Components of Contemporary Holocaust Learning	yes	de	de	10	
3 Institute for Educational Science	Digitisation in Early Childhood Education	yes	de	de	10	
4 Institute for Educational Science	Behaviour in school conflict situations	yes	de	de	10	long description
5 Anglistics	U.SAmerican Literature and Culture from Modernism to Postmodernism	yes	en	en	10	
6 Neurobiology	Sensory Physiology	yes	en	en	10	short description
7 LE Cognitive Science	Action & Cognition II: Higher Cognitive Functions (Lecture)	yes	en	en	10	html tags in description
8 Romance studies	Advanced training course	yes	it	it	10	short description
9 Institute for Catholic Theology	Medieval Encounters between Christianity and Islam	no	en	en	10	no description
10 Institute for Computer Science	Lecture tutorial: System Ecozones and Living Beings	yes	de	de	10	long description; description contains literature references
11 Institute of Art History	Travel pictures. Artist journeys since the early modern period.	yes	de	de	10	
12 German studies	Information Structure, Syntax and Text Coherence (SW3, WP BA)	yes	de	de	10	
13 Institute for History	The French Revolution	yes	de	de	10	
14 Institute of Art History	Form as standard? Social utopias and individual living concepts.	yes	de	de	10	long description
15 Institute for Computer Science	Graph algorithms	yes	de	de	10	
16 English Studies/Art/Art Education	Making Reality: Art, Storytelling, Technology, and the Environment	yes	en	en	10	description contains comment
17 Institute of Psychology	Human-Computer Interaction	yes	de	de	10	
18 Economic Sciences	WIWI-B-01015-MA: Fundamentals of Marketing	yes	de	de	10	short description
19 Social Sciences	Introduction to spatial data visualization and analysis in political science (BA und MA)	yes	en	en	10	
20 Institute for Environmental Syst	Interdisciplinary seminar on applied research methods	yes	en	en	5	
21 Romance studies	Style and Expressive Modalities	yes	es	es	10	
22 Romance studies	Grammar 1	yes	fr	fr	10	

Figure 13: Test set details (screenshot)

Institute for Educational Science	4	26,70%
Romance studies	3	20,00%
Institute for Computer Science	2	$13,\!30\%$
Institute of Art History	2	$13,\!30\%$
Anglistics	1	6,70%
Economic Sciences	1	6,70%
English Studies/Art/Art Education	1	6,70%
German studies	1	6,70%
Institute for Catholic Theology	1	6,70%
Institute for Environmental Systems Research	1	6,70%
Institute for History	1	6,70%
Institute of Psychology	1	6,70%
LE Cognitive Science	1	6,70%
Neurobiology	1	6,70%
Social Sciences	1	6,70%

Table 6: Quantities and percentages of the test set faculties structure



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LangCode	n	%
en	72610	$82,\!24\%$
it	7008	7,94%
es	4096	$4,\!64\%$
sl	3115	$3{,}53\%$
de	748	0,85%
fr	196	$0,\!22\%$
el	179	$0,\!20\%$
ca	142	$0,\!16\%$
$^{\mathrm{zh}}$	85	$0,\!10\%$
da	29	$0{,}03\%$
ja	21	$0,\!02\%$
pt	20	$0,\!02\%$
la	15	$0,\!02\%$
hr	5	0,01%
ru	5	0,01%
bs	4	0,01%
sr	3	$0,\!00\%$
\mathbf{ml}	3	$0,\!00\%$
id	2	$0,\!00\%$
eu	2	$0,\!00\%$
sa	2	$0,\!00\%$
nl	2	$0,\!00\%$
kk	1	$0,\!00\%$
gl	1	$0,\!00\%$
ia	1	$0,\!00\%$
SUM =	88295	$100,\!00\%$

Table 7: Structure of indexed OER per language (Recommendation Engine)

from the Jožef Stefan Institute where the Recommendation Engine for X5gon is developed and was provided to us by the team members working on the project. The total number of indexed OER at the time of search result name in calendar week 19 in 2019 is n = 88295.

Table 7 shows the quantities and percentages of indexed OER per languages. Most of the indexed resources are in English with an quantity of n = 72610 which equals to ~82%. The percentage of Italian resources is ~8%, of Spanish resources ~4.6% and of Slovenian resources ~3.5%. All other languages have a resource proportion of less than 1%, including German in fifth rank with 0.847%.

4.2.5 X5gon Discovery Pilot: Results

This section contains an overview and analysis of data collected in the first phase of the X5gon Discovery Pilot at University Osnabrück (UOS) in the time period from 21. May 2019 to 20. June 2019. Goal of the pilot and the analysis is the evaluation of X5gon search- and recommendation engine regarding quality and relevance of top 10 search results through our target group (students and lecturers).

- Execution period: 21. May 2019 to 20. June 2019 (30 days)
- Date of recommendation data collection: (X5gon API): 10. May 2019



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Levels	Counts	% of Total	Cumulative %
de	745	54.9%	54.9%
en	448	33.0%	88.0%
es	53	3.9%	91.9%
$^{\mathrm{fr}}$	60	4.4%	96.3%
it	50	3.7%	100.0%

Table 8: Frequencies of languages per result record

- Query parameters: title and description of 22 current UOS courses (text)
- A total of 215 search results were evaluated (distributed on 22 courses). Usually the first 10 search results that were returned.
- Data set has n = 1356 evaluations (~61 per course; ~6,3 per search result)

Result Language Structure (languageCode)

This variable shows the language structure of the evaluated search results. University Osnabrück mainly offers German and English courses and some courses are offered in other languages such as Spanish, French, Italian etc. (also see "Test set structure"). The shown search result evaluation data are therefore representative for the language structure of the UOS courses. There are no notable differences between the language distribution in the test set (also see "Test set structure") and the percentages shown in Table 8.



Figure 14: Bar chart of languages per result record

Is the search result a duplicate? (isDuplicate)

The target group was encouraged to mark all duplicates or repetitive search results as "duplicates". The data shows that participants reported 23.8% of the search results as duplicates or repetitions. They noticed that different video qualities, for example, were displayed here as several search results. Video and audio tracks were also sometimes displayed separately.







Levels	Counts	% of Total	Cumulative %
false	1033	76.2%	76.2%
true	323	23.8%	100.0%

Table 9: Frequencies of duplicate or repetitive result records



Figure 15: Bar chart of duplicate or repetitive result records

Search result matches the content of the lecture/course

All entries marked as duplicates (also see "Is the search result a duplicate? (isDuplicate)") have been sorted out resulting in a sample count of n = 1033. Participants were asked if the search results shown matched the content of the corresponding course and evaluated using a Likert scale with answer options (1) "Strongly disagree", (2) "Disagree", (3) "Agree" and (4) "Strongly agree". The question and the answers were given to the participants in German "(de) Das gezeigte Suchergebnis passt inhaltlich zur Vorlesung/zum Kurs".

From the statistics in Table 10 it can be seen that the mean of the evaluation is 1.27 with a standard deviation of +/-0.937, which lies between the answer possibilities of the scale between (1) "Strongly disagree" and (2) "Disagree" with a tendency to "Strongly disagree".

The data shows that 77.9% of the search results were rated by the participants as not matching the corresponding course (Disagree + Strongly disagree). 22.1% of the search results were rated by the participants as matching the course (Agree + Strongly agree). More than half of the search results (56.1%) were also rated as absolutely inappropriate. In contrast, 5.8% of the search results were rated as very suitable.

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Table 10: Statistics of Result Fit To Course/Lecture variable







Levels	Counts	% of Total	Cumulative %
(1) Strongly disagree	580	56.1%	56.1%
(2) Disagree	225	21.8%	77.9%
(3) Agree	168	16.3%	94.2%
(4) Strongly agree	60	5.8%	100.0%

Table 11: Frequencies of Result Fit To Course/Lecture variable





Crosstab: ResultsFitToLecture / HowConfidentAreYou

All entries marked as duplicates have been sorted out resulting in a sample count of n = 1033. In order to evaluate the validity of the data with regard to the fit to the course, the participants were additionally asked how confident they were with their assessment. Table 12 shows a crosstab of the variables "ResultFitsToLecture" and "HowConfidentAreYou" (about your answer).

The following plot shows the data as percentages. The frequencies of samples of the individual bars varies widely (see frequencies in the axis labeling). It can be recognised that the participants were more than ~97% certain or very certain about their assessment when rating "Strongly disagree" (70,3% + 26,6%) and also "Strongly agree" (73,3% + 25,0%).

Crosstabs: ResultsFitToLecture / languageCode

For information: All entries marked as duplicates have been sorted out resulting in a sample count of n = 1033. On the following data you can see the evaluation of the participants in relation to the

	HowConfidentAreYou				
ResultFitsToLecture	Very uncertain	Uncertain	Certain	Very certain	
Strongly disagree	6	12	154	408	
Disagree	12	47	155	11	
Agree	5	54	101	8	
Strongly agree	1	0	15	44	

Table 12: Crosstab of variables "Results Fit To Lecture/Course" and "How Confident Are You"









Figure 17: Bar plot of crosstab of variables "Results Fit To Lecture/Course" and "How Confident Are You" (about your answer).

course language. This is an essential factor with regard to X5gon target "cross lingual" goal.

The following plot shows the data in percentages. Frequency of samples of the individual bars varies widely (see frequencies in the axis labeling). The plot shows that the search results for English queries are 43.1% (Agree 33.4% + Strongly agree + 9.7\%) suitable. Queries for Spanish courses deliver usable results at 31.2% (Agree 25% + Strongly agree 6.2%). German courses: 8% matching results (Agree 4.1% + Strongly agree 3.9%). French courses: 1.8% partially matching results and Italian courses no matching results at all.

4.2.6 X5gon Discovery Pilot: Conclusions

A test set representative of German universities was used to evaluate the search results and OER recommendations of the X5recommend engine. Language composition, e.g. the high proportion of German-language courses and the second highest proportion of English-language courses, is existing

	ResultFitsToLecture				
languageCode	Strongly disagree	Disagree	Agree	Strongly agree	
de	397	72	21	20	
en	111	107	128	37	
es	11	22	12	3	
fr	50	4	1	0	
it	11	20	6	0	

Table 13: Crosstab of variables "Results Fit To Lecture/Course" and "Language Code"



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Figure 18: Bar plot of crosstab of variables "Results Fit To Lecture/Course" and "Language Code".

in a similar form at German universities. Experience has shown that German universities occasionally offer courses in other languages such as Spanish, Italian, French, etc., but the majority of the courses are German or English. From the resulting data it can be deduced whether and how the software delivers purposeful results that are applicable in the everyday practice of teachers and students in the context of German universities.

From the data it can be seen that in the overall search results of participants 22.1% were classified as "suitable for the course". A comparison shows the differences in the languages, so it can be seen that especially English results were rated as "fitting for the course" with 43.1%. Queries for Spanish courses deliver usable results at 31.2% (Agree 25% + Strongly agree 6.2%). However, the sample size of n = 48 is significantly smaller in Spanish in than English evaluations (n = 383) why the good evaluations of Spanish search results can also arise from a randomly "good fit" pick of a Spanish course. The other languages (German, French and Italian) are evaluated <10% as "suitable for the course". This problem was already known before the pilot was carried out and with the following software updates it can be assumed that the search results will fit better in the future.

Since the search results are based on the indexed OER repositories, the database is probably at the current time still too small to provide better fitting results. The X5gon project team is currently working on the indexing of further OER repositories.

Looking at the ratings of the English (43.1% fit-to-course) and Spanish (32.1% fit-to-course) search results as well as the indexed OER of these two languages to date, a significant difference can be observed between the quantities of English (n = 72610) and Spanish (n = 4096) indexed OERs. This could indicate that the amount of indexed OER is less important than expected and the results depend on the fine-tuning of the software. This question should be addressed in the near term.

This pilot study must be understood and interpreted as a baseline for an early software prototype. It enables the comparability of the results of the following pilot runs, which will be performed after the accomplishment of further milestones. When considering these results, it should also be noted that currently only basic elements of the user modeling are included and the semantic search still requires



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fine-tuning.

The next major update of the Recommendation Engine will take place in August. Until then, further important repositories should also be indexed, since the crawling process has currently been started. Therefore, our current plan is that the next pilot run will start in September and will be completed in October. The results expected in October can then be compared with the results of the first pilot after data processing. This allow a conclusion to be drawn about the development progress of the X5gon Recommendation Engine.

5 Other pilots

Although the work plan is focused on three official pilots described in previous Sections, other X5gon partners with OER resources (as is the case of UCL and Nantes) will also help testing X5gon services and tools. In addition to project partners, external OER repositories will be welcome to contribute on piloting of components and services once the project reaches a more mature development state.

5.1 Y1 summary

Université de Nantes went through the installation of the X5gon Connect Service into their OER repository during Y1. Their experience and the issues faced during the set up of the snippet helped to get the X5gon servers infrastructure and communication protocols up and running for the upcoming pilots.

University College London helped in the integration of Moodle sites into the X5gon platform.

5.2 Y2 updates

Université de Nantes has put a significant effort in the development of the X5gon Moodle plugin to enable Moodle sites to be integrated into the X5gon network.

6 Piloting on integrated components

This Section reports on the current progress and plans regarding Task 5.2 "Piloting on integrated components" (M13-M36, Leader UCL).

The task is defined as follows:

UCL, JSI, UPV, UOS and Nantes will pilot integrated components in the social network. In M13-M24, they will start piloting advanced analytics and social context meetings both virtual and physical.

UCL took the lead on this task. In collaboration with other partners, the following aims were established:

- 1. To identify key use cases, target groups and collaborators.
- 2. To develop public web interfaces to allow large-scale collection of real-world user data, A/B-testing and evaluation of X5gon platform components, such as recommendations, transcription, quality and transparency features.







6.1 Key use cases, target groups and collaborators

Self-directed, lifelong learners were already identified as a relevant target group in Y1. This includes pairs and groups of self-directed lifelong learners. Other work packages have also addressed university students.

In order to address a wider range of real-world use cases and target groups, we approached several education charities and startups in London, including:

- CENTURY an award-winning teaching and learning platform for primary and secondary schools, colleges and universities.
- MyBnk, a charity delivering financial education to 7-25 year olds in UK schools and youth organisations.

Other potential opportunities for collaborations that we are exploring include:

- The National Archive.
- UNESCO World Heritage Sites.
- ASEF: Workshop with teachers at the 15th ASEF Classroom Network Conference Theme: Education for Sustainable Development (ESD) and AI: The Role and Readiness of Teachers

Collaborations will proceed with some of the above and potentially other organisations.

6.2 Public user interfaces

A large portion of UCL's research and development efforts has been dedicated to X5Learn, which is the pioneering instantiation of the X5gon "dashboard". Besides X5Learn, other instantiations of the dashboard are feasible by creating customised instances ("deployments") of the original web application that can be adapted for different purposes and hosted on different servers. The feasibility of maintaining multiple deployments has been verified in so far as closed user studies have been conducted by UCL using different versions of the dashboard (see D6.2).

Our objectives for Y3 are:

- 1. To launch X5Learn learning platform to the general public.
- 2. To attract adult informal learners who can utilise the extensively tested learning environment to improve their lifelong learning experience.
- 3. To conduct large scale experiments (such as AB tests) with the consent of the user base to deeply understand how to improve the learning experience of a diverse population of learners.
- 4. To integrate experimental findings into the continuous improvement of X5Learn.
- 5. To continue developing X5Learn, attract and retain a large user base and conduct A/B testing of relevant features to support the needs of educators and informal learners.
- 6. To repurpose the dashboard code for the development of standalone websites that investigate specific use cases in a focused, real-world context.
- 7. To explore the potential for third parties to use white-labelled versions of the dashboard interface.





6.2.1 X5Learn

X5Learn is the first public facing dashboard of X5gon that focuses on enabling interactive learning. Developed by UCL and hosted by Pošta Slovenije, it is intended as the primary "public face" of the X5gon platform, showcasing key features to end users, potential collaborators and other stakeholders. Designed mainly as a personal learning support system, it allows the user to find, assess, navigate, collect and engage with OERs. X5Learn uses the full set of tools and services developed within the X5gon platform.

X5Learn was demonstrated at the CHI 2019 workshop Towards a responsible agenda for HCI. The corresponding position paper is available for download.

6.2.2 Standalone websites

During the iterative design process of X5Learn, a series of alternative designs and directions for innovation have been produced that show promise. This includes features that are included in X5Learn as well as features that are out of scope for X5Learn. Rather than overcomplicating X5Learn with too many features, we aim to explore certain ideas through rapid prototyping in the wild. This approach is orthogonal to the linear development of X5Learn, as it allows for multiple parallel designs and value propositions that we evaluate using an agile, "fail-fast, fail-cheap" methodology, resulting in several websites that have their own web domain, separate from X5Learn. In addition to offering value to the general public, these websites can also be used when exploring numerous possible future directions, exploitation and dissemination efforts. This may include pitching whitelabel projects and similar proposals to potential stakeholders.

6.2.3 Whitelabel versions

One of the original key ideas behind the dashboard has been its potential to be used as a customisable web interface that can be adopted by OER repositories that either lack a powerful user interface or want to extend the capabilities of their current user interface. For instance, discoverability of information in and across documents was identified as an aspect of the user experience for which many conventional interfaces provide only rudimentary support. The new lookahead feature of X5Learn has attracted considerable interest as a promising approach that could complement and extend the user experience of document-heavy OER websites. Educational blogs and podcasts may particularly benefit from the dashboard's ability to make large amounts of (transcribed) text content transparent and easy to browse, using fragment-based topic extraction.

By the same token, other features, such as transcription and translation, may be the focus of different whitelabel projects, depending on the needs of the organisation.

6.2.4 AB testing

As components continue to be developed by various partners, X5Learn aims to accommodate the needs of our partners to continuously evaluate their developments with real users. This requires X5Learn to be fully compliant with GDPR and other legal requirements. Draft versions of the Terms of Service and Privacy Policy have been created and are currently being processed by legal experts. The public launch of X5Learn and subsequent AB testing will commence once this process is complete.

7 Conclusions

During the second half of Y1 and the beginnig of Y2, the three official pilots finalized the installation of the X5gon Connect Service into their respective official repositories. This was a key point for piloting





developments since user and content data needs to be collected from the pilots in order to develop the different models and tools in WP1-4.

The piloting on individual components in Y2 has focused mainly on the X50erfeed and X5recommend components. In particular, transcription and translation systems quality has been assessed by evaluating their performance in the test sets defined for the official pilots. The impact of the X5gon recommendations has been also evaluated on the pilot sites following different approaches. Generally speaking, a large progress has been made on piloting individual components during Y2. However, there are still some issues that we will have to address in Y3 such as the evaluation of the X5analytics component, for sure within the context of the X5gon dashboard. Similarly, we expect that new versions of the X50erfeed and X5recommend components will be needed in certain circumstances, as for instance in the case of new pilots joining the X5gon OER network, and thus we do not rule out the need of further evaluations of individual components. Although Task 5.1 was planned to end by M24, we were all aware of this at the beginning of Y2, and hence we have been preparing ourselves to cope with extra effort in Y3 within budget.

We have also discussed the work carried out in Y2 about piloting on integrated components through the so-called *X5gon dashboard* developed at UCL. It is important to note that, as planned, piloting on integrated components started on Y2. Therefore, there is still a lot of work ahead to be done and many objectives to achieve in Y3.







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