MULTIMODAL SCIENCE COMMUNICATION ACROSS DISCIPLINES IN VIRTUAL COLLABORATION

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Abstract

In this paper, we present the results of a collaborative work experience between science students and humanities students at the University of Minho. The goal of this experiment was to introduce students to multimodal ways of communicating science in a space across disciplines. The methodology used was based on active learning scenarios, on the focus of multimodality as a pedagogical practice, and on the promotion of virtual means of collaboration that can be replicated in hybrid and distance learning contexts. Students carried out bibliographic research, planning through the use of the mind map technique, collaborative writing and the creation of science communication multimodal content, through the creation of a short animated video about one of the scientific themes covered. At the end a feedback questionnaire was applied which indicated that the methodology was well received among the students of both disciplines.

Keywords: Science communication, Collaborative Learning, Multimodality, Flipped Classroom, Interdisciplinarity.

1 INTRODUCTION

In order to take full advantage of science and technology, they must be accessible to as many people as possible and their message must be easily understood. In fact, the Covid pandemic highlighted the importance of simple and effective science communication. However, researchers are only trained for the creation of knowledge and in no instance are they trained for the communication and dissemination of science to a general public. That is why we designed an experiment that intended to introduce graduate and undergraduate students from different disciplines to multimodal ways to communicate science. Science communication requires imagination and creativity, thus this experience was grounded on (1) student-centred active learning practices, (2) multimodality and (3) across disciplines virtual collaboration.

The growing need to change traditional teacher-centred practices to a more active and student-centred teaching and learning approach has led to the development of strategies that redefine the university's educational mission [1] [2] [3]. Higher education systems and institutions need to be intentional drivers of this change process, rather than letting technology and external interests dictate it [1]. According to the Partnership for 21st century skills, the framework for 21st century learning includes learning and innovation skills, focusing on creativity, critical thinking, communication and collaboration. These essential skills must be associated with information, media and technology skills as well as life and career skills. These last ones will arise and consolidate with a proper practice of the first ones. The recognition that students must master these skills to succeed in work and life encourages interdisciplinary approaches and exchange of knowledge between professionals from different areas toward a mutual enrichment. Education should prepare learners to tackle collaborative problem-solving scenarios, inasmuch as effectiveness of collaborative learning is higher than either competitive or individualistic efforts, even to individual achievement [4]. A way to promote active learning methodologies is the pedagogical model of Flipped Classroom [5] . By changing the focus and the way of transmitting knowledge, this teaching methodology is characterised by enhancing the student's individual work in the acquisition of theoretical knowledge outside the classroom (usually through access to videos or other material prepared and/or selected by the teacher), thus using the classes to perform activities aimed at consolidating and/or deepening knowledge, under the teacher's supervision [6]. This pedagogical model, which involves reversing the work proposed to students inside and outside the classroom, will require students to have a greater capacity for organisation and autonomy.

All teaching and learning is multimodal as it happens through speech, writing, gesture, image and space [7]. Indeed, multimodality is “the coexistence in human communication of more than one modality of expression” [8], whether gestures (movements, posture, facial expressions), images (static

or dynamic, real or drawn), sound (speech, sound effects and music) and writing (font and typography) [9]. Besides being a “phenomenon of human communication”, multimodality is also “a diversified and growing field of research” [10]. In *A Pedagogy of Multiliteracies* [11], the New London Group gave a central place to the concept of multimodal within pedagogical practices. That is because writing was no longer the central mode of representation in pedagogical materials decades ago [12], even though traditional literacy still insists that it is. If in 2012, Siegel [13] was tempted to declare then as the time for multimodality, today’s astonishing digital progress, with the increasing presence of AI technology in everyday life or the prevalence of social networks more and more tuned into audiovisual content, makes this concept more relevant than ever.

Bringing multimodality into the classroom means using digital media that support this kind of content and interaction. Virtual walls, like Padlet (https://padlet.com/), are easy to use, enable instant collaboration, allow for multimedia content and are accessible via mobile [14]. Virtual environments are fundamental tools for distance or hybrid learning, but also for experiments, such as the one we will discuss next, that involve different disciplines and classes.

2 METHODOLOGY

In order to contribute to an effective change in Teaching and Learning practices at University of Minho (UM), an interdisciplinary pilot experiment was carried out, in the 2nd semester of the 2018-19 academic year, with students from the School of Sciences (ECUM) and from the School of Art and Humanities (ELACH). ECUM students, finishing their bachelor’s degrees in Applied Biology (LBA) and Biology Geology (LBG), were attending the optional Course Unit (UC) – Biology of Freshwater Pollution (bPad); ELACH students, attending the Corpus Linguistics UC, were on the first year of the Master’s Degree in Translation and Multilingual Communication. The course Corpus Linguistics aims to provide a theoretical and practical introduction to the methodology of corpus linguistics, using web-based computational tools, to create corpus-based resources for specialised languages. In this experiment, students worked together in small groups on the programmatic content of the course Biology of Freshwater Pollution. ECUM students interacted with the course content in an active and collaborative way, while the ELACH students extracted terminology and created parallel corpora from the course material.

This scenario of active and collaborative learning was achieved using virtual murals (see Figure 1). Teachers can (and should) publish in the virtual wall the schedule of the assignments, the learning outcomes and additional or complementary material.

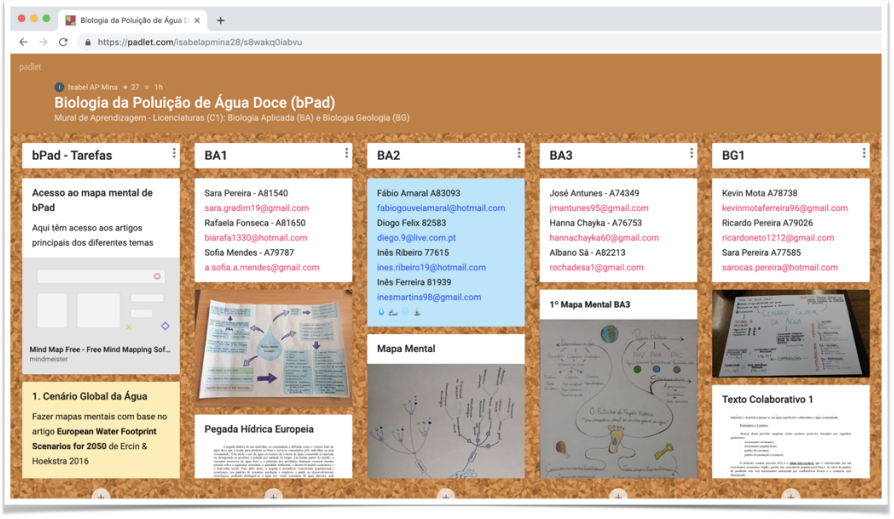


Figure 1. Virtual Wall

There were 4 steps in this experiment: research, planning, textualization and multimodal science communication. This active methodology of co-construction and communication of knowledge demands from students a greater capacity for organisation and autonomy, since we ask them to work together, in a collaborative way. Using a variety of digital tools, students are encouraged to work collaboratively in teams to create multimodal materials (mind maps, collaborative texts, digital narratives).

Water is the common theme of the Biology of Freshwater Pollution course, so the discipline's syllabus was shared with both ECUM and ELACH students. There were seven themes included on the bPad syllabus. The bPad teacher assigned a scientific paper to each one of the seven themes. The groups were instructed to conduct further bibliography research, in order to gather more information on the themes. After reading and researching the bPad themes, students proceeded to the planning phase, using the mind mapping technique (see Figure 2).

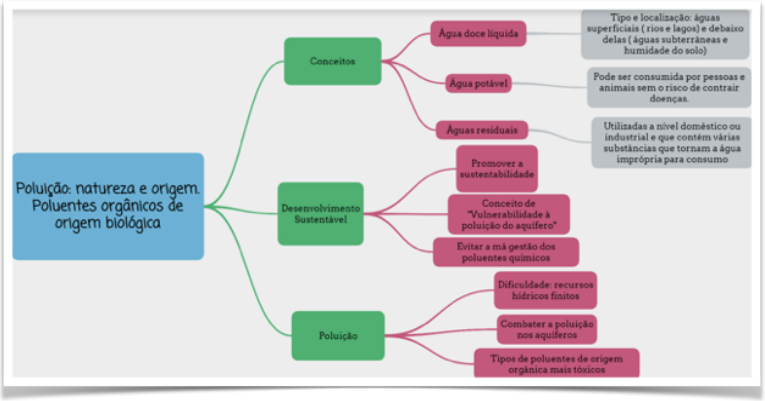
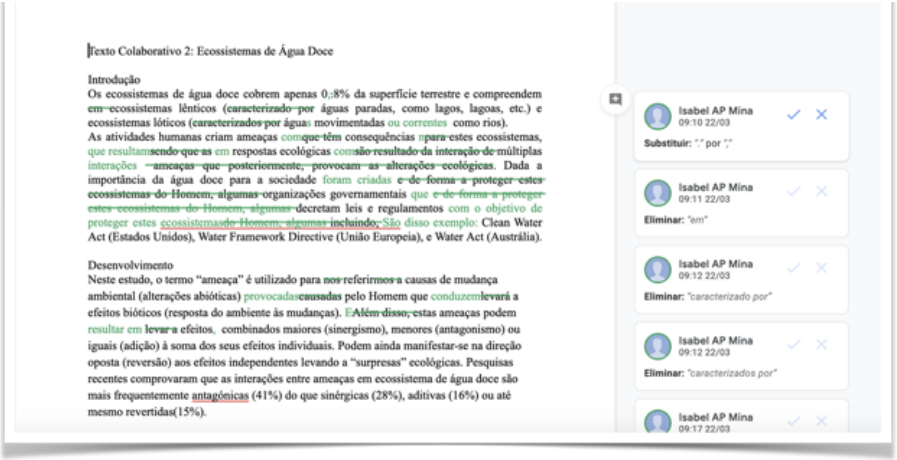


Figure 2. Example of a mind map

Increasingly popular in the educational context, mind maps offer a world of possibilities, whether they are produced in electronic or paper format. As an alternative to pen and paper, there are many free software programs for creating mind maps. The technique known as mind mapping was popularised by the English psychologist Tony Buzan in the 1970s [15]. It aims to optimise the organisation and memorisation of ideas by using a non-linear, tree-like, hierarchical visualisation of information. By functioning as both a representational tool and a metacognition tool [16], the mind map can help implement the planning operation [17] and thus contribute to the improvement of scriptural performance [18]. Each group created a mind map on their theme, using mind mapping tools such as Popplet (http://popplet.com/) or Coggle (https://coggle.it/). This initial stage of mind mapping assumes that each group researches and analyses data from multiple sources and subsequently organises these data into a mind map. The final mind maps were validated by the teacher, before being converted into a collaborative text and into an animated video, and were published on the disciplines virtual walls.

While ECUM students created collaborative texts (see Figure 3) of the seven selected themes (covering all UC contents), using collaborative writing tools, such as Google Docs (https://www.google.com/docs), Frampad (https://framapad.org/abc/en/) and Meeting Worlds (http://meetingwords.com/), ELACH students focused on a single theme to put into practice the corpus compilation methodology (comparable and parallel), the automatic terminology extraction, and the creation of bilingual glossaries (PT-EN and EN-PT).


Texto Colaborativo 2: Ecossistemas de Água Doce

Introdução

Os ecossistemas de água doce cobrem apenas 0,8% da superfície terrestre e compreendem em ecossistemas lênticos (caracterizado por águas paradas, como lagos, lagoas, etc.) e ecossistemas lóticos (caracterizados por águas movimentadas ou correntes como rios).
As atividades humanas criam ameaças com que têm consequências para estes ecossistemas, que resultam sendo que as em respostas ecológicas com são resultado da interação de múltiplas interações ameaças que posteriormente, provocam as alterações ecológicas. Dada a importância da água doce para a sociedade foram criadas e de forma a proteger estes ecossistemas do Homem, algumas organizações governamentais que e de forma a proteger estes ecossistemas do Homem, algumas decretam leis e regulamentos com o objetivo de proteger estes ecossistemas do Homem, algumas incluindo, São disso exemplo: Clean Water Act (Estados Unidos), Water Framework Directive (União Europeia), e Water Act (Austrália).

Desenvolvimento

Neste estudo, o termo "ameaça" é utilizado para nos referirmos a causas de mudança ambiental (alterações abióticas) provocadas causadas pelo Homem que conduzem levará a efeitos bióticos (resposta do ambiente às mudanças). E Além disso, estas ameaças podem resultar em levar a efeitos, combinados maiores (sinergismo), menores (antagonismo) ou iguais (adição) à soma dos seus efeitos individuais. Podem ainda manifestar-se na direção oposta (reversão) aos efeitos independentes levando a "surpresas" ecológicas. Pesquisas recentes comprovaram que as interações entre ameaças em ecossistema de água doce são mais frequentemente antagónicas (41%) do que sinérgicas (28%), aditivas (16%) ou até mesmo revertidas(15%).

Isabel AP Mina 09:10 22/03
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Figure 3. Example of a Collaborative Text

In the fourth and final step of this methodology, students from both disciplines worked together to create a storyboard from the collaborative texts that served as the basis for a digital narrative using an animated video format (see Figure 4). To create the digital narrative students used digital tools, such as Videoscribe (https://www.videoscribe.co/en/), Biteable (https://biteable.com/) and 123apps (https://123apps.com/pt/). This type of web based applications are used to create animated content that combines textual, visual (e.g. graphics, maps, illustrations, etc.) and sound (e.g. music, voiceover) elements. The creation of digital narratives was supervised by the teachers of both disciplines. At the end of the course, ECUM and ELACH students jointly presented the digital narrative in the ELACH auditorium. This presentation provided an important space to practise science communication in a multimodal context, with the aim of popularising scientific knowledge. Real-time feedback applications such as Mentimenter (https://www.mentimeter.com/) and Poll Everywhere (https://www.polleverywhere.com/) were used in order to give students the opportunity to offer constructive feedback to their peers on their science communication skills.

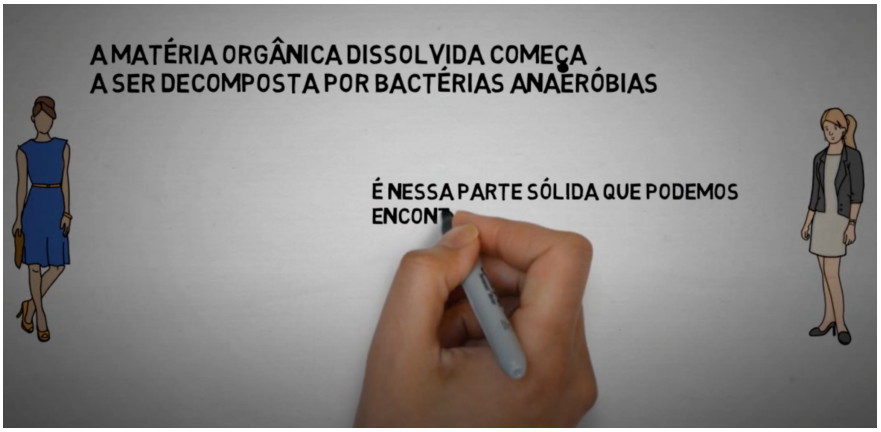

Figure 4. Example of a Digital Narrative (https://drive.google.com/file/d/1C_YIuDwAi5IFomNRH3gdWCrfQQQ9OOtB/view)

According to formal requirements of the Courses Committees and Pedagogical Council of ECUM, the final grade of bPad students must include an individual assessment. A formative test based on bPad student's quizzes was applied. This formative test was initially carried out individually, and after being handed over to the teacher, the students joined their teammates to do it together. Considering the value given to teamwork, the final score of each student test considered 75% of the individual test and 25% of the test performed as a team. The final grade of bPad students included 40% of the grade obtained in the formative teste, and 60% of the evaluation of multimodal activities carried out in teams [mental maps and collaborative texts (50%) and digital narratives (50%)]. The Corpus Linguistics Course adopted a continuous assessment, based on weekly tasks (40%), the elaboration of a reflective e-portfolio (40%) and its respective oral presentation (20%). This experience has shown that it is possible to apply the methodology in an interdisciplinary way, without losing sight of the specificity of the skills to be developed in the students in the subject areas involved.

3 RESULTS

Students from both disciplines filled out a feedback questionnaire about their satisfaction with this multimodal science communication methodology.

Virtually all students found that using various media (e.g. mind maps, collaborative texts, and digital narratives) was more or as interesting than doing a descriptive assignment. 86% of the students considered that the methodology helped them understand the most important aspects of the subject studied. 95.3% of the students answered that the methodology helped to structure the presentation of a subject studied, by highlighting the really important aspects. 93% of students found it helpful to share the various results of the assignment on a virtual wall (e.g. Padlet), with all classmates having access to the results of the assignment.

Regarding the development of skills gained by doing an assignment involving various media (mind map, collaborative text, digital narrative), students gave a score of 4 and upwards (on a scale of 0-5) for the development of digital literacy (67.4% of the time), synthesis skills (83.7% of the time),

organisation skills (83% of the time), multimodal communication (86% of the time) and teamwork (79% of the time).

4 CONCLUSIONS

The evidence collected suggests a very positive perception of the students regarding the use of the methodology. The experience and success in implementing the methodology reinforces the evidence of the potential of mind maps and virtual walls as a tool at the service of a pedagogy that promotes self-regulated learning in a collaborative work dynamic. The creation of these collaborative learning scenarios appears, in fact, as a space in which the active role of the student is fundamental, using effective metacognitive strategies in the various activities developed. By proposing the exploration of technological tools to implement active learning methodologies for more and better co-construction and communication of knowledge, the experiment also contributed to the development of digital literacy skills of the teachers involved.

The data collected indicates that the students also acquired a series of transversal skills: proficiency in handling technological tools to support and promote individual and collective learning; skills in searching online resources, respecting the rules of copyright and intellectual property rights; personal and social skills (through the promotion of critical thinking and collaborative work (face-to-face or online); written, oral and multimodal communication skills that will be very useful in a professional/business context. Finally, the students also developed their skills as future science communicators, better able to navigate digital and multimodal communicative environments.

The results so far (degree of motivation and satisfaction with the functioning of the classes, perception of classes, perception of usefulness, type of skills acquired, etc.) seem to indicate that the implemented methodology is a useful tool for learning, capable of being replicated or adapted not only within other Course Units of University of Minho but also in other institutions of Higher Education.

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