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# Open Education Platform on Complex Thinking: Users' Satisfaction Analysis

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**Abstract.** Open Education holds great potential to revolutionise learning access, resources availability and content quality. The OpenEDR4C is a digital platform open for everyone to the development of Complex Thinking Competence through Scientific, Technological and Social Entrepreneurship content and open educational resources. During its implementation phase, from March to April, 2024, we reached more than 600 users across six countries, aiming to validate the platform's features and the content of the courses. To assess the users' satisfaction about the platform functionalities a survey was conducted right after the educational experiment. This study presents the analysis of such responses shedding light on the first stamp on the users' satisfaction that will be applied to the creation of a user-experience instrument. This tool will be crucial in the subsequent transfer phase, where the platform will be introduced to educational institutions and training centres. From this study, we found that (a) there is no potential bias caused by the types of questions in the survey, (b) the platforms' content relevance and quality was validated, and (c) the interactive elements as learning experience enhancers. The results of this study not only validate the effectiveness of the OpenEDR4C platform, but also pave the way for its future enhancement and wider application.

**Keywords:** Open Education, Complex Thinking, eLearning, Higher Education, Educational Innovation.

## 1 Introduction

The Open Education movement has transformed in several ways, the access, the availability, and the quality of educational content. Traditional barriers to education [1] can be erased through more flexible, diverse, and high-quality educational opportunities, which are largely powered by digital ecosystems [2]. The OpenEDR4C platform is an open educational resource designed to develop Complex Thinking competence through content focused on Scientific, Technological, and Social

Entrepreneurship. It leverages open educational resources to provide a comprehensive learning experience that is accessible to everyone [3] and its content is curated to appeal to the different contexts of participants, in which the educational experience can occur. The validation of this platform sets the opportunity for identifying the best practices to design educational platforms as open resources.

This document reports the implementation phase of the OpenEDR4C platform that took place from February to May 2024. The first section describes the theoretical framework of the platform development. The Method section explains the implementation conditions, the sample characteristics and the description of the applied survey. Then, the study results present an analysis of the responses, providing valuable insights into users' initial experiences with the platform. These findings will feed the decisions towards the creation of a user-experience instrument, which will be essential during the subsequent transfer phase in which the platform will be introduced to educational institutions and training centres, aiming for broader adoption and impact. The discussion section focuses on three main aspects: (a) the users feedback and potential bias caused by the types of questions in the survey, (b) the content relevance and quality, and (c) the experience enhancing elements. Finally, the conclusions express the platform value and potential to be adopted by the participants' communities, while detailing the limitations of this study and future work.

By demonstrating the participants' initial perception and satisfaction, the identification of areas for improvement and suitable adaptations for the functionalities and content, this study lays the groundwork for further development and integration of the OpenEDR4C platform into diverse educational settings. Our findings underscore the potential of Open Education to transform learning experiences and highlight the importance of user feedback in refining educational technologies.

### 1.1 Open Education

Open education is positioned with educational pathways that promote free access to knowledge and collaborative participation, breaking down traditional barriers to learning. Open education refers to a movement of opening up knowledge and processes with practices, resources, technologies, assessment, accreditation, learning and strategies that enable the construction and dispersion of knowledge [4,5]. The open learner is increasingly engaged and flexibilized, controlled and shaped, communalized and accountable, and finally enabled and empowered [6]. The open education educator must ensure digital inclusion and diversity as key aspects to consider in open practices and platforms [7,8]. By adopting open education, a culture of accessible learning is fostered, mediated by platforms that can share knowledge and accessible resources.

In the context of open education, open platforms emerge as key catalysts for democratising access to knowledge, making high-quality educational resources available to a global audience without economic or geographical barriers. An open platform can promote debate between different actors and bring together knowledge, multidisciplinary experiences and educational resources, following the principles of open science [9]. In these platforms, the design of the interface and the actual study of the interface on users should be studied in depth to identify the potentialities in open education [10]. Effective collaboration in open educational contexts requires well-

planned processes and platforms that support collaboration, particularly in physically distributed environments [11]. It also requires integrating both the educational [12] and business communities through challenges to be solved [13]. This business-university linkage can provide thematic, social and digital enrichment for all actors involved [14]. The advancement and adoption of open platforms in open education not only amplifies inclusive learning opportunities, but also fosters a culture of collaboration and co-creation of knowledge, essential for promoting digital learning in elearning environments.

## 1.2 eLearning

Universities have incorporated learning platforms within their digital transformation initiatives. [15] consider the learning management system (LMS) to be a crucial and widely used platform for online teaching and learning. An advantage of using the LMS is the ability to collect data on student activity, which allows for the creation of student categories based on their online profile interaction [16]. However, this can only be achieved if a learner-centred design is implemented with the objective of facilitating learning [17]. An LMS offers the benefit of consolidating the learning environment, enabling the organisation of content in a manner that facilitates the assessment of students' skill progression.

Virtual learning is currently a widely popular trend. However, the abundance of information can cause young users to struggle with maintaining attention on completing a specific learning unit [18]. Furthermore, the advancement in the distribution of knowledge has led to a transformation in students' cognition, requirements, and approaches, presenting both prospects for growth and obstacles for higher education [19]. Authors [20] have identified a relationship between the user's perception of e-learning and the quality of the system, service, and teaching. [21] recommends focusing on ensuring that the infrastructure is adequate to deliver high-quality connectivity and responsiveness in the learning system. In order to enhance learner satisfaction, it is important to take into account many factors while considering the use of technologies for learning.

Communication and interaction of the system with the end user are key elements of any Information Systems (IS). Authors [22] point out that the process of identifying the factors that influence the effectiveness of IS consists of two important steps: 1) including interactive elements that enhance success, and 2) using validated instruments to measure the system's success. [23] identifies the pedagogical technique, specifically highlighting the crucial problem that must be taken into account while implementing multimedia in LMS. In their study, [24] found that incorporating support chatbots and intelligent content recommendations into scenarios with enablers in an intelligent artificial (IA) setting greatly enhances educational outcomes. Adding components to Education 4.0 such as IA, robots, augmented reality, among others [25] allowed an effective digital transition in virtual learning towards the future. It is thereby imperative to integrate key elements such as educational interactive components, and Industry 4.0 technologies

### 1.3 User Satisfaction

User experience (UX) is essential for driving engagement, promoting adoption, fostering advocacy, building trust, and driving continuous improvement in open education initiatives. By prioritising user satisfaction, open education stakeholders can create more meaningful and impactful learning experiences for users around the world [26]. UX plays a crucial role in the success and sustainability of open education initiatives at different levels.

High levels of user satisfaction can drive greater engagement and adoption of open educational resources (OER) and practices across resources or educational platforms. When users find OER to be valuable, relevant, and “user-friendly”, they are more likely to incorporate them into their teaching and learning activities. [27]. When discussing user interaction and UX, “feedback loops” can be used as a mechanism for continuous improvement [28]. User satisfaction serves as a valuable feedback mechanism for improving the quality and effectiveness of OER. Gathering feedback from users, educators and content creators can help identify strengths, weaknesses, and areas for improvement, leading to iterative development of OER content and relevant delivery methods [29]. Additionally, prioritising user satisfaction encourages a culture of continuous improvement within open education initiatives [30]. By listening to user feedback, addressing user needs and preferences, and striving to exceed user expectations, open education providers can enhance the overall UX and achieve greater impact.

Users with a positive OER experience and high levels of satisfaction are more likely to promote and advocate for open education within their networks and communities [31]. Positive word-of-mouth recommendations can help raise awareness, increase adoption, and attract new users to education initiatives [32]. Furthermore, UX and satisfaction contribute to user retention and loyalty within open education platforms and communities [33]. Consequently, satisfied users are more likely to continue using OER, participating in online courses, and engaging with open education communities over the long term [34]. Additionally, high levels of user satisfaction build trust and credibility in open education initiatives and institutions. When users have positive experiences with OER and open educational practices, they are more likely to trust the quality and reliability of the content and the integrity of the organisations behind them [35]. Therefore, it is important to have a dedicated tool to evaluate user satisfaction and UX in open education to enable systematic evaluation, standardised metrics, actionable insights, data-driven decision-making, user-centred design, continuous improvement, and accountability and transparency. This with the final aim to support the ongoing development and enhancement of open education initiatives to better meet the needs of learners and educators.

## 2 Method

### Data Acquisition and Preparation

This study employed responses from the "Evaluación de satisfacción OPENed 030624" survey, compiled into an Excel database and imported into Python using pandas. The dataset contains a series of questions concerning user satisfaction, encompassing ease

of tasks, satisfaction levels, and perceived effectiveness, which are central to our analysis.

### **Polarity Scoring System**

To facilitate quantitative analysis, we established a polarity scoring system, converting qualitative survey responses into quantitative scores. Each response across seven key questions was mapped to a numerical value reflecting its sentiment. For example, levels of satisfaction were scored from -1 (Very unsatisfied) to +1 (Satisfied), allowing for numerical assessment of subjective data.

#### **Statistical Analysis**

#### **Two separate statistical tests were applied:**

1. T-Test: Independent two-sample t-tests with unequal variances were performed to evaluate mean differences in polarity scores between genders for each question. This method is appropriate when variances between groups are not assumed to be equal, providing an assessment of whether observed.
2. ANOVA: One-way ANOVA was used to compare mean polarity scores across multiple educational levels. This analysis was performed for each question to ascertain if variations in educational background significantly influenced the responses.

For both analyses, polarity scores were first computed for each survey question based on our predefined mappings. We then grouped the data by gender and educational levels, respectively, and calculated t-statistics and F-statistics along with their corresponding p-values. The entire analysis workflow, from data preprocessing to statistical testing and visualisation, was scripted in Python.

## **2.1 Implementation**

From February to May, 2024, an implementation phase was conducted in which the research team introduced the platform's content and functionalities to communities from diverse institutions and organisations within the Spanish-speaking world. The aim was to validate the platform's relevance and potential to scale the complex thinking competence among the participants in the three introductory level courses: Scientific, Technological and Social Entrepreneurship. The target audience included higher education students and lifelong learners, leading to presentations of the platform and courses to diverse groups, including students, teachers, administrators, and activists. The study sample comprised participants from 17 institutions across six countries: Mexico, Bolivia, Peru, Guatemala, El Salvador, and Spain. Every implementation was supported by a facilitator, a research team member who guided the pathways to follow and set specific goals for each workshop and asked to complete the feedback survey by the end of a two or three hour workshop. From those experiences 622 responses were collected from participants (Fig. 1) expressing how the platform allowed them to navigate across the content and the elements that played relevant roles in their overall experience.



**Fig. 1** Implementation with students of Universidad Católica Boliviana “San Pablo”, La Paz, Bolivia.

The average age of the respondents is 27.54 years old, and their mother tongue is Spanish. All were all involved with education institutions, or educational processes for the non-profit organisations. Most respondents were either studying their pregrad or have at least a bachelor degree, the fewer have doctorate and other or non degree achieved. Their level of expertise with digital platforms varies: as we could retrieve, only one third of the sample had four or more years interacting with educational platforms. Additionally, information was collected also in a qualitative manner through videos and focus groups to evaluate the perception of the convenience of using the platform in a regular way, although those results are not reported in this document.

## 2.2 Instrument

The following questions were used to measure user satisfaction with the platform, assessing various dimensions of user experience including value, usability, usefulness, desirability, credibility, and technical feedback. The goal was to gather comprehensive feedback to enhance the platform's effectiveness and user engagement.

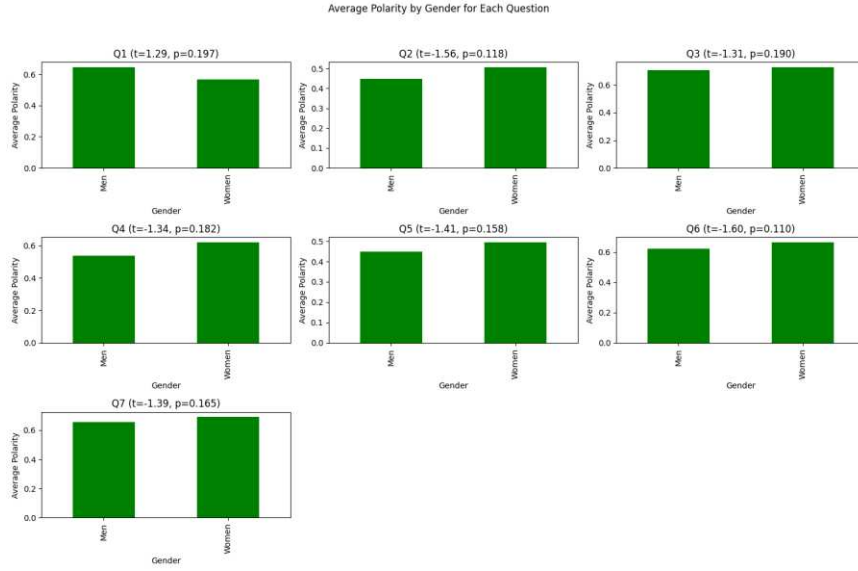
**Table 1.** User satisfaction survey

| Dimension    | Category     | Item               |
|--------------|--------------|--------------------|
| User profile | Demographics | Gender             |
|              |              | Age                |
|              |              | Nationality        |
|              |              | Level of education |

|              |                      |                                                                                                                     |
|--------------|----------------------|---------------------------------------------------------------------------------------------------------------------|
|              | Experience           | Years of experience using learning platforms                                                                        |
| Value        | Overall experience   | Q1. How would you rate your overall experience with our platform?                                                   |
| Usability    | Usability            | Q2. How easy was it to navigate and explore the content?                                                            |
| Usefulness   | Content quality      | Q3. Did the platform's content help you improve your understanding of entrepreneurship?                             |
|              | Content quality      | Q4. In terms of educational content, how would you rate the quality of the platform's content?                      |
| Desirability | Interactivity        | Q5. How would you evaluate the interactivity of the platform?                                                       |
| Interest     | Engagement           | Q6. How much did your interest in continuing to learn about entrepreneurship through our platform increase?         |
| Support      | Security and privacy | Q7. How secure and private do you perceive the platform to be in ensuring that your data and privacy are protected? |

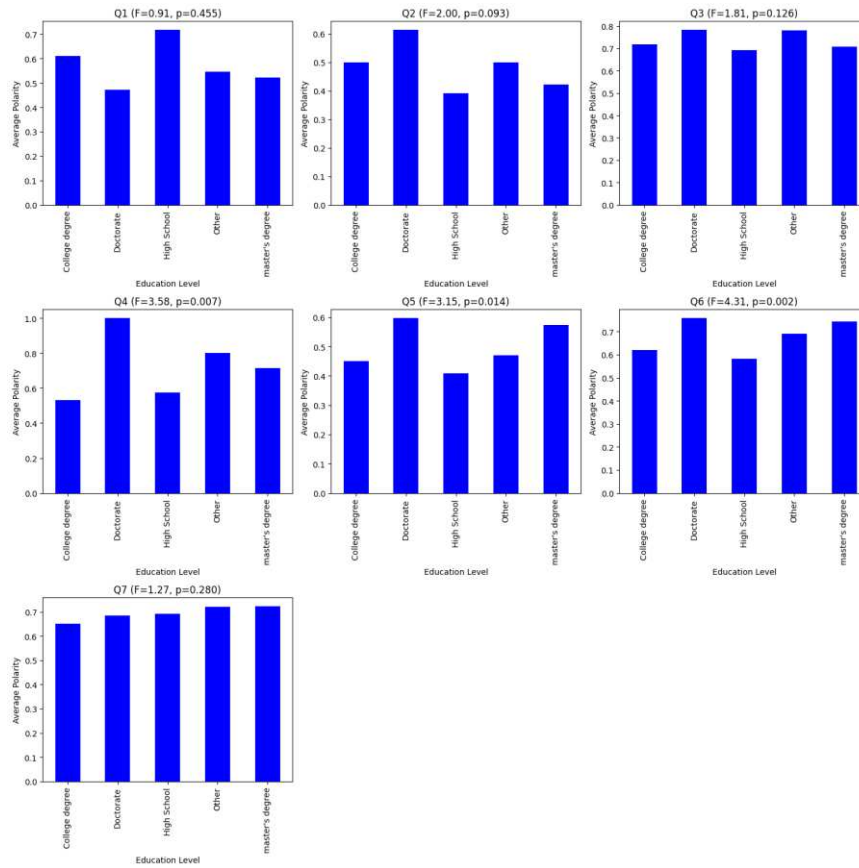
### Results

The t-test results from the survey data comparing responses between men and women across seven questions as shown in Fig. 2. As it can be observed, for all questions (Q1 to Q7), there were no statistically significant differences in polarity scores between genders, as all p-values were above the commonly used threshold of 0.05. A positive t-statistic for Q1 indicated that men responded slightly more positively than women, but this difference was not statistically significant. Negative t-statistics for Q2 through Q7 suggested that women generally responded more positively than men; however, these differences also lacked statistical significance.



**Fig. 2.** Average comparisons of Polarity by Gender for Q1-Q7 with t-test.

In summary, while there were some observable differences in the responses between men and women, none of these differences reached statistical significance, implying that there is no strong evidence to suggest that gender influences responses in this dataset.



**Fig. 3.** Average comparisons of Polarity by Education level for Q1-Q7 with ANOVA

One-way ANOVA was used to analyse responses to seven survey questions by educational level (Fig. 3). The study found No significant differences in overall experience, ease of navigation, and understanding of entrepreneurship content across educational levels (Q1, Q2, Q3, Q5 and Q7) indicating that the platform (and these questions) provided a consistent experience and effectiveness in content delivery for all these users regardless of their educational level. In this sense, it is worth noting that there were significant variations in perceptions of Educational content (Q4) and the increased interest in continuing to learn entrepreneurship (Q6) as well as engagement and interest in continued learning.

### 3 Discussion

There was no significant difference in terms of gender towards the perception of the evaluated platform, it was positively evaluated. Fig. 2 shows that the responses were positive in general, there was no significant difference in the perception of the

participants according to the platform's value, usability, usefulness, desirability, interest, and support. As in [24], although gender was taken into account in the data analysis, there was no relevant difference in the data. The gender perspective is not a relevant factor at least in the analysis methodology for this platform; therefore these items can be used in the future validation instrument without any concern of a possible bias in relation with the participant's gender.

Additionally, we observed there was a perceived acceptance of the use of this platform by the participants. Fig. 3 shows a very positive evaluation, mainly by those students in higher education. In [19], the relevance of the use of networks or web-based information management, combined with student interaction, which characterises this proposal, is mentioned. The opinion of the overall experience of the platform was the most favoured aspect, meaning an appropriation of the educational resource.

Furthermore, from the analysis we can conclude that the educational platform is relevant for meaningful learning of the participants. Although it is not perfect, it shows an adequate scaffolding for it. The combination of answers in questions Q3, Q6, and Q7 in Figure 3 gives the highest scores with no difference in the participants' schooling. In contrast to [14], the perception of the participants is that there is a benefit in general and not only in business applications or domains. Interactive, disruptive platforms based on motivational technologies are the right digital scenario to motivate self-directed learning in open educational settings.

Interactivity in educational platforms is a gateway to learner motivation and participation. Although the interactivity elements evaluated were not negative, they were a less important aspect than the average of the other components, as shown in Figure 3. Complementing previous findings on inclusive education or institutional requirements as in [7], interactivity largely marks the positive experience of users. The emerging use of media such as chatbots, artificial intelligence entities, and personalised learning in general, among others, will be the natural and/or most influential means to determine whether a platform is interactive and the motivation towards it.

## 4 Conclusions

The presented platform shows significant potential for future use. Figs. 2 and 3, give us enough information to establish at least a building principle around it. Complex thinking as a desired competence in the participants and a mega competence to be developed, marks the right scenario in different higher education contexts and can be adequately exploited. The performed analysis allowed us to confirm that there is no potential bias caused by the types of questions in the survey, or the characteristics of the participants. Also it was confirmed that the content relevance and quality of the open educational resources was positively perceived by the participants with no significant influence on their level of education. Finally we observed that experience enhancing elements were perceived as relevant in the overall evaluation.

The findings highlight the necessity of considering educational diversity in the design and enhancement of educational platforms to ensure tailored content quality and interactivity that meet varying expectations, while maintaining high standards of usability and security for all users. These considerations will be the basis for the

inclusion of the relevant aspects in the validation tool that will be put together to be a permanent part of the platform for its continuous improvement process.

A limitation of this study is that we conducted the surveys outside the platform, which caused us to miss many of the potential responses by participants. The satisfaction survey was applied as an exploration method, the following step is building a proper evaluation instrument and to validate it according to usability and user experience standards. Complex thinking for open education is an achievable goal, at least in the analysis of this paper, although future work is needed to reach this goal through the OpenEdR4C platform. This study is another step in that direction.

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