Example selection and Application example of the proposed process

Example selection

To identify the relevance and viability of the proposed process, the described process of the systematic mapping of the literature carried out by Connolly et al. in [1] was used, and was complemented with the proposed process. The objective was to integrate the proposed process, identify if there were similar works and as a differentiating factor to verify if it was possible to find more related articles from the snowballing strategy applied semi-automatically. For this, the following characteristics, from Connolly et al. [1], were replicated: (i) the study area is related to Computer Games and Serious Games, (ii) its purpose is to identify the possible positive impacts of games on users 14 years of age or older, especially, with regard to learning, skills improvement and commitment, and (iii); as a result of the process, 129 works were found, to which more specific filters were applied to finally have a reduced list of 70 primary works that report empirical evidence on the impacts and outcomes of computer games and serious games related to learning and engagement, in addition, a multidimensional approach was developed to classify games.

Given this context, for the purposes of the analysis of this proposal, the information available in Connolly et al. in [1] was used, in order to be able to replicate the SMS and make the comparison of the results obtained. In this sense, our process began with a review of the proposed research question, the analysis criteria, the strategy, the search procedure and the study selection process (with its inclusion and exclusion criteria), as well as the process of extraction and synthesis of works. Next, the application of the semi-automatic literature mapping process guided by the Snowballing strategy is described in detail, using the work of Connolly et al. in [1].

Application example of the proposed process

When executing a research protocol for systematic literature studies in EBSE, it is suggested to have a research question, in the present project the same question presented in Connolly et al. in [1] is adopted, which is: What empirical evidence is

there on the positive impacts and outcomes of computer games? In https://bit.ly/3uNUpRR is presented the steps of the proposed process. Next, its Operationalization is shown:

Step 1 - Build the search string: For the definition of the string, the OR connector was used to relate the synonyms and alternative terms, and the AND connector to combine the keywords. Only English terms were used. In https://bit.ly/3LCKrcC is presented the keywords that are critical to the search string. According to Connolly et al. in [1], the search string used included terms for games (Part a) in conjunction with terms for possible outcomes, impact and effects for the use of games (Part b). This last part was derived from the considerations of the terms used for the specific impacts and results, such as: learning, profile, commitments, motivational attitudes, emotion and behavior.

Step 2 - Execute the search string: The work search process was executed in Google Scholar to obtain the first results, however, it was limited to a certain number of characters, therefore, the string had to be separated into three parts as shown in https://bit.ly/3qWH8VP. It is also possible to see the result of applying the string with or without date restrictions.

Step 3 - Store the most cited works: As previously described, the main element of the proposal is based on the number of citations that examines or measures the frequency with which a work is referenced, this information is provided by Google Scholar. In this sense, after obtaining the results of the application of the search string and given the number of works, the most cited works were selected and stored. For this activity, the reference management tool Zotero was used, which allows users to collect, organize, cite and share works and their respective references. In https://bit.ly/3K4tbwF is shown the user interface with the management of the works of the application example of the proposed process..

In https://bit.ly/3DAG13h is presented in detail the title of the work, origin or digital library where it is located, year and number of citations, the latter is the value that interests most in the proposed process, since it allows identifying the works that could be selected or discarded according to the inclusion and exclusion criteria. The works of Connolly et al. in [1] were also stored in the Zotero folders, with the aim of

being able to identify the citations and make a subsequent comparison. It was also important to use the ascending and descending sort option provided by the tool. Likewise, Zotero allowed the selected works to be exported in folders, this in order to classify them and then treat them as a whole and thus eliminate the repeated ones and organize them by the most cited ones through spreadsheets in the following link, the consolidated files are left with the information that was managed at each stage https://n9.cl/wvk7b.

Step 4 - Identify the works that cited the works selected from step 3: In this step, Google Scholar was returned to find which authors were citing the works from step 3 (more information at: https://n9.cl/6ynnr), which allowed to obtain 54 lists in HTML format. After obtaining these files, they received a similar treatment: the lists were joined and the repeated ones were eliminated (more information at: https://n9.cl/j15o, partial sample).

Step 5 - Unify all the works in order to eliminate those that were duplicated: the 54 files from the previous step were compiled into a spreadsheet to obtain a single list. A filter was created to identify the occurrences of the names and to order them by the largest number (more information at: https://n9.cl/xc3mv).

Step 6 - Execute the search string without date restriction: The first step was executed again, but in this case without date restriction, from there the 60 most cited works were selected that were also stored in Zotero (see https://bit.ly/3Kejeg4).

Step 7 - Store the works from step 6: In this step, the first 20 works with the highest number of citations were chosen (more information at: https://n9.cl/xc3mv).

Step 8 - Join the works obtained in step 5 and step 7, and eliminate the repeated ones: Up to here there were three lists that were unified and duplicate occurrences of names that were eliminated were identified, with that the list of the most cited works of the entire process was obtained (more information at: https://n9.cl/d3t70).

Step 9 - Analyze the results: After executing the steps of the proposed process, a total of 112 works were obtained, all of them with a number of important citations. The first thing that was done was to compare this result with the Coded Papers (as the results of the execution of the protocol are called) of Connolly et al. in [1], to find if they had similar jobs. From this comparison, it was identified that of the last list

obtained with our proposed process, only one work coincided with the Coded Papers (see https://bit.ly/3DvwqLh). This table also shows the number of citations of such work at the time of executing the query. Second, in the lists of the previous steps, 3 similar works were also found, which are listed in part b (see https://bit.ly/3wXSoFu). These works are shown by being present in both proposals and by having a significant number of citations. This result (112 works) allows to track citations and give visibility in the first instance to works that under a traditional mapping process were not considered.

It should be noted that the Coded Papers (129 in total) met the inclusion criteria, they were coded using a data extraction form that the researchers developed in previous works, this allowed them to classify the works, their results and impacts in several dimensions, that classification was used to apply other quality criteria to the works that will be detailed later. It is important to note that for Connolly et al. in [1] the number of citations was not an inclusion or exclusion criterion for the execution of the SMS, and that the works presented in https://bit.ly/3wXSoFucoincide in both works since they had a considerable number of citations.