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Learning Indicator Capitalization: Protocol for Needs Gathering and User-Centered Design

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Abstract—We presented in this paper a protocol for users’ needs gathering in order to study the strategies when they interact with data indicators. As we aim at proposing a design approach allowing the data indicators to be capitalized, we need to encourage the involvement of users in the design process. Their actions can be diverse, including appropriating, reusing, sharing, and adapting data indicators. This led us to set up focus groups including heterogeneous and non-expert users in these complex activities. The protocol, based on a gamification methodology, allows us to initiate a user-centered design approach for our proposal. The collected verbatim will then be analyzed to extract different expressions of the users’ needs for data indicators, as well as their needs in terms of interaction with the latter. The first iterations of the protocol have enabled us to establish our research directions and put our research effort in perspective.

Index Terms—learning analytics, data indicator, capitalization, user-centered design, need gathering

I. INTRODUCTION

The development of TEL (Technology Enhanced Learning) systems in recent years has deeply changed the educational world [9]. The questions of ethics and usability of computer tools have become central. Learning Analytics (LA) and its associated notions including learning traces and data indicators that are still partially understood by the majority of users of these TEL systems [10]. The research effort presented in this paper is part of the *écri+* project, which aims at promoting students’ success in the university via a platform built to improve their French writing skills. Data indicators are here meaningful variable, related to the process and quality of learning in a TEL system [5]. It is an effective way for both teachers and students to take full possession of this digital dimension of learning [1]. Nonetheless, their design process is time-consuming and resources-intensive, from both technical and human standpoint, whilst also strongly correlated to their context [13]. The difficulty to identify the observation needs from various users and then for them to extract the information they need, can be a deterrent [12]. A feeling of inadequacy of the proposed indicators in relation to the requirements of the end users is therefore commonly noticed [10]. Such complexity partly hinders the dissemination of data indicators

in pedagogical practices [2]. Despite the ease of access to indicators and their personalization, their comprehension remains an obstacle to their adoption by users.

Our research work focuses on ensuring data indicators remain relevant, and their development be progressively done over time, in different contexts and by different users. For this purpose, we seek to develop an approach built upon the principles of data indicator capitalization, as the combination of four concepts for indicator design and use process. This allows the appropriation, reuse, sharing, and adaptation of data indicators while contributing to the improvement of user accessibility to TEL systems [8]. This approach places users at the center of the design process, as they are involved in each step of the data indicator’s life circle. Our intention to support the user’s action in this process led us to the design of a protocol dedicated to users’ needs gathering to gain a deeper understanding of the users’ interactions with data indicators. First, we develop the protocol for user need gathering using a focus group method. Then we expose the data analysis method used in our research scope and the first results we obtained.

II. PROTOCOL TO STUDY INDICATOR CAPITALIZATION

If data indicator can be considered as an object that users are creating and interacting with, the challenge is how complex of an object it is to handle, especially for either teachers or learners, who are not experts in data analysis. For that matter, a user-centered design will enable them to better express their needs [11]. It will also get them to embrace the capitalization approach in the longer term (beyond the design phase) [6], by placing the user as an actor in the design. To seek more involvement from non-expert users in a capitalization process, it is first necessary to explore the existing needs and practices. It is by taking into account the diversity of the user target that we organized a first series of focus groups to collect needs. This method of expression and confrontation of opinions allows for a pooling and a complementarity of individuals, which aligns with the four concepts of indicator capitalization mentioned previously.

However, gathering a need for data indicators is heavily limited by the participant’s knowledge of what is possible/existing. How can participants in a focus group reflect on potentially new concepts? Our objective in this protocol is

therefore to get them to collaboratively build data indicators in order to observe, not the result of this design, but the objects brought into play during capitalization actions on these indicators. What we mean by objects are both the interactions produced during the focus group and the concepts linked to the indicators handled by the participants.

We chose to put the participants through the complex task of needs gathering with the creation of a material base, to counterbalance the abstraction. We started by compiling a list of data indicators in relation to the *écri+* project and what have been studied in our literature review [4], [5], [7]. A transposition to our study context led to the selection of 18 indicators. These selected indicators were given names/titles deliberately open to interpretation to encourage discussions among the participants, while compensating for the diversity of technical and professional profiles. This list made it

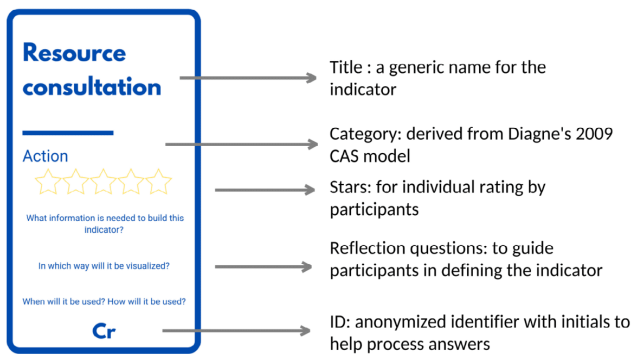


Fig. 1. Example of Indicator Cards

possible to create a set of “Indicator Cards” (see Fig. 1). Each indicator became a card that can be easily manipulated by the participants while discussing, criticizing and combining each proposal. [3]. The gamification (through cards) of the interaction with data indicators makes it possible to play down the complexity of the task.

The first step in the focus group is familiar with, and personally evaluate 5 indicators, which are distributed in the form of a card to each participant. The latter marks from 1 to 5 stars, “Do I want to have this indicator in my learning environment?”. The participant can then interpret each proposed indicator, what it implies, what it brings him, or what it contains. The participants are also invited to think about the visual representation of the indicator. This is followed by a pooling of ideas, with each participant presenting an indicator and its interpretation to the group. This step of expression and confrontation of interpretations between the 3 to 4 participants significantly nourished the exchanges. Once the different data indicators have been analyzed and compared, participants choose one to proceed with its (de)construction. In fact, they are asked to create the “recipe” for the indicator, with the creation of its design process. To facilitate this activity, it is preceded by a game-like situation in which participants co-designed a real cooking recipe using colored post-its and markers. Participants can then base their creation process on this example.

As part of the first iterations of the focus group, we prepared a satisfaction survey, which was completed freely by the participants from the experiment that lasted from 1.5 to 2 hours. It consists of 18 questions, 6 of which are free text and 12 rating scales from 1 to 5, and was completed 14 times out of the 25 participants in all focus groups. The experiment is still undergoing. This paper introduces the first results and illustrates the purposes of the study. All feedback is processed indistinctly of whether it was from teachers, students, or even educational engineers. The survey aimed to succinctly assess

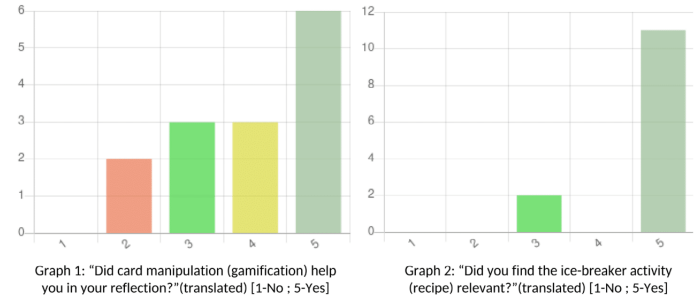


Fig. 2. Extracts from the satisfaction survey following the experiment the coherence of the process, the understanding of the concepts addressed and the satisfaction among the users. One of our concerns is the added value perceived by participants in the use of Indicator Cards, as well as the ice-breaker (see Fig. 2). The data from Figure 2 show a broad consensus on the use of a recipe as an analogy, whereas Indicator Cards were experienced differently depending on the participant, although their use was also validated. A majority of participants found the use of a focus group method relevant for the proposed activities, although some pointed out the possibility to complete it with individual interviews. The accessibility of the different objects handled by the participants is the main blocking point in the focus group process. Indeed, the complexity of the objects can discourage the process of capitalization that we try to gradually introduce. This objective is fully achieved by this first stage of participatory design, especially considered in the light of the difficulties encountered in previous interactions with similar participants. It should be pointed out that the objective is not only about understanding of the concepts by the participants, but their handling of complex objects in an autonomous and relevant way.

III. DATA COLLECTION ON CAPITALIZATION

We present here the nature of the collected data and how they are acquired during this experiment. We want to see how indicators’ appropriation can be translated into a quantitative value based on the frequency of its use, through Indicator Cards. First was extracted quantitative data on the indicators, during the evaluation and classification steps. An average of all scores per indicator is calculated. We mitigate statistical effects by collecting as much ranking data as possible in the limited number of experiments. Indicators are currently only evaluated 94 times and classified 27 times by 25 participants. However, trends are already emerging (see Tab. I), three indicator stand

out with scores above 5. First, the “List of students enrolled in a course”, reaches a significant degree of appropriation on the part of teachers specifically. The “*Activity complexity*” is a popular choice among students. And the “*Progression level*” is overall most often elected. Then in last position is the “*Productivity score*” particularly displeasing teachers, with the term “Productivity” not perceived positively among French teachers. A closer look at the profiles of the participants is therefore crucial in further exploration of these results. The

TABLE I
INDICATOR SCORES

ID	Indicator name	Total score
LDIC	List of students enrolled in a course	5.75
DA	Activity difficulty	5.20
NA	Progression level	5.00
CR	Resource consultation	4.25
TP	Participation rate	4.20
EET	Evolution of commitment over time	3.80
EPE	Student productivity evolution	3.83
TR	Success rate	3.71
TCM	Module completion rate	3.50
DS	Satisfaction level	3.50
TF	Attendance rate	3.00
DRA	Activity duration	3.00
PE	Student’s trajectory	3.00
TEM	Engagement rate per module	2.83
RD	Drop out risk	2.80
TC	Connection time	2.60
RT	Work rhythm	2.40
IP	Productivity score	1.40

major part of the collected data is verbatim transcribed during the focus group by an Observer, and from audio recording, all in the respect of GDPR. This data can be a direct answer but also a reaction or remark about an instruction. For instance, debates pointed out on many occasions the interconnection between the indicators showcased by each participant. The first iterations have validated the data collection intended by this protocol. In the current state of data collection, the outcomes presented here illustrate the general direction of our preliminary interpretations.

First of all, we want to identify the users’ needs and how the data indicators match, to develop a relevant model for both. For example, some users are at ease with traces as component of indicators and others prefer to remain in familiar territory with the manipulation of data and student activity ; some want to juggle between different scales for an individual, a group, then a whole school. The diversity and the complexity of the “data indicator” object led us not to propose a construction based on need or traces, but rather the (de)construction of the usefulness of the indicator and its constituent elements. Giving a tangible base of illustrated examples, combined with the possibility of giving dynamic feedback by re-specifying needs, allows us to envision a better specification of the collected/expressed needs. This interaction, which aims to facilitate the expression of the need, can then be considered in the form of a computer-based system.

We also seek to identify the needs for interaction with these indicators. The design process itself of the indicator does not need to be either functional or exhaustive. We

are looking to observe the strategies put in place by the participants to create an indicator and make it their own. They are considered here as the need for an interaction to be carried out to capitalize data indicators. These “expressed needs”, in accordance with the technical properties necessary for a data indicator capitalization tool, are listed and categorized in [8].

IV. CONCLUSION AND FURTHER WORK

We initiated a validation of the hypotheses we drew on the definition of capitalization as part of a response to the challenges of data indicators design costs and adoption. Users’ needs gathering is an essential phase in our global approach to ensure user adoption of our future design and implementation. Our main focus is the users’ interactions with a computer-based system, built to help them participate in the data indicator capitalization design and use. For that, more focus groups will be carried out and data analysis methods will be explored. The protocol we presented here points out the necessity of collecting users’ needs and understanding the way they are expressed. For instance, how and why one data indicator is chosen. Our future work will include further analysis on the collected data and a study on how, from a technical standpoint, we can accompany users throughout the data capitalization process (appropriation, reuse, sharing and adaptation of capitalized data indicators).

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