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iTeachApp, a teaching analytics tool for providing self-assessment and recommendations to teachers

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Abstract. In order to support teachers to engage themselves in a learning process to improve their techno-pedagogical skills, and to relieve instructional designers (IDs) of their workload, we have previously designed a behavioral computer model of teachers that allows their evaluation from a LMS mastery perspective, and paves the way to teaching analytics and recommendations. To instrument this model and provide teachers and IDs with a digital support that best meets their expectations, we present here the user-centered method we followed to (i) evaluate our model to their perceptions, (ii) determine consistent uses relative to their needs, and (iii) develop iTeachApp, an application that provides teachers with a personal analytics dashboard and automatic recommendations, and offer IDs institutional analytics, to detect specific profiles of teachers and get insights of common LMS behaviors at different scales.

Keywords: Teaching analytics · Academic analytics · Learning Management System · Teacher evaluation · User-centered approach · Behavioral model · Dashboard.

1 Introduction

Learning management systems (LMS) have been widely adopted by higher education institutions around the world for over a decade, with a considerable acceleration during the COVID period [8]. On the other hand, the number of LMS users was not growing as quickly as expected, although they were considered for a long time as a useful tool to facilitate teaching and learning activities [10]. Many teachers face several difficulties in integrating these platforms into their practices. Their main problems seem to be technical and organizational, due to the lack of support and the lack of time dedicated to its learning [5]. Furthermore, many universities hire instructional designers especially for helping teachers to develop, enhance and diversify their pedagogical designs as well as their skills in technology enhanced learning (TEL) tools. However, universities still struggle to carry out their missions with only few instructional designers (IDs) compared to the teacher population (e.g., there are 6 engineers for 630 teachers in our university). They also lack insight into teachers' competencies,

while teachers are not always aware about the features TEL systems such as an LMS offer.

In order to deal with these issues, we aim to support teachers' self-assessment of their own practice on a LMS for them to engage as learners of their TEL environment, and at the same time, to reduce the work pressure of the instructional designers. Hence, we have proposed in a previous work a behavioral model composed of six axes (evaluation, reflection, collaboration, resources, communication, interactivity and gamification), on top of which we have built several teaching analytics (TA) indicators to provide teachers with self and social awareness (usage trends, curiosity and homogeneity scores) [2].

In this paper, we expose the user-centered method we applied to instrument our model and its indicators within a TA application that we describe in detail as well. To reach these goals, we first examine (RQ1) how understandable our model was by teachers and what limitations we could detect with regard to their own perception of their LMS use. Secondly, we attempt to (RQ2) determine how teachers would be willing to engage in an activity of self-assessment and improvement of their LMS skills. In particular, we seek to determine what type of recommendation would best fit teachers' needs and practices (RQ2.1). Since our goal is not to provide an application that would completely substitute for instructional designers but a way to leverage teacher solicitation, we aim to find out (RQ2.2) whether teachers would be willing to help their peers and collaborate with IDs. Finally, we want to identify the kind of visualizations and functionalities that could be interesting for IDs in order to assist them in the decision-making process (RQ3).

2 Related work

Teacher evaluation has been defined by [1] as the achievements of teachers and what they need to develop or improve in their performance. However, there are few studies that focus on the evaluation of teachers' techno-pedagogical performances in LMS. We suggest then to provide teachers with sufficient material for self-evaluation and learning, a requirement that should be met before attempting to include such skills as part of any institutional evaluation.

To involve end-users in a research project, two types of approaches are commonly followed: a user-centered approach and a participatory approach. They both allow to capture the users' needs and thus to develop, in an iterative way, a quality tool that meets the users' expectations [3]. The user-centered design practice incorporates careful consideration of users' needs, desires, and their limitations throughout the design process, which allows for the assessment of both effectiveness and relevance of the tool [4]. For instance, [3] employed this approach to ensure an explicit understanding of user needs and contexts in order to develop a dynamic learning dashboard generator. On the other hand, participatory approaches belong to the user-centered approaches, but they advocate the active involvement of users, which means performing all the steps of a project in a collaborative and shared way so that the product meets users' needs

and is usable [9]. For example, [6] have developed a method for participative design of learning dashboards, which they call PADDLE (PArticipative Design of Dashboard for Learning in Education). In the context of our work, we aim at developing an application for teachers that does not require teacher involvement in all the design phases. Therefore, we have opted for a non-participative user-centered approach to instrument our behavioral model and its indicators.

3 Methodology

In order to instrument the model and its indicators within an application that would be more easily accepted by teachers and IDs, we elaborated an online questionnaire for teachers, and we also scheduled three interviews with the instructional designers of the university (IDs).

The questionnaire consists of four sections. The first section focuses on general questions to capture contextual factors that characterize the teacher (university site, gender, age, etc.). The second section aims to study teachers' satisfaction of LMS via the SUS questionnaire (system usability scale)¹. The third section is devoted to validating the range of features our model covers by letting teachers check that their practices could be described through our model. In the last section, we collect the teachers' needs and expectations so that we could anticipate and make possible modifications to our application before the experimentation.

Subsequently, we conducted three non-directive interviews with IDs to gather their feedback given their experience with teachers, in order to define and develop the support tool. We chose this type of interview to ensure that interviewees would be free to develop further hypotheses during the exchanges. During the first interview, we used the statistical results of the questionnaire addressed to teachers as a basis for discussion, together with a first prototype of the application. In the second and third interviews, we proposed a new prototype, taking into account the comments made beforehand.

4 Findings

Questionnaire : we received 76 responses from teachers. With respect to the use of the platform's features, most teachers (63 respondents strongly agree and 11 agree) frequently use the LMS resources. Assessment features are in second place with 20 respondents strongly agreeing and 30 agreeing. In third place, gamification, collaboration, feedback and communication features have similar but low usage compared to the first ones (respectively 4 teachers, 7 teachers, 11 teachers and 18 teachers who use them very frequently). On the other hand, some teachers mentioned using other features: (i) activity reports indicating the number of views for each activity and resource, as well as (ii) the use of "groups" functionality allowing a teacher to form groups of students within a course. With

¹ <https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html>

the exception of these two functionalities, we have not identified any use of the LMS that is not covered by our model. This model will therefore be enriched to integrate a student management dimension and complete the reflection axis with an activity reports functionality.

In the last section, 57 teachers expressed their wish to have a tool for peer recommendations or feedback on their use of the platform, and 14 teachers for self-assessment. We left the question opened to other proposals, so one teacher mentioned that they preferred trainings over several times, two other teachers proposed tutorials for certain functionalities or a guide of good practices and what they can do on the LMS. 7 teachers mentioned their unwillingness to get a tool complementary to the university's LMS, probably because they are satisfied with the platform, so they do not need help. Among teachers seeking help, we received 51 responses, both asking for help from IDs and from a close colleague. Finally, 65 teachers are willing to help their colleagues if they ask. Therefore, these responses assess the need to provide a support tool for teachers as a significant portion are interested in having one and many would like to be able to incorporate recommendations from close colleagues and instructional designers. **Interviews :** based on the results of this questionnaire, we developed prototype of our application that was presented during the first interview with IDs, and improved afterwards. The latter provided insights on the need to promote digital trust (e.g., identity protection, document protection) [7]. In our case, this trust implies the need to give the teacher the right to accept or refuse to be recommended to colleagues. On the other hand, they emphasized the importance of presenting teachers with the list of courses studied and the time interval of each course so that they are aware of the origin of their results. In addition, they suggested clarifying some of the terms so that they would be more understandable to teachers; for example, the regularity score becomes homogeneity score, and the subtitle “active” used to refer to the pattern of use of the LMS becomes “intensive use”. On the dashboard intended to the instructional designers, they were interested in having a filter by indicator (LMS usage trend, curiosity score and homogeneity score) to better identify teachers in need or those considered as experts by axis. Additionally, they indicated their desire to have a link to see each teacher’s dashboard (without having access to their profile page).

5 Application

After we made all the necessary modifications to our tool, we were able to develop a first version of the iTeachApp application, which is now ready to be experimented by teachers and IDs.

Once logged in, teachers can have an overview of their situation. Each axis (**A** in Fig. 1) is detailed in an accordion with a different background color: green for axes where the teacher has a high tendency to use the platform features represented by the axis in question (intensive use), and red color for the opposite case (non-intensive use). For each accordion, the two different curiosity and homogeneity scores are also included as well as a description of the axis and the

scores. On **B** in Fig. 1, we provide a radar visualization that summarizes both scores so that the teacher can have a comparative view of the different axes. This allows them to easily visualize the representation of their use of the institutional LMS and to position themselves on their wishes and preferences to improve their mastery. Axis and scores are provided with help message that allow the user to understand its overall signification through a simple vocabulary.

We have also proposed 3 recommender systems aiming at helping teachers to improve their practices in the university LMS. These latter, given for each axis, are shown on part **C**. In this specific case of the axis “Evaluation”, the expanded part of the accordion allows to visualize: (i) a set of unused features that might facilitate the teachers’ evaluation of their students, (ii) the “Contact an Instructional designer” button which opens an email box to directly contact the IDs with a pre-formatted email indicating the name of the axis and the scores obtained, and finally (iii) the “Solicit a close colleague” button opening a window that displays the top 3 most recommended colleagues who are close physically and thematically. For each teacher, an example of one of their courses selected as relevant for that specific axis is given with a description of the course. On a page devoted to the teacher’s profile, the latter can accept or refuse to be

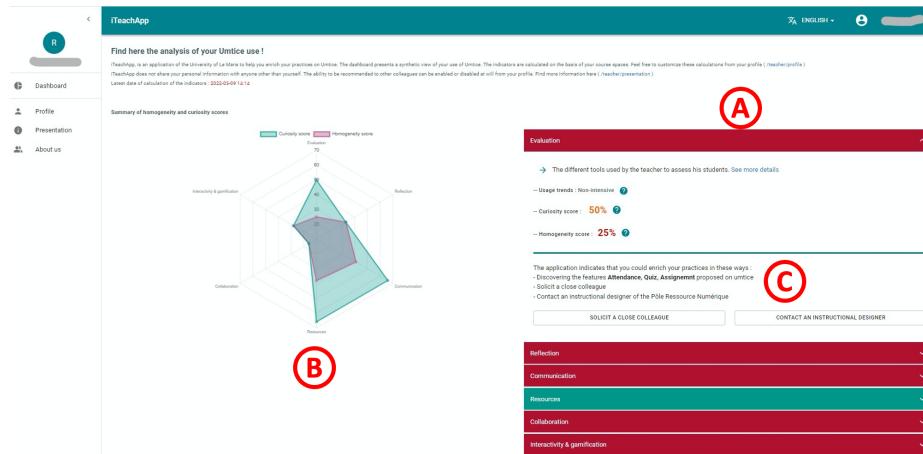


Fig. 1. Teacher’s dashboard.

recommended to their colleagues, choose the maximum number of recommendations per month in which they can appear, by default, each teacher can be recommended to a maximum of 3 colleagues per month. Finally, the teacher can consult the list of their courses taken into account in the evaluation and choose to remove those that do not seem relevant.

iTeachApp is also addressed to instructional designers to help them detect cases of interest. The figure 2 represents the ID’s dashboard. On part **A**, a data table is provided to visualize the list of teachers with their information

(name, first name, service and specialty). On section **B**, visualizations provide aggregated evaluation result over the entries of the table (depending of the filter chosen). Individual evaluation dashboard can be displayed by clicking on the “Axis/score” button for a given teacher. At right of section **B**, a radar visualization shows the average of the two scores (curiosity and homogeneity) by axis. On the left, a bar chart summarizes the average number of teachers with intensive/non-intensive use by axis as well. The data in these 3 elements (table, radar, bar chart) depends on the two filters at the top of the page. The first allows IDs to select teachers according to their specialties or departments to which they are assigned, which makes it easier for them to compare specialties and evaluate departments. The second one filters teachers according to their metric values and by axis. For example, the choice of the indicator “LMS trend usage” with the value “intensive use” and the axis “Communication” allows to identify all the teachers of the university who frequently use the communication tools of the institutional LMS.

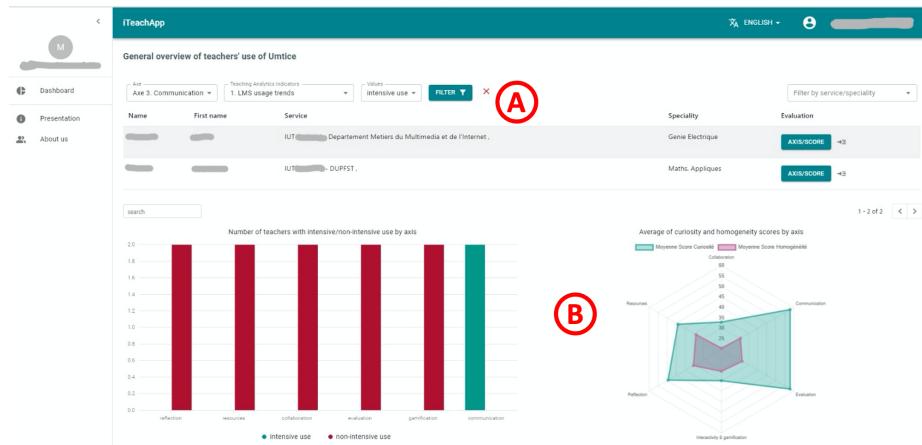


Fig. 2. Instructional Designers’ dashboard.

The different TA metrics we propose can thereby be used to detect teachers in particular needs for a certain axis, in order to propose them consistent and precise help. On the other hand, expert teachers in particular domains of competencies can also be identified, a wish IDs have as they are also looking for these profiles to obtain precise feedback on their LMS in order to define its functional evolution, and to better organize tutoring for newcomers.

6 Conclusion

On the basis of an explainable machine learning model, we followed here a user-centered method to evaluate our model from the teachers’ point of view, and to

identify how best we could provide teachers and IDs with suitable Teaching Analytics based on this model to help them improve their LMS skills and support teachers' needs respectively. Given the results we obtained from questionnaire to teachers, we discovered that the behavioral model could be enriched by integrating a dimension concerning student management, while the existing "reflection" axis could be completed with a functionality we did not detect previously. Regarding teachers' expectations, we noticed a great interest on their part to have a support tool that provides recommendations from close colleagues and instructional designers. The majority of them were also open to help each other and to improve their practices on the LMS. With respect to these results together with the interviews of the IDs, we were able to select wise types of visualizations and recommendations to provide to teachers.

With an operational version of iTeachApp, our short-term perspective is to experiment it at a university scale in order to study its usability and appropriation by teachers as well as IDs' interest in it. In the medium term, we intend to improve the behavioral model and our application by considering teachers' and IDs feedback after the experimentation. At long term, we obviously project to study the impact this application could have on teachers' practice.

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