A Platform for Tracking Teacher-Student Interaction

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Abstract. The value and effectiveness of office hours held by faculty and other staff members involved in student mentoring (e.g., advisors and tutors) has been investigated by several studies that have demonstrated that One-On-One (1:1) interaction, whether in person or via remote communication tools, has significant impact on academic success. Despite teacher-student meetings are a crucial component of the learning experience, very little is known about office hours practices beyond the requirements of faculty and staff handbooks: attendance, utilization, and outcome are seldom reported or sparsely tracked, mostly on an individual basis, and without standards.

In this paper, we introduce a novel system especially designed for educational institutions to support them in measuring and enhancing engagement with office hours and mentoring sessions.

Keywords: Learning analytics · Office hours · Learning Management Systems

1 Introduction

Several aspects contribute to delivering quality learning experiences in higher education, including commitment of instructors, design of lectures and coursework, time spent with peers, and mentoring from faculty and advisors [1]. Specifically, over the last decade, the importance of teacher-student relationships in contexts other than lectures is gaining interest. Research has demonstrated that especially student-faculty contact outside of the classroom has a positive impact on students' academic success. Particularly, first-year students benefit from interaction with an advisor or a faculty mentor [2]. Moreover, 1:1 meetings are especially important in colleges and universities that serve first-generation students or minority, underrepresented, and financially disadvantaged individuals, where mentoring and interaction with faculty and advisors is a crucial part of academic success [3]. Also, building student-teacher relationships via face-to-face communication with instructors, whether in person or using computer-mediated tools, has beneficial impact on students enrolled in commuter campuses and institutions located in rural areas [4]. As nowadays most faculty and staff handbooks in educational institutions require instructors to dedicate some of their time to 1:1 meetings with students, weekly office hours (OH) represent the most widespread form for having face-to-face conversations. Indeed, they offer a convenient opportunity for checking learning progress and commitment, identifying and preventing potential issues, and building a professional and personal relationship that results in increased mutual understanding.

Nevertheless, several studies found that actual 1:1 interaction between faculty and their students is infrequent and largely limited to formal and structured situations, such as classroom lectures, grades and feedback to assignments, or e-mail communication [5]. This is mainly because, despite prescribed rules adopted at the organization level, current practices in terms of OH are mainly left to the individual initiative and commitment of single instructors, mentors. Unfortunately, as reported by [6], time conflicts, poor advertisement, other coursework and duties, and commuting to campus, lead to students having poor engagement with OH. On the other hand, in addition to students' non-attendance, instructors' failure to be present and available during scheduled time [6] discourages students from seeking face-to-face interaction.

As a result, despite communication between teachers and learners is becoming more personal thanks to the use of Social Media, face-to-face interaction is among the most overlooked factors: although Learning Management Systems (LMS) are becoming more advanced and support unprecedented personalization options [8], there are no systems for measuring and incorporating learning analytics about interpersonal communication between instructors and students. In addition to the lack of data, the scientific literature focusing on face-to-face interactions in higher education involves different objectives and criteria. As a result, it is difficult to compare the findings of multiple studies involving very limited samples, scopes, or time frames, and aggregate them in an actionable framework and in standard guidelines. Regardless of the means by which OH are offered and of the type and purpose of 1:1 meetings, there is a demand for systems for helping faculty and staff in educational institutions track opportunities for interaction and monitor their performance. However, addressing the current lack of data is the very first step required for offering insights on key dimensions of academic success, increasing teachers' and students' awareness about the value of their interaction, and optimizing allocation of their time and effort.

2 Related Work

Individual meetings with faculty are an essential element of good teaching: either in the context of scheduled OH or in the form of appointments, they create unique opportunities for 1:1 mentoring that are very different in quality and outcome than group conversations. Particularly, OH were found to positively affect several dimensions of academic success [1]. As reported by several studies, visiting faculty and advisors regularly has been positively correlated with several indicators of student learning performances in the context of different disciplines [7].

However, research about OH shows that teachers and learners find it difficult to leverage this instrument to the fullest: the former are often discouraged by low participation and consequently avoid investing a significant amount of time in reaching out to students; also, at each step in their career, several aspects prevent them from feeling incentivized to advertise their availability outside class [1]. On the other hand, students might overlook the value of mentoring or feel intimidated by 1:1 interaction with their teachers and, therefore, fail to attend OH on a regular basis for substantive and intrinsic reasons. In the last decades, the increasing availability and adoption of technology, such as instant messaging tools facilitated creating touch points between students and faculty and advisors, as demonstrated by [4]. For instance, the success of distance learning and

the consequent transition of courses and programs to on-line education favored the introduction of the concept of Virtual Office Hours (VOH), or Cyber-Office hours, in which 1:1 meetings are held over the phone or using computer-mediated tools. Several studies investigating the effectiveness of VOH in helping build student-teacher relationships demonstrated that, in addition to having a positive impact on students who are located remotely or commute from nearby areas, they are particularly suitable for workers, parents, and learners live in the local community who have other types of commitments [5] [9]. Unfortunately, despite their convenience, the transition to on-line systems and the introduction of new forms of communication did not result in any progress in terms of acquiring data about the value of the personal relationship between students and their instructors and advisors: nowadays there are no systematic approaches for measuring the outcome of 1:1 meetings and incorporating them in student performance analytics. Although current LMS offer multiple instruments for communicating and capture several metrics about user activity and interaction with content, they offer little support to analyzing the outcome of face-to-face mentoring.

In [10], the authors present the case study of a drop-in center that was designed to provide students with an informal replacement to traditional OH. They installed a digital system in a writing center with the aim of tracking interaction between students and their teaching assistants and obtaining statistics about attendance to face-to-face meetings: students check in and out meetings by scanning their identification card using a magnetic reader located at the entrance of the facility. By doing this, they collect information about participants, acquire additional feedback about user satisfaction, and calculate the average duration of a meeting, which, in turn, is utilized to manage an electronic queuing system that optimizes waiting times.

3   System Design

In this paper, we suggest a system for adopting a more structured and systematic approach in quantitatively acquiring, analyzing, and improving faculty-student engagement. To this end, we introduce a novel web-based platform that supports scheduling 1:1 meetings during and outside OH, tracking their attendance and duration, and obtaining analytics about their outcome that can be incorporated into learning and performance reports. The ultimate objective of our work is to create a solution that is compatible with the different university policies in terms of appointments and OH management as well as with the diverse practices adopted by individual faculty and staff, and to provide users with a flexible system that requires minimal integration overhead and a short adoption and learning curve. To this end, we involved a group of faculty, staff, and students in analyzing the key dynamics, requirements, specifications: as most OH meetings happen impromptu or without prior notice (e.g., open door policies) and in a limited time window, the use of technology that introduces an additional step, that is, clocking the details in an agenda (e.g., start and end time) is among the main barriers to adoption. As a result, we co-designed a modular workflow based on metaphoric micro-interactions with technology that mimic and replace actual gestures realized before and at the end of meetings. Specifically, we modeled our solution around tasks that students already realize in physical interaction in the context of OH, that is, (1) knocking on the door to verify whether the instructor is available, (2) entering the office,

which determines the beginning of the appointment, and (3) exiting the room, which indicates that the meeting is over. Similarly, the proposed system is based on an interactive label posted on instructor's door that works as follows (see Fig. 1):

1. ping: students use their phone to scan the label; by doing this, they access a webpage where they can check instructor's current availability;
2. check in: if the instructor is available, this logs the start of the meeting; otherwise, students can add their name to the queue or book an appointment in a different time;
3. check out: after the meeting ends, either the student or the faculty can scan the label again or use a web interface, respectively, which allows the system to acquire the duration of the meeting and release instructor's availability for the next appointment.

The interactive label can be in the form of a QR code or a Near Field Communication (NFC) chip that encodes the link to the instructor's page on the platform, so that students can simply take a picture of or tap on the tag as they enter or exit the office. By leveraging metaphors and natural interaction via physical gestures, our approach aims at lowering barriers to adoption and facilitating the transition to a technology that renders keeping a log of OH and meetings transparent to the user and, thus, minimizes its effort. Nevertheless, students can directly operate the web platform in a traditional fashion. The interactive label can be posted on office doors, so that students can conveniently scan it when they enter the meeting, whereas the link can be shared in course material (e.g., in the Syllabus), on LMS, and it can be included in announcements, invitations, and e-mails (e.g., as part of the signature). As a result, the proposed solution can be suitable for face-to-face meetings, as well as for sessions held remotely using video-conferencing tools. In addition to accessing the system directly, a web component (i.e., widget) in the form of an HTML code snipped can be embedded in existing external web pages, so that faculty and staff can incorporate the proposed solution in their personal page on their organization website, and make it more intuitive for students to use the service. By doing this, the system offers an intuitive tool for collecting data about office hour utilization as well as other types of 1:1 mentoring.

Furthermore, as the objective of our design is to adjust to individuals' practices, the system can automatically activate and deactivate the check-in feature based on the scheduled OH; alternatively, faculty and staff can manually indicate their availability. Also, the proposed system enables students to leave a message in case instructor's office is unattended; simultaneously, the system can notify users if teachers have other duties that requires them to leave their office and cancel scheduled meetings. As a result, the system can also be utilized to track and analyze attendance and commitment of faculty and staff, and it can help address the lack of data in studies about their availability and presence during required times [6].

Also, the system includes features that enable collecting feedback at the end of each meeting. To this end, its default forms can be customized at the faculty, department, college, or university level, to collect standard and in-depth Key Performance Indicators (KPIs). As with teaching evaluations, student feedback can be shared with faculty and staff.

Finally, the system incorporates a reporting section that features learning analytics and provides faculty, staff, and students with detailed information about availability, utili-

zation, and attendance with respect to OH and meetings. By doing this, we aim at increasing individuals' awareness about their commitment to opportunities for 1:1 mentoring. Reports are also available to managers and the administrative staff (e.g., the Chair, Dean, and Provost), so that they can access standardized KPIs that can help them obtain an actionable overview of OH practices at their institution, identify successful approaches, and implement interventions and initiatives to promote attendance, as highlighted in [5]. Also, reports generated by the proposed solution can be utilized as an additional dimension for evaluating the performance of faculty and staff. Moreover, the data exported from the system can be utilized in combination with other learning analytics to realize further research on academic success.
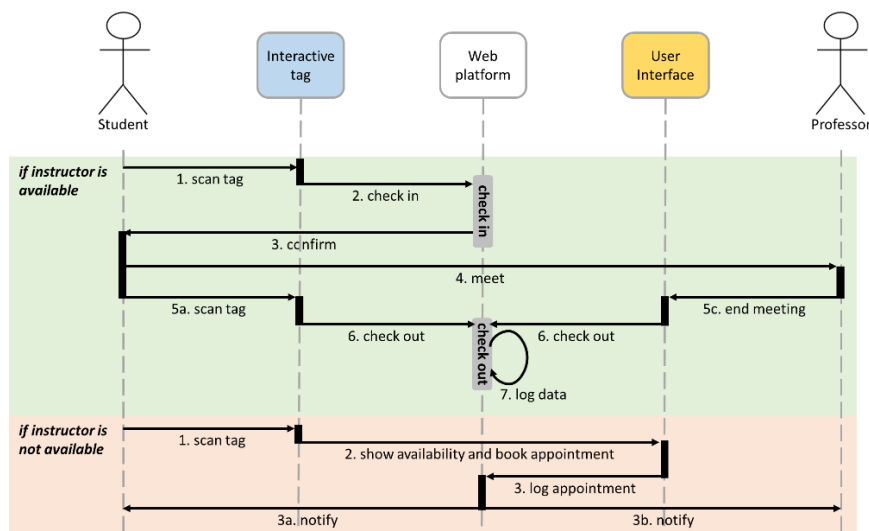

Fig. 1. Sequence diagram of the proposed system. No interaction with the user interface of the platform is required in case the instructor is available, which renders technology completely transparent in the process.

4   Conclusions and Future Work

Nowadays it is extremely difficult to obtain a clear picture about the quantity, quality, and impact of faculty-student interaction: despite several studies focused on OH and investigated their correlation with academic success, there is a general lack of data that prevents any systematic approach to analyzing the value of OH at the level of the individual faculty member, department, and educational institution. In this paper, we proposed a web-based platform that enables managing face-to-face meetings between students and their faculty and advisors in the context of OH or other types of mentoring sessions. On the one hand, the aim of our system is to address the current lack of data about teacher-student interactions and obtain metrics about this important component of learning experiences; on the other hand, our objective is to provide users with a customizable one-size-fits-all technology that seamlessly integrates with the diverse existing practices adopted by organizations and operated by individual faculty and staff

members. To this end, we involved key stakeholders in a participatory process that helped identify the main user constraints and barriers to adoption, and we co-designed a solution based on micro-interactions that mimic physical gestures that already occur in office appointments. Specifically, we utilize QR codes and NFC chips to enable students check in and out meetings by simply scanning with their smartphones the interactive labels placed on the instructors' doors. In addition to facilitating interaction with and management of OH, interactive tags can be utilized to augment the signs currently posted on the office doors of faculty and staff, so that students and visitors can simply access digital content that: (1) makes information accessible to individuals with disabilities, (2) enables faculty to add more material (e.g., out-of-office video message, bio, links, and calendar availability), (3) supports services (e.g., booking an appointment, sending a message, checking in during OH), and (4) tracks interactions between faculty and students to understand and improve engagement dynamics. Also, the proposed system can effectively be employed in advising and tutoring centers, international offices, and other contexts in which measuring interaction. In addition to increasing quality, gaining more information about the impact of mentoring and tutoring can produce insights on aspects that are crucial for academic success, such as student retention, timely completion, adequate financial planning, and overall satisfaction with their choice of institution and career. Furthermore, although the system is especially suitable for educational institutions, it can be effectively utilized in other types of private and public organizations, such as banks and government offices. The system and its features can be accessed and used for free by individual instructors at http://tools.addemy.com.

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