Design and Developing a Digital Health Learning Platform: `iManage`

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Abstract.
In the recent two decades, the health community has been considering e-learning platforms as a way of learning health related aspects. Many countries in the world are considering using technology to help improving the health services. These initiatives are taken by research institutes, universities, and other professional organization. All these efforts are supported by United Nations Development Programme, World Health Organization, and other funding agencies or institutions.

To the best of our knowledge, none of these platforms considered the same designated health purposes and all of the following categories of people: children, nursing aides, autistic students, hearing and aphasia participants. This paper describes our efforts to develop a digital health learning platform called `iManage`. Besides explaining health related concepts, `iManage` will evaluate the research study findings as well as reviewing and analyzing the results of its platform.

Keywords: e-learning, health related concepts, findings analysis

1. Introduction

Many countries cooperate with the purpose of using technology to improve the quality of health in the world. For example, countries like India, Brazil and South Africa channeled their Facility Fund to Viet Nam through UNDP (United Nations Development Programme) and the WHO (World Health Organization) (WHO; 2018). This represents just one vivid example of South-South cooperation in key areas of education and healthcare, utilizing the advanced ITC infrastructure and innovation. This collaboration facilitated through the project is expected to generate analytical work that contribute to building a base of evidence to further effective South-South cooperation in the area of e-learning and health.

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Another effort to accommodate technology in health and welfare services was recently done in Finland. Ahonena et al. described the competences that students have before their studies and those they expect to gain from the study module *Developing Digital Health and Welfare Services* in multi-professional groups during their bachelor studies (Ahonena et al.; 2017). Their experimental results demonstrate that students are keen to learn about developing digital health and welfare services, and they see that multi-professional work requires a communicative environment and respect for every profession.

Many other efforts targeting using technology to improve the health services is done by universities and research institutes. For example, Stanford University offers a course called *Building for Digital Health*, as a new Bio-design course sponsored by the Stanford School of Medicine and Stanford's Computer Science department. Its goal is to provide Computer Science students with the opportunity to apply their skills to real-world health technology development projects, while enabling School of Medicine faculty to leverage these talented individuals to help advance their technology concepts toward patients.

It is known that the development of digital health solutions for current health care settings requires an understanding of the complexities of the health care system, organizational setting, and stakeholder groups and of the underlying interplay between stakeholders and the technology. For example, Lee et al. described and discusses the applicability of an iterative evaluation process in guiding the development of a digital health solution as a technical and organizational entity in three different health care systems (Lee et al., 2018).

An interesting similar platform is Xealth, a digital health prescribing platform that enables clinicians to easily integrate, prescribe and monitor digital health tools for patients from their EHR workflows, such as patient education, online third-party apps and programs, device monitoring, and non-clinical services such as ride shares, food delivery and e-commerce product recommendations. Using the Xealth platform, care teams and physicians can monitor patient engagement and analyze the effects of more engaged patients (Xealth, 2019).

A similar work toward designing a digital health learning platform was done by Arthur Little, who has elaborated nine principles to gear digital offerings to success, such as enabling interaction within the different players in the healthcare ecosystem, integrating platforms to ensure connectivity or considering regional characteristics (Little; 2016).

An outstanding review providing insights into best practices for scaling digital health initiatives in low and middle income countries derived from practical experience in real-life case studies is (Labrique et al., 2018). The paper discusses how these experiences may influence the development and implementation of health programmes in the future.

None of these platforms considered the same designated health purposes and all of the following categories of people as we did in our study, from a wide variety of patients: children, nursing aides, autistic students, hearing and aphasia participants. This paper describes our efforts to develop a digital health learning platform, called `iManage`. Besides explaining health related concepts, `iManage` will evaluate the research study findings as well as reviewing and analyzing the results of its platform.

Our paper is structured as follows. Section 2 describes the process flow, the preparation stage which includes initial setup of platform, questionnaire creation, setting up the study and implementation stage which includes research study requires consent forms, evaluation of research study answers, and reviewing and analyzing the results on the platform. Section 3 illustrates the general concept related to members, user roles, questionnaire library, email templates, studies, study requests, invitation and learning management system. Section 4 presents the action done by

the admin such as, inviting researchers as well as members, managing the users, managing the email templates. Section 5 shows the actions done by the researcher like, creating questionnaires, setting up study, inviting members, managing email templates, reviewing study statistics, evaluating user/participant answers and, creating and uploading course materials on Learning Management System. Section 6 describes the implementation details, in particular technical details of the `iManage` system. Conclusions and References end this paper.

2. The process flow

This section presents the process flow that has two phases: *preparation* and *implementation*. In the first phase, the preparation, the IT (Information Technology) administrator initializes the website with their own URL (Uniform Resource Location) and release the mobile application. In addition, the IT administrator will add new users who can work as: researchers, admin and individual participants. Moreover, researchers and the admin are users who create the questionnaires for screening and measurement. In the created studies, individual participants will contribute to the studies. Another step of the preparation phase is creating the questionnaires, researchers with the help of IT administrator will upload the necessary questionnaires. The required information about the participants will be collected from the answers of these questionnaires for further analysis and research. There are three kinds of questionnaires: single, grid and composite. Single questionnaires are used to build a series of questions that have differing answers. Grid questionnaires are used to build a series of questions having the same set of answer options. Composite questionnaires are a combination of single and grid questionnaires. The final part of the preparation is setting up the study, where a researcher should be able to build studies by importing pre-made questionnaires from the questionnaire library. There are five different types of studies: *active*, *passive*, *clinical*, *medical* and *nutrition*. There are different kinds of studies available and they are regular studies, intervention studies, event-based studies.

In the second phase, the implementation, the participants are identified and registered on the platform. In this stage, the participants visit the study homepage and register their email address. They fill in a screening questionnaire (if the study has one). These questionnaires are the basis for building the research study. The researchers assign study materials (modules) to participants to collect useful information about them. The researchers then evaluate the answers to the screening questionnaires either during this process or anytime later. The researcher reviews and makes an analysis of the data collected through the questionnaires needed for this analysis.

3. General Concepts

This section describes the general concepts of the system, i.e., members, user roles, questionnaire library, and more. Members tab lists all the registered members in the system and it can be used to search for members using fields such as: first name, last name, username, gender, email, city, country, state. In the system, a researcher can also enable and disable the member privilege in the system. The platform has many different roles, based on their login privileges. Without this role, a user cannot log in to the `iManage` platform. Every time this role is assigned, an email is sent to the user specifying user has been registered.

For example, a researcher is an individual who is assigned a researcher role, being able to create, publish and edit questionnaires, studies and perform actions (enable, disable members, send out study invitations).

Similarly, an admin has the main role to manage users, email templates, and to invite researchers as well as members to use the platform.

Another feature of the system is the questionnaire library. The questionnaire library consists of single questionnaires as well as grid questionnaires and all the other questionnaires. These questionnaires represent the basis for building a research study. Single questionnaires, also known as single answer questionnaire, are used to build a series of questions having different answers. These are used to build individual set of questions. On the other hand, grid questionnaires, also known as group answer questionnaire, are used to build a series of questions having the same set of answer options.

Different kind of emails are required to be sent for instances such as Account Registration/Activation, Account Verification, and so on. There are pre-made templates for each of these instances. Alternatively, a researcher can create one, too. This feature is called the *email template*. Another feature, called "Studies", lists all the studies. This feature gives the possibility to the researcher to build studies by importing pre-made questionnaires (single questionnaires, grid questionnaires, or composite questionnaires). The "Study Requests" feature lists all different types of "Study Requests" that the user is invited to participate.

Members and researchers can be invited into the `iManage` platform using the invitations feature. In order to invite a member, an user can upload the user email information file or send invitation individually with a premade template. A researcher can be invited using the researcher name and researcher email address. The researcher can also download the study data sets.

A new feature, called "The programs", redirects the user to the Learning Management System platform. In this platform, courses are built according to researcher's requirement. The researcher can create the different modules, add quizzes, assignments, tasks and assign it to the participants.

The admin of the system is responsible for the initial setup of users in the platform and for sending invitations to the members as well as researchers into the platform. The admin is also responsible for managing the users and for providing different roles or managing the roles of enrolled members. Another part of the admin's job is to manage the email templates. Many different emails must be sent out after the user registers onto the platform such as "Connection Request", "Forgot Password", "Account Activation", etc. For these, there exist pre-made email templates available which can be used by admin or modified to send emails for the specific purposes.

The researcher of the system designed the platform different actions can be performed. Researchers can review all users, members, questionnaires, programs, etc. One of the important actions of the researcher is to create and build the questionnaires. Researchers can create the questionnaires and response option as well as setting the corresponding value to the question accordingly. The platform automatically calculates the sums/points for answers from participants. Both the answers and the points are displayed on the platform for each user or conveniently exported in Excel files that can be used directly in external programs for analysis purpose and more. When questionnaires are assigned to users, a start date must be specified. There are different fields that are to be filled when creating questionnaires, such as: variable name (this unique variable name identifies each question, hence this variable name cannot be the same for two different questions), variable type (this determines the format of question to be set up). There are nine different formats of questions available. The researcher can select from those that best fit the questionnaire. They are:

1. single choice (radio button) – horizontal,
2. single choice (radio button) – vertical,
3. single choice (dropdown),

4. multi choice (checkbox) – horizontal,
5. multi choice (checkbox) – vertical,
6. free text – all,
7. free text - integer only,
8. free text - date picker,
9. multiline paragraph text.

Other fields include question, response option, value (each response option has a corresponding numerical value associated with it), mandatory (checking this field indicates questions that are to be answered mandatorily by participants), conditional logic (using this option we can link the two questions together and create a conditional question), submit question and save draft.

Another important researcher's action is setting up the study. There are five basic steps in setting up the study. The first step in creating a study is to enter the basic details of the study such as Study Title, Researcher Name, Study Type. This step also requires the researcher to upload three documents: the IRB (Institutional Review Board) form, the Instruction form and the Consent form. These documents are required for every study to ensure each user understands the process to complete the questionnaires and has given consent to take part in the questionnaires as well. The second step in setting up the study is to build the questionnaires, which will eventually constitute the study. While creating the study, besides importing already built questionnaires, the researcher can also create new questions using the set question feature. The other three steps are: creating filter (study inclusion criteria can be set based on demographic, medical, variables and clinical criteria), managing emails and sending out invitations.

Different kinds of study can be set up based on the researcher needs:
1. regular study: when the researcher does not have special circumstances required for the creation of studies then this study is created, and
2. event-based study: when triggers are needed to be set with conditions such as fitness, medical, clinical, demographic, geolocations, beacon, nutrition; Triggers can also be programmed to be sent daily or weekly with trigger action being message only, message with questions, message with questionnaires, etc.

Other important actions include inviting members, managing email templates and reviewing study statistics. Navigating through a study list after a study has been started, the researcher can observe and analyze different statistics for the study, such as participants targeted, total invited, panel member invited, CSV invited, or simply participated. Apart from these actions, evaluating participants answers, creating and uploading course materials on the learning management system represent also a crucial part of the `iManage` system.

4. Implementation details

This section describes some of the technical details of `iManage` system. Next, there will be a list of some screenshots related to `iManage` system with clarifications.

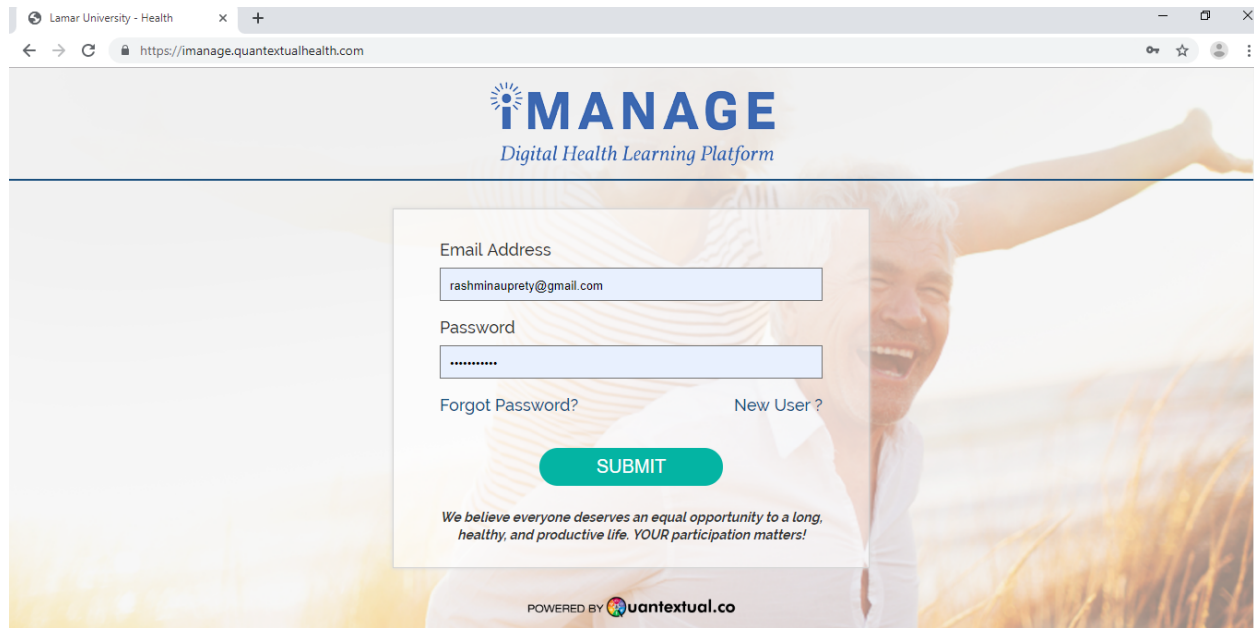Design and Developing a Digital Health Learning Platform: `iManage`

Figure 1. The *Login* page of Learning Management System

Figure 1 shows the *Login* module for the participants as well as the researchers. Participants can access the `iManage` system by using their login credentials whereas researchers can add/edit/delete the contents for the participants.
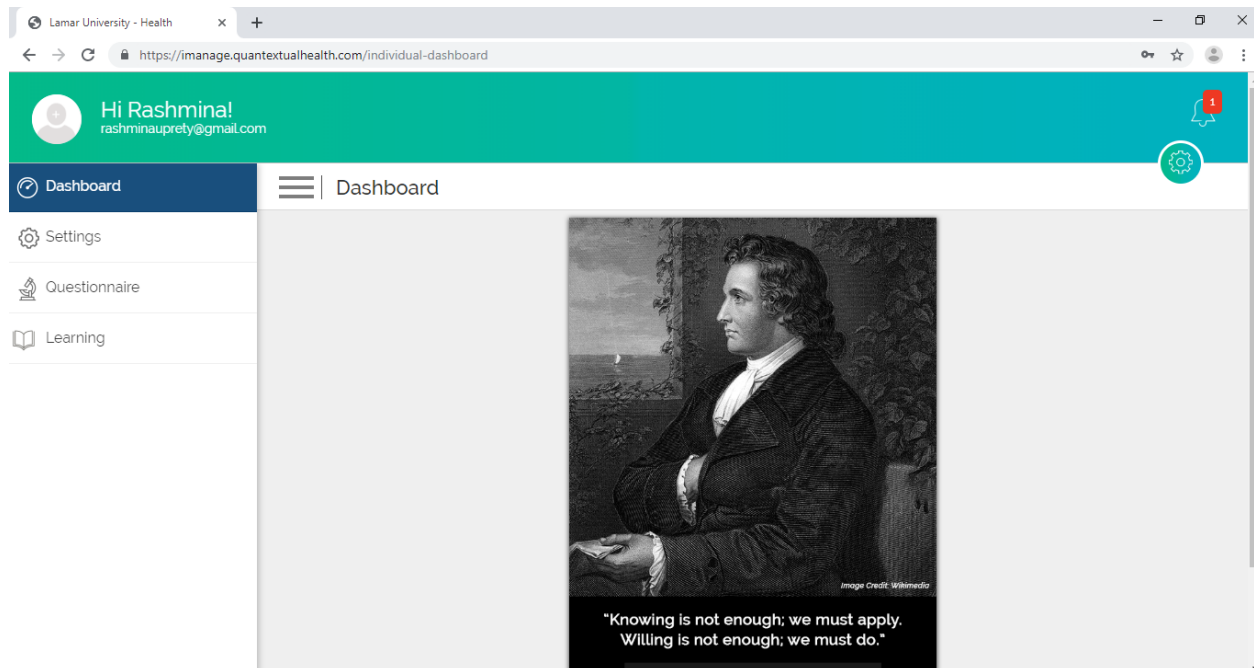

Figure 2. The *Dashboard* page of Learning Management System

Figure 2 shows the *Dashboard* page of the LMS. On the left, there are four options:

- *Dashboard*: If we click on it then we remain on the *Dashboard* page or come back to the *Dashboard* page from any other pages.
- *Settings*: If we click on *Settings*, we see the profile settings of the current end user.
- *Questionnaire*: If we click on it, we see the questionnaires that we are assigned and have the invitations to complete.
- *Learning*: If we click on *Learning* then it takes us to the *My Courses* page as shown below.

On the right we can see the notification and settings icon. The *Notification* icon is used in case of receiving any notifications. For example, the `iManage` system will send notifications, if the courses have been assigned or if anyone has been invited to complete the questionnaires.
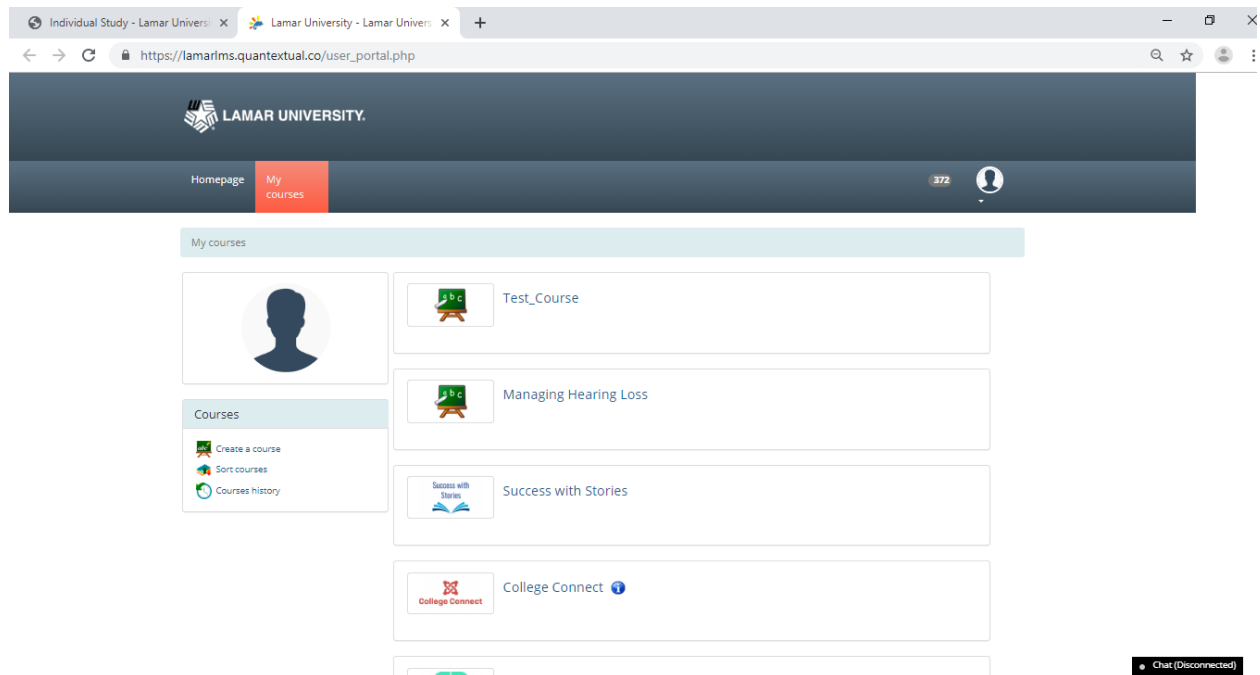
Figure 3. The *My Courses* page of Learning Management System

In Figure 3, we see the list of the courses assigned to both the researchers and participants. This is the page where the researcher can create a new course using the *Create a course* option shown on the left. This option is absent for the participants.

Design and Developing a Digital Health Learning Platform: `iManage`
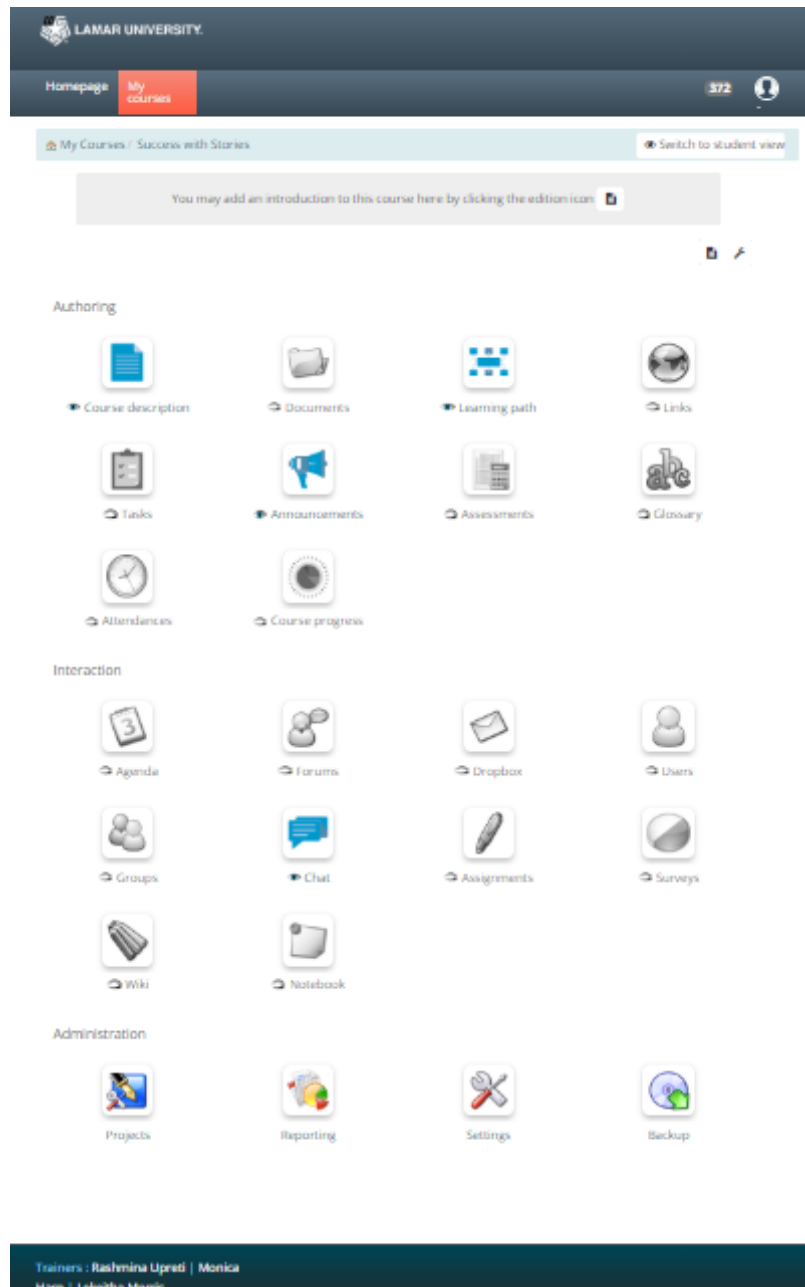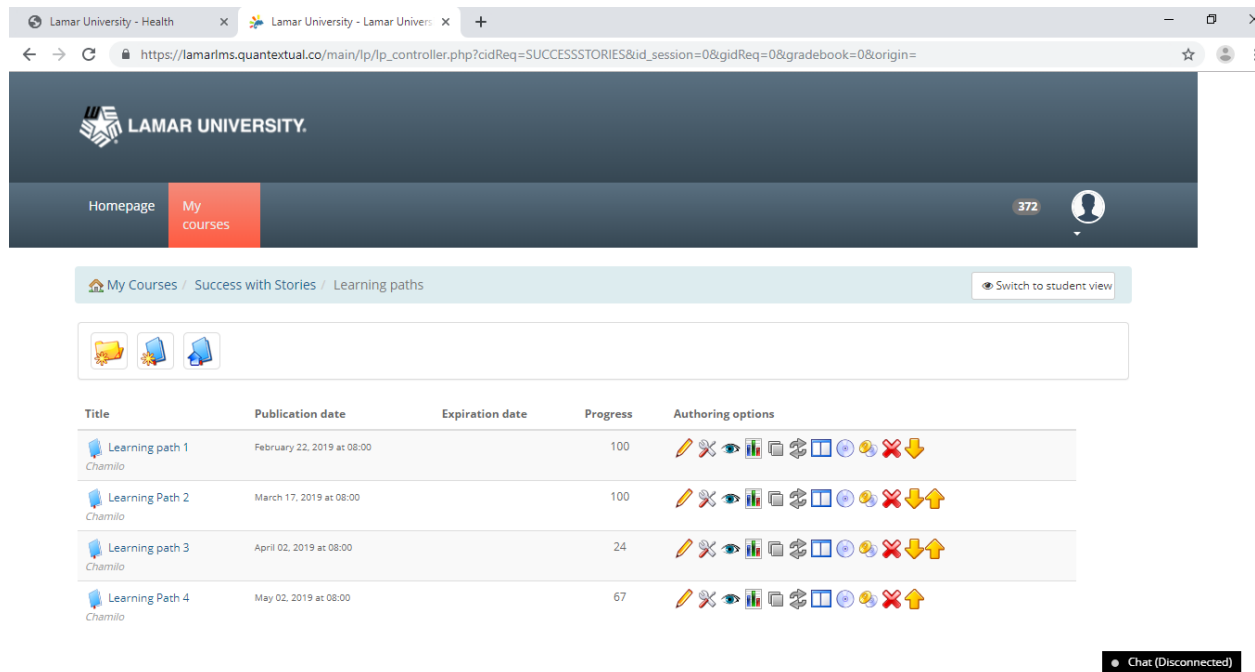
Figure 4. The *Course* page of Learning Management System

Figure 4 describes different *Authoring*, *Interaction*, and *Administration* tools. Rich media documents can be created inside the *Documents* section and can be added to the *Learning path* section to make it visible to the participants. The top right section *Switch to student view* has one button. In this way, the researchers will be able to see the content seen by the participants and then toggle back to the researcher's view to add the contents/assignments/tasks.

Design and Developing a Digital Health Learning Platform: `iManage`
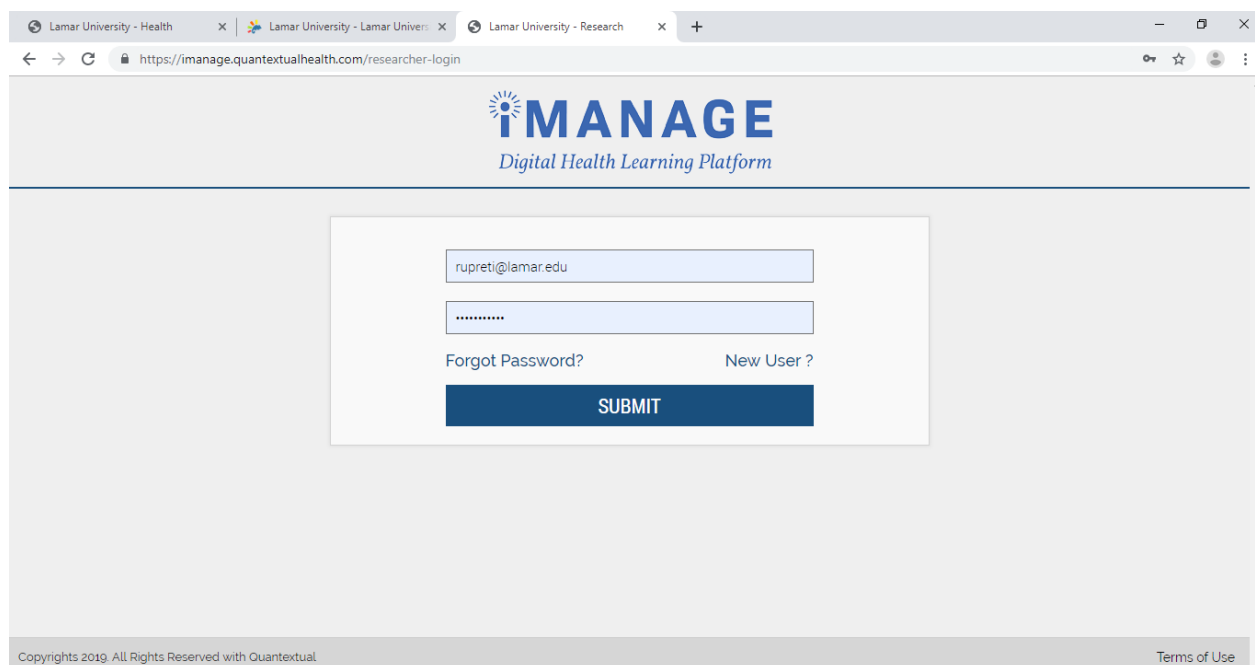
Figure 5. The *Learning Path* page of the Learning Management System

Figure 5 describes different learning paths, i.e., the modules of the courses made for the participants. Participants usually access the module one by one to complete the study. Different options are also visible on the right side, such as editing files, changing the configuration settings and accessing the status of the completion of the modules by different participants using those options.

Figure 6. The *Login* page of the *Questionnaire* side of the `iManage` system

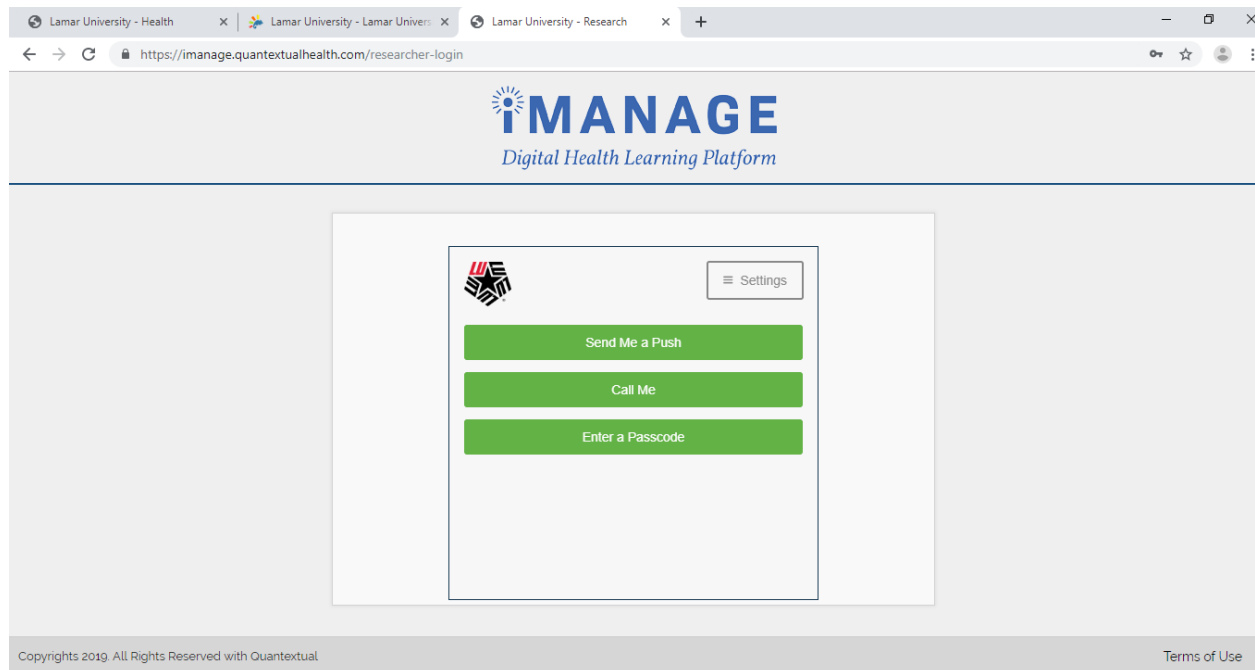Design and Developing a Digital Health Learning Platform: iManage

Figure 7. The *Duo-Login* for the iManage system

Since the iManage system is a research project that collects sensitive health information about the participants, Lamar University has set the policy to implement the duo-login for the better data security (Figure 7). Only the approved trusted people have the access to the participants data.
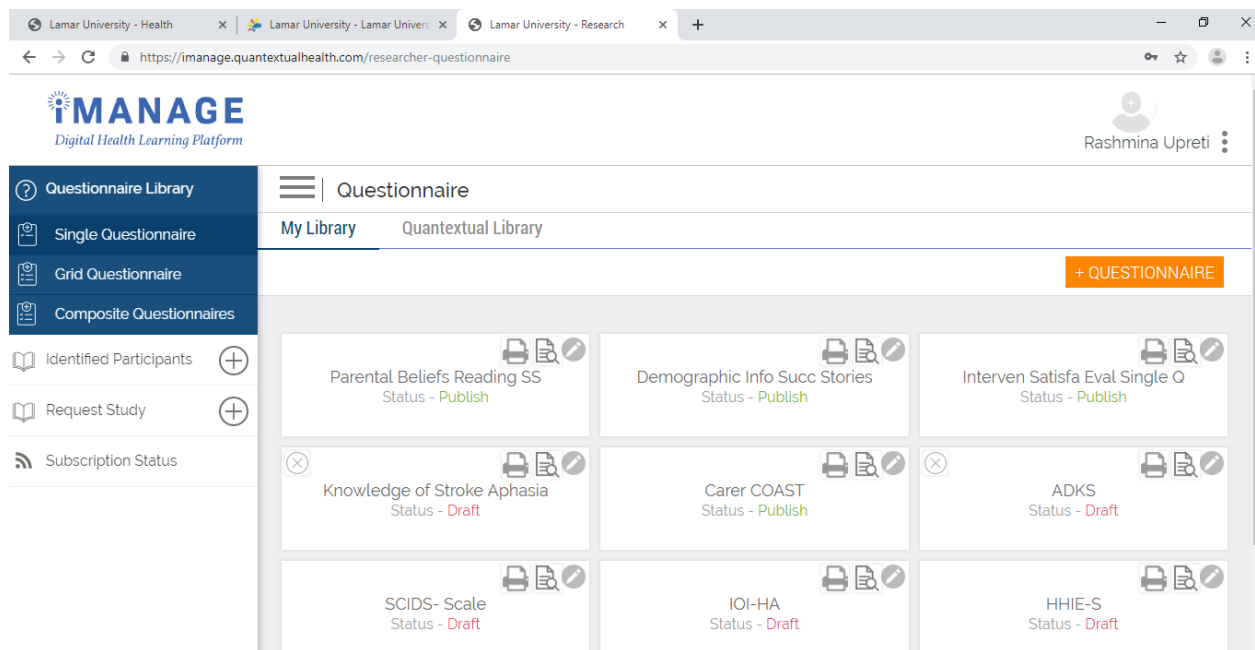

Figure 8. The 'Questionnaire' page of Questionnaire side of the iManage system

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Figure 8 shows the side of the `iManage` system where we can add the different single, grid or the composite questionnaires for the research purpose.

Therefore, we can say that the `iManage` system is the digital learning application that is very user-friendly. To summarize, the `iManage` system helps developing the courses and creating the questionnaires for the research very easily.

5. Conclusion

The `iManage` system was launched and developed after receiving the grant award from the Lamar University Presidential Visionary Initiative. The `iManage` system hosts the Web and mobile versions of several health self-management programs. For the first time in Lamar University, a digital system has been developed to cultivate and promote digital technologies in the field of health and disability management. As a future work, we will analyze data collected from users and check `iManage` system effectiveness.

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