Function Design Optimization of Learning Management System (LMS) Based on Student Perspective—Case Study of Canvas Application University of Colorado Denver

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Abstract. As educational concept incorporates the computer science into the management methods, the innovative Learning Management Systems (LMS) have been extensively applied. This research is intended to ascertain the functional requirements derived in the course of LMS development by conducting the quantitative research of Canvas application (one of the representative LMSs) amidst the student users at the University of Colorado Denver. In light of the assessment of rationality and effectiveness towards current Canvas function settings, the findings reveal the predominant using purposes which include the integrated informational function, social networking function and customized learning function; and the study further indicate the practical recommendations in terms of the corresponding demands. The obtained results are supposed to be instrumental for the optimization and upgrade direction of LMS based on the purposes of improving learning motivation, learning efficiency, and learning outcomes.

1. Introduction
Years of computer science evolution enabled abundant resources and approaches of education to spring up, notably the development of learning management system, which was designed to facilitate the organization and assessment of study activities. It provides instructors with a virtual platform to create and deliver teaching materials, monitor student participation, and evaluate student performance. Student users are able to take electronic courses and online exams, exchange and share learning experiences through this channel [1]. The extraordinarily complicated and enormous user base presents challenges for maintaining and enhancing its quality construction.

Nevertheless, there is a general absence of investigating the learner’s using experiences of LMS function in current academic researches. On the one hand, some studies were carried out from the perspective of the technology companies that developed LMS software, which cared more about the demands of schools or educational institutions since they are the purchasers of products [2]. Thereby the content centered on analyzing the marketing factors such as support services or pricing structure, whereas the student’s opinions tended to be neglected. On the other hand, a great deal of reports focused on the examination of LMS existing functions which are remarkably similar. The research neither revealed that the design concepts of LMS were conservative and lacking innovation, nor propose the new function design adapting to the latest market demands.

This research aims at filling the gap in the empirical investigation towards both learner experiences and function design of LMS. Based on the literature review about Learning Design Taxonomy and UX-oriented evaluation model, the quantitative research is established to review Canvas function setting and
assess its convenience, effectiveness, and efficiency. Stemming from the evaluation feedback from 142 students of the University of Colorado Denver (UCD), the study results identify the shortcomings of existing functionality and the updated user requirements, and further demonstrate the constructive design recommendations. The ultimate purpose is to enrich the modern trend of the intelligent tutoring system by interpreting the core demands of LMS functions.

2. Literature Review

2.1. Learning Design Taxonomy
Learning activity design could be categorized according to different design concepts. “Assimilative activities” relate to obtaining the course information and learning materials, such as viewing videos, looking at the documents, or listening to audio lectures. “Communicative activities” indicate the interaction or communication with other users. “Interactive activities” encompass applying the learning knowledge and developing transferable skills. “Assessment activities” involve various methods that enable faculty or students to track the learning progress and examine academic performance [3].

2.2. UX-oriented Evaluation Model
By means of surveying the prominent factors that affect user’s evaluation of LMS from the published studies, table 1 is organized showing the assessment criteria. The user’s judgement involves various design factors on the platform. To some extent, the demographic background of users could be the influencing factor. All the literatures underline the importance of communication and collaboration, integration with other websites or systems, and the individual learning management.

| Authors and References | Assessment Factors of LMS Derived from Cited Literature |
|------------------------|--------------------------------------------------------|
| Poulova, Simonova and Manenova 2015 [4] | (1) Tools for generating contents: Page, File, Syllabus, Video, Integration; (2) Communication tools: Discussion panel, Chat, Inquiry, Comments; (3) Tools for collecting and evaluating activities: Task, Test; Workshop, Safe Assignment; (4) Tools for co-operation with other systems: Group mode, Wiki, Virtual classroom, Statistics, Database. |
| Kraleva and Kralev 2018 [5] | Age, Mobile platform, Science research, Asynchronous work, Accessibility, Communication, Social skills, Entertainment, Use media like video, audio, images |
| Aldiab, Chowdhury, Kootsookos, Alam and Allhibi 2019 [6] | Integration, Discussion, Reports, Blogs, Quick mail, Workshop, Safe Assignment, Virtual classroom, Tracking, Statistics, Database. |

3. Quantitative Research

3.1. Selection of Respondents
The researchers choose the undergraduate students from UCD as the object of investigation, because they are the group who are quite familiar with high-tech products and Canvas functions. College students belong to the primary constituent of LMS user group. If we want to better develop LMS market, we must focus on their evaluation criteria for creating more conducive functions.

3.2. Questionnaire Framework
Referring to the UX-oriented Evaluation Model and the relevant theoretical research, this study proposes to collect the most authentic opinions from the respondents. The survey is delivered with the electronic questionnaire consists of six multiple-choice questions and five Likert Scale questions. The questionnaire was divided into three parts, including demographic information, students’ previous usage
experience of Canvas and personal perceptions towards Canvas usability, and ascertaining the core demands of LMS and its specific functions.

4. Data Results Analysis

4.1. Demographic Information
A total of 142 valid questionnaires were collected and the demographic characteristics of respondents varied in Grade, Major and Frequency of using Canvas. Most of participants are junior and sophomore students. By contrast, the gross number of freshmen and seniors merely accounts for around 10 per cent. Communication students constitute a larger proportion than students major in Economics. Moreover, only a small minority of students as 4 per cent major in Finance. As far as the using frequency is concerned, the duration is mainly distributed between one to three hours and more than four hours.

4.2. Reliability Analysis
In general, if the Cronbach’s Alpha reaches more than 0.7, the reliability of the questionnaire is qualified [7]. After standardizing the data from 142 questionnaires by SPSS, the Cronbach’s Alpha coefficient is 0.785 which is greater than 0.7, so it can be inferred that the credibility of the questionnaire is satisfactory.

4.3. Validity Analysis
Validity is related to the reasonableness and availability of the survey design which is verified by factor analysis. The factor model adaptability analysis is carried out on the questionnaire data before conducting factor model analysis. The KMO value is 0.657 which is over 0.6, meaning the validity is acceptable. As for the significance testing, the p-value is 0.000 which passes the Bartlett’s Test of Sphericity with a significance level of 0.05. Therefore, the data is suitable for exploratory factor analysis.

4.4. Evaluation of Canvas Application and Demand for LMS Function
The questionnaire inquires two aspects of evaluation respectively. For one thing, respondents assess the degree of helpfulness to elementary learning activities by scoring 0 to 5. Most of students express greater appreciation of “Access to teaching materials” function and the average score is 3.93. The option “Receive learning feedback” is in the second place by scoring 3.89 and “Submit assignments” ranks third in the list with the score 3.77. However, the function “interact with tutors and classmates” does not get ample recognition, and the level of helpfulness is marked as 2.65 and 2.38 out of 5.

For another, regarding the comprehensive assessment of Canvas, more than 85 per cent student agree that Canvas can be closely integrated with their offline learning progress. The ability that makes the study more programmatic is also recognized by almost all the students. Yet the average rating falls short on the function “promotes the individual participation in team work” and “meet all my daily study needs”, which reveals that the application of Canvas is inclined to match up with the classroom learning while lacking the assistance of more complex study activities.

The subsequent research focuses on exploring the functional requirements of LMS in a broad sense. 117 students out of 142 value the experience of “easy to master the operation method” most. Students are also willing to benefit from LMS regarding “high communication efficiency”, “save time and energy of study” and “convenient interaction”. By comparison, “overcome procrastination”, “strengthen memory”, and “stimulate learning interest” are not belong to the valued experiences. When asking the most desired new functions specifically, more than half of people answered “provide learning analysis reports” and “social features”. There are also urgent demands for “E-course live broadcast”, “share screen to co-work” and “customized learning plan”.

4.5. Chi-Square Analysis on LMS Demands among Different Majors and Grades
Chi-Square test (cross analysis) is used to investigate the difference of desired user experiences of LMS from students of different grades. It can be concluded that students of all grades attach consistent importance to the experience. Nevertheless, the factor of option “Easy to master the operation method”
presents the significance at the level of 0.01 (\( \chi^2 =12.133, \ p =0.007<0.01 \)), meaning junior and senior students have higher requirements on the simplicity of system operation than freshmen and sophomores [8].

No significant difference in the overall samples is seen between the different majors (\( p>0.05 \)) except for the Question “save time and energy of study”. Specifically, 55.56% of Communication students did not choose this option, which is significantly higher than that Economics students (21.43%). The student’s perspective on whether LMS should save learner’s time and energy is statistically significant (\( \chi=4.726, \ p=0.030<0.05 \)), but the other preferences are not manifestly different among the two majors.

5. Discussion
Although the computer science and communication technology are rather developed and the employ of LMS has become a popular trend, the existing researches do not specifically pay attention to the user’s views in the improvement function design. With the empirical investigation, this study links the practical learner experience of Canvas to the evaluation of LMS systems, and makes progress in detecting the design limitation and interpreting the orientation of feature upgrade in the future.

5.1. Integrate with External E-resources
The study’s first important finding is that the central functions on Canvas are limited to act as the adaptation and supplement of classroom learning, relying heavily on the traditional study methods without making full use of the abundant resource on the internet.

The bulk of functions are designed to complete the most basic in-class activities including learning materials delivery and assignments submission, which seems to merely transfer the medium of traditional teaching activities to the computer, instead cooperating with the external online systems as database or virtual library. Such a demand gap signifies that although LMS improve the efficiency and convenience of study, it is still regarded as the proxy for formal learning. The future design should provide more innovative and extensive content to exploit the advantages of intelligent study and Internet resources to the full.

5.2. Enhance Social Network Approach
The second finding uncovers the demands for cooperation, social networking, and communication tools. Compared with the communication between classmates, most interviewees show a stronger need to interact with teachers. They hope that LMS can help them get timely and direct instruction, and they also express their expectations for the online live classes. The ability to promote group cooperative learning and collaboration activities are considered necessary for LMS as well. Students agree that the social network functions will intensify the learning engagement and cultivate their transferable skills. Taking this requirement as a starting point, LMS should enhance its communication and interactive services beyond the e-mail function to create a better information exchange environment.

For instance, the platform could try to establish different learning groups according to students’ major study and selected courses, and then unite different universities to let students with similar background join the same study groups and communicate their personal learning progresses. It is also beneficial for students and faculty to exchange their perspectives and considerations privately or to launch a more in-depth academic discussion through an alike approach. In this way, the users can not only get rid of the limitation of time and place of in-class communication, but also acquire more diversified and comprehensive information.

5.3. Introduce Customized Learning Service
The ultimate and paramount finding is about student’s preference for personalized learning service that offers them the most appropriate learning material by identifying the individual learning characteristics and learning behavior. It is the requirement that inspires LMS to develop the Effective Personalized
Learning Recommendation Systems which will not only avoid the liability of information overload, but also provide the most relevant information of student’s personal interests [9].

The development of this new function requires LMS to be able to track students’ learning dynamics, assess their academic performance, complete the individual learning analysis reports, and assist in developing exclusive study plans with professional advice. In addition, LMS should customize the using strategy of the functions and create the personalization of the learning experience, so as to foster the innovative learning content delivery and help students to timely evaluate and reflect on their learning progress.

6. Conclusion and Future Research
In this research, the learner’s usage habits and preferences of LMS functions are broadly accumulated and analyzed, forming the foundation upon which the feasible strategies proposal of LMS is built, with the purpose for optimizing advantages, reforming the deficiencies of the online learning platforms, and ultimately creating a polished experience for the users.

In conclusion, above all is to simplify the operation methods and increase the accessibility of LMS before optimizing the existing functional settings. The function development ought to be built around the core concept that keeps the interface design generous and simple. From the learner’s aspect, it is unnecessary to insert the recreational design elements such as the game mechanics, while what is valued most is whether LMS can contribute to learning efficiency and effectiveness. Some subjective variables related to learners themselves are not the main criteria for evaluating LMS, which means that most learners do not expect LMS have the power to change their learning habits or stimulate their interest in learning. As for the specific function optimization methods, improving the interactive function, customization function and integrative function is the trend in user’s demand.

For the sake of assessing the effectiveness of the above new function design, the next research steps include calculating the student’s academic performance after the application of new functions, analyzing the correlations between the innovate learning design activities and the learning outcome, and further putting forward a more elaborate design scheme.

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