DiaryQuest: A Web-Based Learning System Utilizing Diary Study

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Abstract

DiaryQuest is a web-based learning management system designed to address challenges in utilizing diary studies in education, particularly in large classroom settings. Diary studies promote student reflection and a deeper understanding of topics like Human-Computer Interaction (HCI), but traditional methods of analyzing diary entries are labor-intensive. DiaryQuest simplifies this process by offering educators tools for creating diary assignments, tracking student submissions, and analyzing entries using methods like Latent Dirichlet Allocation (LDA) and sentiment analysis. For students, it provides an intuitive interface with progress tracking to ensure timely entries. The system also includes interactive visualizations, such as word clouds and dynamic tables, enabling educators to explore student insights more deeply. DiaryQuest enhances the management of diary studies, promotes engagement, and fosters a more personalized and reflective learning experience.

CCS Concepts

• **Applied computing** → **Education**; • **Human-centered computing** → **Human computer interaction (HCI)**.

Keywords

Diary Study, HCI Education, Learning Management System

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1 Background and Related Work

Diary study plays an important role in higher education [3, 13] and computer science education [10]. It aids in cultivating students' in-depth understanding of programming languages and system design and enhances their self-reflective capabilities. This approach encourages students to document their thoughts, problem-solving methods, and progress in programming skills throughout the learning process. Through continual recording and reflection, students can more clearly observe their developmental trajectory, understand the challenges encountered during learning, and discern how to overcome these obstacles. In Human-Computer Interaction (HCI) education, diary study is an effective learning strategy that helps students better understand user needs and experiences [7]. By requiring students to maintain ongoing diary entries [18], they can observe user behavior and reactions from multiple perspectives. This method allows students to track subtle user reactions during the use of systems or products and record various encountered problems and challenges. Through these observations, students can gradually develop keen insights and acquire skills to identify user pain points. Moreover, diary study is not only about observing others' experiences; students can also reflect by documenting their own experiences using software, systems, or interface designs. Such dual-experience recording enables students to consider optimizing interaction designs from both the designer's and user's perspectives, aligning them more closely with real user needs. This depth of participatory learning enhances students' understanding of user requirements. It bolsters their empathy during the design process, ultimately aiding them in developing interaction systems that better meet user expectations.

2 Problem and Motivation

The importance of diary studies in computer education is increasingly emphasized, particularly in prioritizing personalized learning and self-reflection to address the difficulties faced by computing students studying HCI [17]. However, the diary studies method also faces challenges in practical application [8]. For teachers managing large classes, extracting useful data from student diary entries is undoubtedly daunting. The diversity in students' points of interest

and cultural backgrounds presents distinctly different perspectives in each diary entry, making selecting and distilling meaningful insights both time-consuming and labor-intensive. Relying on traditional manual coding methods is not only resource-intensive but also ill-suited to the needs of educational settings. Through the analysis of diary studies, teachers can facilitate classroom discussions or activities, encouraging students to share personal experiences and explore commonalities and differences. However, current Learning Management Systems, such as Canvas [6], offer limited support for diary study, primarily providing functionalities for assigning homework and uploading submissions without the necessary analytical tools to assist teachers in summarizing and delving deeper into the data. This situation further leads to insufficient interaction and feedback between students and teachers, rendering diary writing monotonous and meaningless [11]. Therefore, we seek to develop a new application to provide teachers and students with a platform to engage with studies and learn about the data meaningfully [14].

3 Approach and Uniqueness

Our approach leveraged Kvan's collaborative design method [15]. Each author conducted a week-long diary study based on the four-phase diary educational framework [7], crafting five diary entries each, then engaging in group reflection discussions. This process allowed authors to share their experiences, discuss the challenges faced during the diary tasks, and identify essential features for developing a new system. Based on findings, we designed and developed "**DiaryQuest**," an interactive web-based learning management system that utilizes diary study for both students and instructors. To this end, DiaryQuest can be described through the student, educator, and analytics view.

3.1 Student View

Creating a conducive homework environment can effectively enhance students' enthusiasm for completing assignments [9, 19]. DiaryQuest features a streamlined and intuitive interface design that enables students to complete their diary entries effortlessly. The left panel displays the diary entry prompts preset by educators, while the right text box provides students with space to compose reports on user events and experiences. This layout ensures that students can clearly understand the task requirements and focus on documenting significant details of user interactions. Given the longitudinal tracking characteristic of diary study, students might forget to submit entries during busy academic periods. To address this, DiaryQuest integrates a progress bar [1] and notification system [4, 16], which constantly reminds students of their task completion status and assists them in effectively managing their submission timelines through progress visualization, ensuring the timely completion of records at each stage.

3.2 Educator View

The variability of the diary study settings presents challenges in assigning diary study tasks [7]. DiaryQuest offers detailed guidance to educators for efficiently setting up diary assignments, considering the diversity in class size and student interests. Educators can select various diary study testing software, setting appropriate recording frequencies and participant numbers for each [8]. Leveraging historical data from the testing software, DiaryQuest provides educators with critical analytical cues, highlighting potential research foci of the software, such as user privacy, UI design, and behavioral design. This data-driven guidance assists educators in crafting optimized diary recording prompts, enabling students to capture key user experience factors more accurately and enhancing their understanding and analytical capabilities in HCI. The platform also offers a timeline-setting feature, allowing educators to schedule submission deadlines and review periods flexibly and facilitate student progress tracking.

3.3 Analytics View

Upon the completion of data submission by students, DiaryQuest conducts a comprehensive analysis of the data and offers three modes of data analysis along with corresponding data visualization tools. Students can also view and interact with their own analytics reports after finishing all submissions. Initially, the platform employs the Latent Dirichlet Allocation (LDA) analytical method [2] to generate themes or prevalent "human factors" discussed by students based on software usage, while allowing educators to flexibly adjust the number of themes required for analysis. Subsequently, DiaryQuest provides an interactive word cloud [12] that displays the frequency distribution of vocabulary across all student posts. When one or more words are selected, the word cloud dynamically updates to show the frequency and distribution of related words within the text. Finally, the platform has designed a dynamic table that, based on the selection of vocabulary from the word cloud, displays related student diary entries. This table also integrates sentiment analysis using the DistilBERT Huggingface model [5], revealing students' positive or negative emotional responses to specific topics, thereby assisting educators in gaining a deeper understanding of students' varying perspectives on the same factors. Through these three analytical modes, DiaryQuest offers a comprehensive view that supports educational personnel in deeply exploring students' learning processes and emotional tendencies.

4 Results and Contributions

We invited two teachers with extensive experience in diary study instruction to evaluate the system and received positive feedback. This tool streamlines the management process of diary studies. It facilitates tracking student submissions and grading and allows for a deeper analysis and understanding of student opinions. The platform's provision of multiple analytical views enables teachers to examine student feedback from various perspectives, thereby stimulating subsequent discussions.

Our contribution is DiaryQuest, a web-based learning system that simplifies diary study management in education. It tracks submissions, offers analysis, and helps educators make informed decisions. With data visualization and flexible tools, DiaryQuest enhances understanding of student perspectives, supports discussions, and adapts to various assignments, fostering better educator-student connections and personalized feedback.

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