Pedagogie-digitala.ro Institutul pentru Educație

Revista de Pedagogie Digitala

2022, vol. 1, nr. 1, pp. 23-27

ISSN 3008-2013

https://doi.org/10.61071/RPD.2283

Digitalised Interactive Educational Experiences with EdSense's Digital Smart Pages

Mihai Vlase

Altfactor, "Dunarea de Jos" University of Galati

https://orcid.org/0009-0008-6806-0380

Dragoș Sebastian Cristea

Altfactor, "Dunarea de Jos" University of Galati

https://orcid.org/0000-0001-8227-4854

Marius Ivanov

Altfactor

marius.ivanov@altfactor.ro

Abstract: Recently, there has been a significant evolution in digital educational content that involves transitioning from the simple presentation of information in written form to the inclusion of innovative technology. This alteration is intended to facilitate the ease of integrating educational content.

This article describes the concept of Digital Smart Pages (DSP) within the EdSense educational platform context and proposes a design for this educational component. By observing user actions within the DSP and utilizing various components to process these actions, users can have a customized experience within the platform, experience that will lead to a more accessible and enjoyable assimilation of educational content.

Keywords: digital education, e-learning, personalised education, innovative technologies, educational technologies, augmented reality

Primit: 20.12.2022. Acceptat pentru publicare: 29.12.2022

Citare:

Vlase M., Cristea D.S., Ivanov, M.P. (2022). Digitalised Interactive Educational Experiences with EdSense's Digital Smart Pages. *Revista de Pedagogie Digitala, 1*(1) 23-27. București: Institutul pentru Educație. https://doi.org/10.61071/RPD.2283

Introduction

In the last years, the educational landscape has experienced a significant change due to the inclusion of digital technologies. One important aspect of this evolution is the transition from traditional printed manuals to dynamic and interactive digital manuals in educational settings. This shift has not only affected the way students receive information but has also changed the way teachers and students communicate and the overall experience of learning.[1][2]

The creation of digital manuals in schools can be attributed to the early 2000s, when technological advances in education began to become significant. Early attempts involved creating digital copies of existing written materials, providing electronic versions that could be accessed via computers. However, the actual transformation occurred with the advent of portable devices like tablets and smartphones, this allowed for a greater degree of interaction and immersion in the learning process.[3][4]

This evolution has been facilitated by a combination of technological advances, educational research, and a growing appreciation of the necessity of personalized and adaptive learning environments. Today's digital manuals contain multimedia components, interactive simulations and adaptive learning technology, being intended for diverse populations and learning styles. The combination of augmented reality (AR) and virtual reality (VR) has increased the potentialities, allowing students to participate in content in previously impossible ways. This evolution concords with a larger shift towards digitalization in education that promotes accessibility, inclusion, and collaboration.[5]

1. EdSense smart e-learning platform and Digital Smart Pages

The EdSense platform is intended to serve as an important software tool for online education, being able to provide an unprecedented, interactive, and motivating experience for students by combining gamification, artificial intelligence, and augmented reality. The primary objective of the platform is to provide a space in which users can learn at their own discretion, with the greatest degree of personalization possible. The platform is intended to be utilized by a large audience and cover a variety of topics and interests. Combining the features of mobile learning (m-learning) and online learning (e-learning), the platform EdSense demonstrates the concept of u-learning (ubiquitous learning). Combining augmented reality and personalized learning, EdSense allows anyone to learn at anytime, anywhere, and adapt to the individual needs of each user.

The fundamental unit of the educational content that will be implemented or generated by EdSense, respectively the fundamental component of the content, will be the concept of a digital smart page (DSP). As a result, the entire content composition of the platform will be a combination of DSP pages.

From an architectural perspective, DSP resembles a web page with a responsive design, containing lines, columns, cells, this architecture being ideal for accommodating the page on various digital devices of different sizes (monitor, tablet, smartphone). The DSP will have both simple multimedia components (text, images, video, audio) and interactive multimedia components, such as: interactive videos, personalized quizzes, personalized recommendations, communication with the rest of the users via components, tagging, or interaction with the rest of the users via AR.

The functionality of a DSP comes from the inclusion of the following features: a) a DSP communicates and take its content from the AI-based components of the EdSense platform (search, recommendation, personalization); b) it provides the opportunity to implement and register, in an organized manner, some structures and components related to Gamification, such as scores, badges, qualifications, and appreciation. These data, once accumulated, will be able to be incorporated into analytical structures like rankings; c) the significant components of the page are described by unique identifiers that are used to modularize the information associated with the page. As a result, a specific component (for example, an interactive video) will be able to be incorporated into different environments, such as the pages of digital books, lessons on a particular curricular theme, or as a prototype for a resource library. d) have functions that record the user's actions, both navigational (e.g. if he pressed the buttons, if he documented his writing in various text fields, if he moved the Drag-and-Drop components), as well as educational actions (e.g. if he correctly answered a question, how many times he attempted). The information thus recorded will be preserved for further analysis and as inputs to artificial intelligence-based recommendations. e) Some of the properties of the elements in DSPs (text fonts, colour) can be altered together, for multiple pages, based on the Style or Template properties. f) It is

possible to print the information in DSPs. g) could contain additional information regarding the DSP's properties. h) have quick identification features (QR Code) and access to Augmented Reality applications.

2. Digital Smart Pages Architecture

As previously mentioned, a DSP is a page comprised of multiple, interactive components. These components include simple informative texts, audio and video players, sliders, tests that are more complex, single-choice, multiple-choice, drag-and-drop components, interactive videos or activities based on AR. When communicating with components from a DSP, a user begins a sequence of activities. Every time you click on a page element, input into a text field, press a button, or even change the size of the browser window, an event is triggered. These events are partitioned into two primary types: a) General or page events, triggered by the user's interaction with the DSP. These events are of great value when tracing the activity of a user on a page, b) Component events, specific actions pertaining to components, such as pausing or playing a video or audio file, or moving from one specific position to another.

Conversely, the results of user tests are aggregated through a gamification component. This module then returns feedback that is either a rank, badge, or another form of evaluation. The gamification module takes into consideration various factors, including the amount of time it takes to solve the tests and the number of attempts made. All these parameters, plus the test results, contribute to the assessment of the gamification process. Additionally, based on the user's activity within the DSP pages, an artificial intelligence (AI) module is employed to provide personalized content to users. This content may include personalized results that are recommended, or tests that are conducted.

Figure 1 shows all the interactions with DSP websites. The figure describes and visualizes the connections and activities between DSP pages and the remainder of the platform components.

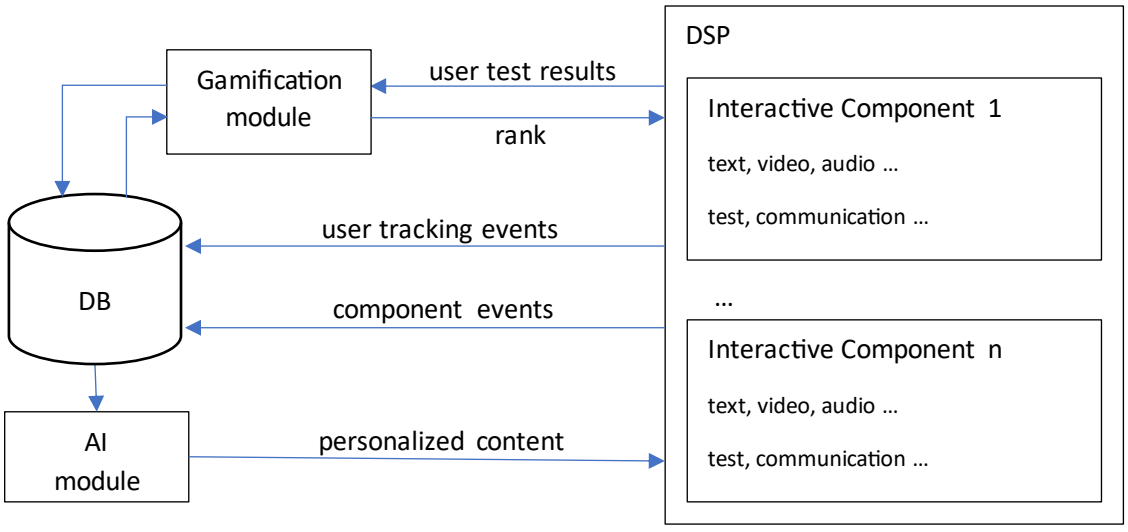

Figure 1. DSP architecture

3. DSP for User Activity Tracking

To assist in the design of the necessary DSP pages for the project, an investigation of methods for tracking the activities of users in web apps was conducted. The larger scope of this analysis was selected, as it considered the potential value of web-based identification methods for the design of DSP pages. Two types of user activity are required by all web apps: the first is the URLs that are visited, this information is used to know which web pages are accessed by users, the second is the actions that are taken, such as buttons that are pressed or texts that are entered. These two activities are intended to minimally follow the user's interaction with a web page. One of the most popular and frequented solutions for tracking the URLs that users visit is Google Analytics (GA). Despite the fact that it contains numerous

descriptions of the real-time traffic of the observed site, the pages viewed or sessions dedicated to work, GA provides limited information regarding the actions taken on the pages.

The current investigation concerned existing solutions that exist for collecting and processing information regarding the user's actions on the page. The practical solutions employed by these platforms in services can also be employed within DSPs. As such, the different types of user behaviour that should be monitored and the methods for monitoring user activity in web apps were both centralized. [6], [7].

Behavioural analytics is the act of observing and recording the quantitative and qualitative data of users with the object or product being studied, this information is then used to identify the way users interact with the object or product, and why. Two of the most popular behavioural analysis tools are: a) thermal maps (heatmaps), which can be used to follow the location of users' clickables and their scrolling behaviour on pages; b) session recordings (session recordings), which can be used to observe the actual actions of users while visiting a website.

Three primary types of heatmaps exist: a) Scrolling heatmaps, which illustrate the degree to which users are scrolling down the page and the average position they take pausing. b) Click heatmaps, which demonstrate where visitors click (and tap on mobile) while visiting the website. c) Motion heatmaps, which illustrate the manner in which users move their mouse while browsing. Heatmaps are beneficial because they can visualize the typical user experience on a website. For instance, it's apparent that many users don't descend into the page sufficiently to locate an important resource or button that would lead them to the registration of the website, or to a digital store.

As a result, the EDSense website's administrator can choose to increase the position of the resource or button in order to increase the rate of action on it. While heatmaps offer a generalizable view of the heat, they also have a limited capacity to show the overall trend. It doesn't offer any means of tracing a user's specific interactions with the website being studied in order to later decide how to enhance their experience. This is accomplished by collecting pages' events on the page.

Session recordings, also called user replay, are recordings of actual user actions while visiting a website. Records demonstrate the motion, click, tap and scrolling across multiple pages on desktops or cell phones. Also, there is a limited form of tracking the interaction of users with elements on the page, but this is still not sufficient and individualized configurations are necessary for each analysed element separately. Other platforms (e.g., Hotjar, Smartlook, Crazy Egg or Lucky Orange) allow the recording of all user activity on the page, regardless of the actions taken on the page or the configuration prior to it. All these documents are then accessible to the administrator.

Because of the large volume of records that can be accumulated over time, the platforms that provide these services have a large variety of filters that can be used to only collect those records that the administrator is interested in. These services for recording are designed to follow the privacy rules of the GDPR so that you can add filters to the recording of user activity that would prevent the collection and transmission of personal data to servers.

By storing the sessions of all users, all of the user's interactions with the analysed website are collected, including the URLs they visited, the clicks they made, the pages they scrolled through, the movements of their mouse, and the text they entered. Various analyses can be conducted with this information. The data that was collected will allow us to define events that will be later studied. The benefit of having all of the events in one place is that it can be decided at any time how to analyse an event as a page, the data about the event will already have come from the other data gathered.

Regarding the methods of Tracking Web Application User Activity, according to [8] the following web activity tracking methods were used in the EDSense platform and can be mentioned: Cookies, Cache, Local storage and session storage, Web fingerprinting.

Different services employ different methods to follow and evaluate users. Before more advanced tracking methods were developed, websites employed simple methods to observe online activity.

The majority of previous versions of web tracking were limited to a per-session basis. When a visitor visited a website, the web application utilizes a POST method to transmit data to the user for that session without the user being involved in any way. Once the window or tab was sealed, the user couldn't be traced anymore. Another method of website activity monitoring is by using an account to log in. As a result, each activity is automatically linked to the user in question. For example, to utilize the EdSEnse platform, all users are required to create an account. In this context, the primary focus is on the storage-based tracking of objects.

The utilization of cookies is by far the most common method of tracking based on storage. Information regarding the user's details is stored in cookies and is maintained in the browser. Each cookie is uniquely identified. Every individual

site is typically dedicated to a specific type of cookies. Depending on the owner of the site, third-party cookies may also be present. These cookies are also used to store information about the user's actions on the website. If a cookie is present on multiple websites or domains, it is essentially a third-party cookie. Unless cookies are erased, information about user activity on the sites is increasingly collected, this results in a profile of the user. Typically, the objective is to provide personalized advertisements to each user, but other objectives can be accomplished as well. For instance, cookies can also be employed to gather anonymous data and usage information.

Caching is a method of storing temporary Internet files. First-time visits are typically longer than subsequent visits because files like images, other website resources, and locations are stored on the first visit. It's not necessary for these images to be re-loaded every time someone goes to a website. The cache can also be utilized to decrease the time needed to search for a DNS address when a request is made to a website. Local storage and Session storage are the other two storage types that can store user information. They are similar to cookies but have a larger data storage capacity because of their larger size. Local storage is significantly larger (5MB) than cookies (which are around 4KB).

4. Conclusions

In this article, we have described the concept of the Digital Smart Page (DSP), which is a central component of the EdSense platform that facilitates education. Based on the traditional web page design, the DSP contains a variety of components intended for educational purposes, including functions that test, evaluate, or communicate. What sets the DSP apart from other conventional e-learning apps is its interaction with multiple modules, this increases the popularity and personalization of educational content. The proposed DPS architecture describes the associations between DSP pages and other components within the EdSense platform, including the AI module and the gamification module. By using the events from the DSP, these modules can provide specific information to users of the platform. As documented in this article, DSP utilizes multiple types of events for both page and component tracking. Through these events, the personalized generation of content becomes possible, and the post-acquisition analysis of data can enhance the creation of educational materials. The integration of the gamification component into the platform is expected to increase user participation, which would increase the popularity of navigating educational resources. Alongside the personalization of content provided by the AI module, this combined approach attempts to facilitate a more enjoyable and smooth learning experience for users, making the absorption of educational content more accessible and pleasant.

References

[1] Clark, R.C., and Mayer, R.E. (2016). E-learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning. John Wiley & Sons.

[2] Hattie, J., and Yates, G.C.R. (2014). Visible Learning and the Science of How We Learn. Routledge.

[3] National Center for Education Statistics. (2020). Educational Technology in U.S. Public Schools: Fall 2019. U.S. Department of Education.

[4] Sharples, M., et al. (2017). The educational use of mobiles in K-12. Handbook of Mobile Teaching and Learning, 1-16.

[5] Johnson, L., Adams Becker, S., Estrada, V., and Freeman, A. (2015). NMC/CoSN Horizon Report: 2015 K-12 Edition. The New Media Consortium.

[6] https://www.hotjar.com/website-tracking/how-to-track-user-activity/

[7] https://www.smartlook.com/blog/tracking-user-activity-on-website/

[8] Tomasz Bujlow, Valentín Carela-Español, Josep Solé-Pareta, Pere Barlet-Ros, Web Tracking: Mechanisms, Implications, and Defenses.

* * *

The project "Ed-SENSE - Innovative educational platform for collaborative, collective and individual training, based on an artificial intelligence, gamification and augmented reality system" is financed from European funds through the Regional Operational Program (POR) 2014-2020, Priority Axis 1 - Promoting technology transfer, My SMIS Code: 150022