Changing the Wheels on a Moving Car: Leveraging a Content Management System to Develop an Extensible Digital Intervention

Brian Dillon

Vasilis S. Vasilou

Samantha Dick

Ciara Heavin

Martin Davoren

See next page for additional authors

Authors

Brian Dillon, Vasilis S. Vasilou, Samantha Dick, Ciara Heavin, Martin Davoren, Samantha Dockray, Conor Linehan, and Michael Byrne

Changing the Wheels on a Moving Car: Leveraging a Content Management System to Develop an Extensible Digital Intervention

Brian Dillon

Cork University Business Information Systems, University College Cork

brian.dillon@ucc.ie

Vasilis S. Vasiliou

School of Applied Psychology, University College Cork

v.vasiliou@ucc.ie

Samantha Dick

School of Public Health, University College Cork, Ireland

samantha.dick@ucc.ie

Ciara Heavin

Cork University Business Information Systems, University College Cork

c.heavin@ucc.ie

Martin P. Davoren

School of Public Health, University College Cork; Sexual Health Centre, Cork

martindavoren@sexualhealthcentre.com

Samantha Dockray

School of Applied Psychology, University College Cork, Ireland

s.dockray@ucc.ie

Conor Linehan

School of Applied Psychology, University College Cork

conor.linehan@ucc.ie

Michael Byrne

Student Health Centre, University College Cork

m.byrne@ucc.ie

Abstract

Drug use among higher education students is a pertinent public health issue, with around a quarter of students reporting current use of an illicit drug. MyUSE is an algorithmic, digitally delivered intervention aimed at reducing harms from drug use among higher education students. While many digital interventions around this topic exist, previous work has failed to employ behavioral science in a systematic way. MyUSE focuses on user-centered design (UCD), targeting relevant behavioral changes which are translated into digitally delivered components. This paper describes the challenges of working in an interdisciplinary project team and presents the software-based solutions applied to overcome them. The methodology described demonstrates how sharing the implementation workload can promote synergistic interdisciplinary work in parallel. By providing a flexible centralized platform to manage content and ideas, certain technical requirements become clearly defined and addressed.

Keywords

Extended Abstract

The development of the MyUSE project (described elsewhere; Dick et al. 2020) took place over a 36-month period, involving three systematic literature reviews and a large mapping exercise to guide the intervention development. A comprehensive synthesis of knowledge, using the Behavioral Change Wheel framework (Vasiliou, V. S. et al. 2020), assisted the project team to identify the most potent components for inclusion. The development of the prototype took place over 12 months, adopting a UCD framework (Organ et al., 2018) and agile methodologies to facilitate adaptive project planning (Beck et al., 2001). In this paper, we describe the technological challenges and solutions faced during the adaptation of a series of behavior change techniques to a digital format. This approach is presented to support other research groups in combining expertise toward the development of digital applications targeting emerging societal problems.

Establishing requirements and adapting technologies

The focus of early intervention development was to effectively translate the existing literature of harm reduction practices into an engaging web application, utilizing modern web technologies. The newly developed *MyUSE Clinical Algorithm* would lie at the core of the application (Vasiliou, V. S. et al. 2020), connecting 11 modules of the intervention content, each comprising a number of navigable 'pages'. Module content is divided into pathways, conditionally provided to users based on an integrated profile building assessment. While a large body of work was available to support the application design, the format, features, and page flow logic of each module were yet to be determined. The team adopted three key principles that guided the design and development of the algorithm:

a) Users will be brought to different pages of the intervention modules via a *Decision Tree Rules Engine*. Page flow logic would be dictated by any number of conditions, based on the literature, specified within a single easily configurable JSON file.

b) A *Feedback Generator* will process tailored content to engage the user, included as part of each page and based on answers throughout the course.

c) The efficacy of the application will be continuously evaluated and should allow further enhancements to design and content without changing the core application. An internal mechanism to measure engagement would lend to this.

The development process involved parallel work around technical implementation, content, and design. Choosing a suitable technology stack was key to accommodating the ongoing changes to design and content

without hindering creativity or innovation. Time and resource restraints had to be considered for development milestones to be met.

Integrating the Content Management System

One of the initial difficulties we encountered was consolidating the work and expertise across our multidisciplinary team. The behavioral change content often moved quickly ahead of the design and implementation of the digital platform, initially leading to some overlapping workloads and back-tracking. As the personalization of the behavior change intervention grew, so did the functional complexity.

NetlifyCMS, an open-source CMS package, was employed to share the workload in creating and editing content. The intention was to offer a 'blank canvas' to team members, allowing the rough mapping of content and ideas in the early stages of development. By visualizing the structure and relationship of content, a set of required features and navigation logic emerged, prompting technical discussion amongst the team and making it easier to identify technical limitations early on.
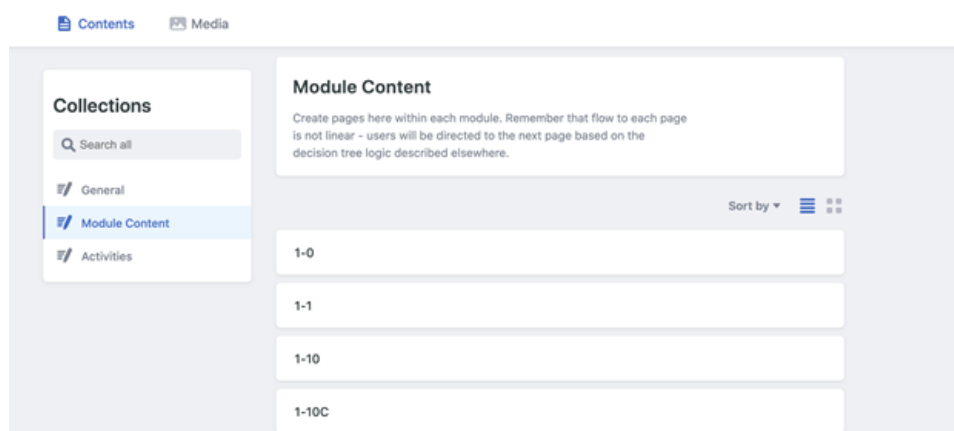

Figure 2. The NetlifyCMS Interface, available to core team members for content creation.

Dynamic Integration of components

NetlifyCMS (illustrated by Figure 2) provides an integrated UI to facilitate the creation and easy editing of YAML markdown files, particularly with regards to textual content (Attardi, 2020). Published 'pages' are rendered within the local repository to subsequently be consumed by the application. In the early stages of our development, additional notes would be added to page contents in order to better illustrate design instructions in place of, or complementary to, design mockups.

NetlifyCMS supports Front Matter, thus allowing variables, arrays, and objects to be defined within the CMS and rendered to YAML. By leveraging *Nuxt Content*, a headless CMS package as part of the NuxtJS framework, we could define pre-written *VueJS* UI components within the markdown and inject these variables. The Feedback Generator controller could then process this text and output the correct content to be shown to the user.

Typically, implementing interactive features are the responsibility of the developer. However, by combining these technologies we could facilitate faster, automated implementation of both design and content, allowing team members to easily implement design and content without prior coding experience. This innovation was of significant benefit to the speed of development, giving content-creators the means to apply custom-built components, recall items from state, and specify dynamic content to be displayed on

each page. Figure 3 illustrates a typical page outline within the CMS, allowing users to integrate dynamic content within the working prototype.
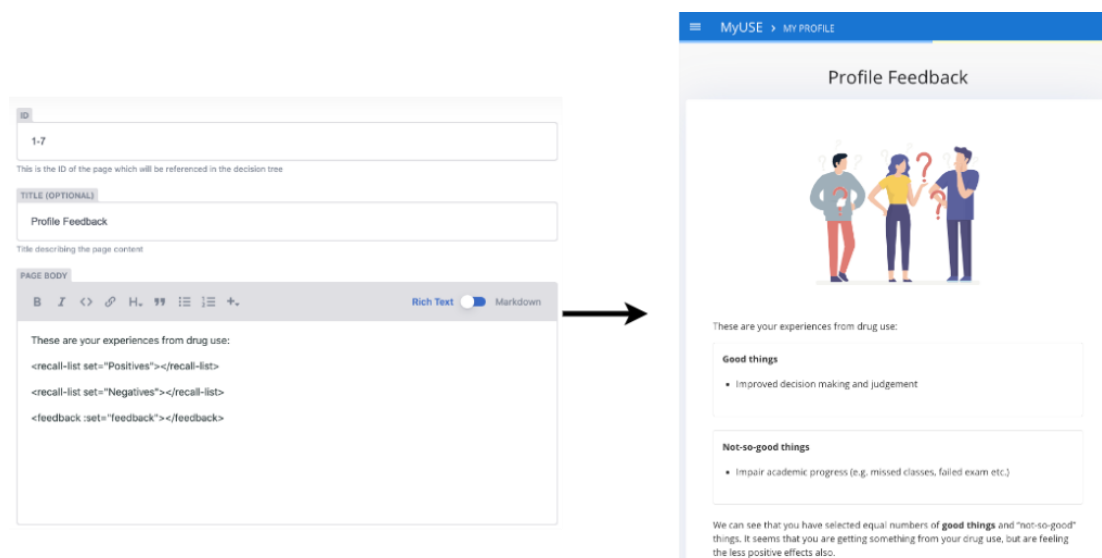

Figure 3. Typical page outline within the CMS, paired with the Feedback Generator module.

As the project unfolded, further leveraging of NetlifyCMS functionality allowed the assignment of unique identifiers to content, enabling granular analysis of components. This provided a mechanism to facilitate data-driven design and evaluation, ensuring that content resonated with our target users i.e., students in higher education. This also allowed easy implementation and testing of experimental designs, specific modules or components.

Contributions

This paper briefly illustrates how the MyUSE team utilized an innovative technology stack in which different layers of a digital behavior change intervention development could be integrated in a way that accelerated continuous and concurrent progress towards a shared goal, the development of the MyUSE platform. The described methodology naturally complements parallel interdisciplinary work and the quick conversion of ideas into a clear set of features and technical requirements.

The approach outlined has the potential to greatly improve the speed of development by providing non-technical team members the tools to implement and manage complex content. It also eases the workload on developers who are balancing the principles of agile, with a focus on '*maximizing the amount of work not done'* (Beck, et al. 2018). The extensibility of this approach also offers scope to easily repurpose content alongside continuous data-driven design, enabling multidisciplinary teams to quickly and effectively respond to broad societal issues.

Funding

References

- Attardi J. (2020) The Editorial Workflow. In: Using Gatsby and Netlify CMS. Apress, Berkeley, CA. https://doi.org/10.1007/978-1-4842-6297-9_13
- Beck, K., Beedle, M., van Bennekum, A., et al, (2001). Manifesto for Agile Software Development, Retrieved Oct 15th, 2020 at URL Agilemanifesto.org.
- Organ D, Dick S, Hurley C, Heavin C, Linehan C, Dockray S, et al. (2018). A Systematic Review of User-Centered Design Practices in Illicit Substance Use Interventions for Higher Education Students. 25th European Conference on Information Systems - Beyond Digitization: Facets of SocioTechnical Change, Portsmouth, UK
- Vasiliou, V. S., Dockray, S., Dick, S., Davoren, M. P., Heavin, C., Linehan, C., and Byrne, M. 2020. "Reducing Drug-Use Harms among Higher Education Students: X Contextual-Behaviour Change Digital Intervention Development Using the Behaviour Change Wheel," preprint, Preprint, In Review, October 8. (https://doi.org/10.21203/rs.3.rs-86503/v1).
- Dick S, Vasiliou VS, Davoren MP, Dockray S, Heavin C, Linehan C, Byrne M. 2020. A Digital Substance-Use Harm Reduction Intervention for Students in Higher Education (MyUSE): Protocol for Project Development.
- Vasiliou, S. V., Samantha, D., Dillon, B., Heavin, C., Davoren, M. P., Dockray, S., Linehan, C., and Byrne, M. 2020. "A new clinical algorithm embedded in a contextual behavior change intervention for higher education student drug use," in *"Addressing Global and Grand Challenges with Analytics*, Virtual: The International Conference on Information Systems.
- Dick S, Vasiliou VS, Davoren MP, Dockray S, Heavin C, Linehan C, Byrne M. 2020. "A Digital Substance-Use Harm Reduction Intervention for Students in Higher Education (MyUSE): Protocol for Project Development"