

I.D.E.A.

Intelligently Designed Educational App

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1 Introduction

In this white paper, we will lay out the motivation for our project and describe the methods and thought processes that have brought us to develop the final version of our deliverable. The design of the app-prototype required us to go down many paths of exploration and inquiry, and hopefully, as you read further, will also take part in our design process.

2 Motivation of the Project

Pretty much ever since the beginnings of the internet, people have started to create educational content on almost any topic imaginable and have shared it with others around the world. Platforms such as Youtube connect content creators with those that want to learn more about a specific topic. Other platforms such as Netflix or CuriosityStream provide documentaries for people to learn and broaden their horizons. Udemy, Coursera, KhanAcademy and other companies sell courses created by educators or offer them for free. All of these are great resources for getting introduced to a topic. However, we believe that they have a risk to them. They rely mainly on passive educational content such as videos, recorded lectures or slides. The user can thus spend considerable time passively consuming this content in the genuine belief that he or she is “being productive”. However, in our personal experience, the passive nature of the content makes it easy to get distracted in the process and pay only half-hearted attention to the material.

This has also become evident in the wake of the ongoing Covid-19 pandemic. The small scale learning environment at UCG allows for very interactive seminars that are tailored to the students’ interests and many lecturers know to use

this to make their courses enjoyable. Unfortunately, with education moving online we experienced first hand that most lectures now consisted of monologues by the teachers potentially supported by a slide show. Occasionally, presentations of the same format by students were introduced to “spice things up” but the overall nature of education became very passive. This should not be understood as an attack on the teachers who we realise did their best to cope with a new situation that everyone needed to get used to. However, it made us wonder whether technology by now should not be able to provide tools to make education online more interactive. This motivated us to look into existing concepts of interactive teaching online, come up with our own ideas along the way and finally attempt to integrate our findings into two prototype courses which people could follow through our self-programmed app.

3 Design and Function of the App

IDEA was built under the philosophy that a good education app is tailored specifically to the user. Nothing more, nothing less. It features a minimalist design; every line of code, as well as every button, slider, bell and whistle were implemented with efficiency in mind — both in terms of the app’s functionality, and to encourage efficient learning. IDEA was built as a mobile-first web application, that is accessible on any device with an internet connection. Although it is built using the latest web technologies, steps were taken to ensure compatibility with older devices was maintained, where possible. The app is dynamic, fitting to a large variety of screens and adjusting itself appropriately to different device orientations. Its interface is sleek, and features an intuitive “swipe to the next page” design, reminiscent of turning a page in a book. Blue hues tint the app’s white surface, indicating to the user what elements can be interacted with. A uniform color scheme was chosen to ensure that the app’s design did not steal attention away from its content. Two fonts are primarily utilised throughout the app: a serif for titles, and sans-serif for body, the latter which was chosen for readability. Within the settings tab users have the option to enable a unique font “Sans Forgetica” that was designed to facilitate memory retention (<https://sansforgetica.rmit/>). The settings tab also features a “dark mode”, in order to facilitate healthier and more effective learning in the evening, and in dim-lit environments. These settings are automatically saved and reapplied whenever the user re-enters the app. In this way users may tailor the entire app experience to better suit their needs. All in all, both the app, and its content, hopes to live up to its title as “Intelligently Designed”, by tailoring itself to the needs of each individual user.

4 The Interactive Model of Learning - Why Bother?

This section is based upon an extended interview with Judit Kukawka M.A., educational coordinator of pre-elementary institutions in the ministry of education, northern Israel

It is easy to under-appreciate the complexity of human learning. The premise of this project's motivation can crudely be compacted down to "interactive - good, passive - bad", and although for all our purposes seeing it in that light is sufficient, this more academic section of the review demands a little more sophistication than that.

The general underlying research question that corresponds to the essence of the project's goal has to be clearly defined. Since our aims amount to increasing the proportion of interactive learning in relation passive absorption, it can possibly be formulated as so:

Given a certain ratio of passive to active learning, will increasing this ratio in favour of active learning prove beneficial to various indicators of learning (i.e. retention, understanding etc.)?

One can imagine various ways in which this could be studied. Taking a few groups and instructing them with different methods and comparing to a control will do just fine. However, there is a flaw with this simple test. Our results could indicate that, on average, a certain method of study turns out to be more effective than others (which is most certainly what would come out), but then, what meaning can we hope to gain from such a finding? The reason we have to ask this question is because people themselves vary widely in learning styles, and a measure of 'interactivity' is just as much of a measure of what is happening inside the brain than outside of it. Returning to our hypothetical study, let's say people performed better on subsequent retention tests if they were part of the 'interactive' group where they learned the information through playing a game, compared with the 'passive' group where participants were exposed to the information only through a video. The reason those two words are in quotes is that this kind of study will not necessarily provide a verdict on interactivity, or more precisely, on external interactivity. For example, a person in the video-watching group may, in contrast with most of his peers to the group, derive a lot more internal interactivity from watching a video rather than playing the perceived interactive game. For this person, he was put in the interactive group, and he would arrive at the same conclusions as the researchers of the study, but from flipped data.

This, then, unavoidably leads us to modify the definition of interactivity. Anything we do in the outside world is only done in the service of stimulating our brains, and so instead of classifying methods of learning as 'interactive' or not, we would need to classify them as: 'most likely to induce internal interactive engagement' or not. That's a bit of a mouthful, and however subtle of a difference it may seem from just 'interactive', it leads to important consequences, namely that we cannot, in the name of good scientific practice, call something interactive or not.

So, after having discussed what we should mean by interactivity, it seems a little more of an odd question to ask whether it is a better style of learning than passive absorption - *of course* it is. In fact, that was probably the implicit assumption we all had when first considering the distinction between the two. 'Passive' learning cannot be all that passive, as almost tautologically any sort of learning must be active in some sense - the brain needs form connections, rewire, etc.

Another approach is to observe the learning styles of babies and infants. It comes as no surprise that they are all very active. That is how we all learn growing up; from seeing, hearing, feeling (and licking) the world around us. As we develop, each person has his own unique way of learning most effectively, and it would be at best incomplete to attribute effectiveness to a method of learning. Instead, we should attribute individuals to a *compatibility with a method of learning*.

Therefore what is perceived as an externally active method of learning, like our app, should be more clearly seen as a platform that is more likely to be compatible with more people's learning styles. Then, we do not, we cannot, fully advocate for interactivity with same religiousness as preachers advocate the teachings of scriptures. Whatever happens inside a learning brain is mostly dependent on the individual, and learning methods should allow for the possibility that they are not always compatible with everyone to the same extent.

To summarise, a better research question could be of the form:

Do 'externally perceived interactive methods of learning' tend to align with true and effective internally active methods of learning in humans?

5 Concepts Implemented in the App

The concepts implemented in the app to improve the educational experience can be divided into two broad themes: tailored experience and interactivity.

5.1 Tailored Experience

One problem that is present in any educational setting, whether online or in the classroom, is that students are at different levels of understanding. While some might bring in previous knowledge making it easier to understand the material others might have a particularly difficult time getting a grasp of the concepts that the teacher tries to convey. This puts the teacher in a predicament. He or she has to choose whether to reduce the pace which gives struggling students time to understand the material but might have others bored or the continue with new content at the risk of leaving some behind. However, it does not have to be this way. Technology enables us to tailor the content to each student's personal skill level. This way aside from being able to choose their own pace at which to go through the course materials, the content itself will actually be adjusted according to their learning progress and preferences. At the beginning of a course a short quiz might allow to get an impression of the student's current knowledge which can be used to skip or abbreviate sections with which he or she is already familiar. The student's success in answering questions throughout the course can be used as guidance to automatically adjust the difficulty of future questions. This ensures that the challenges the student is presented with match their current skills. Striking this balance is essential as it is precisely the borderline between boredom and overtaxing where we experience the state of "flow". This state name by the psychologist Mihaly Csikszentmihalyi occurs when the challenge an individual is presented with matches their ability to complete it allowing the individual to become fully immersed in the task or experience. Achieving flow state during learning is thus

desirable as it makes the learning experience feel effortless and has been shown to increase student satisfaction ¹.

5.2 Interactivity

Multiple concepts to increase the interactivity of a course were implemented, namely brainstorming, quizzes and interactive models.

- Brainstorming is an activity that encourages thinking about a topic in broad terms. It is often used in classrooms but rarely seen online, especially not in courses that are followed by only one individual at their own pace. We nevertheless thought of a way it could be implemented. The student is given the chance to enter as many associations with a given topic or question as he or she can think of. Once the ideas run out, the results are then matched with a list of keywords (and their synonyms) that the educator would like students to come up with. The student is shown which terms he correctly associated with the question and for which terms he or she did not mention any synonym. This feature especially suits situations where students should think broadly about what might affect a certain mechanism, possible effects of a problem and the like. A valid criticism is that it might be hard for educators to predict all the ways of expressing terms that students might come up with. However, this could be combated by continuously updating the list according to the submissions of students. If a term that is not on the list gets entered frequently the educator can review it and add it to the list if appropriate. Unfortunately, we were not able to implement this improvement as our current software does not allow for everyone's submissions to be saved to a general database. The brainstorming feature in the sleep health course thus relies on a predetermined and unchanging list.
- Quizzes can take over multiple functions. Firstly, they can provide a student with feedback on whether or not they have understood the material that they were previously introduced to. If a student is unable to answer the questions this indicates a lack of understanding for the content that should be addressed before moving on to the next topic to avoid getting lost. The course might in fact be set up in a way that makes it impossible to advance without solving a certain task successfully, though this risks causing frustration for the student if it is not paired with adequate feedback on what exactly the student misunderstood. A more lenient alternative is to point students to the section that the question was based on but only encourage them to look at the respective section again rather than prohibiting them from moving on. Secondly, quizzes can also play an important role in facilitating a personalised learning experience which links back to the discussion on tailored content. The results of the quiz serve as an indicator of the students current understanding and the following sections of the course can be adjusted accordingly.
- Interactive models provide a great opportunity for people to explore certain dynamics themselves and understand the intricacies of complex behaviours. Though not all topics lend themselves to creating models on the topic, many are suited

¹Rossin, Don Ro, Young Klein, Barbara Guo, Yi. (2009). The Effects of Flow on Learning Outcomes in an Online Information Management Course. *Journal of Information Systems Education*. 20.

exceptionally well (see for example the spread of pandemics, natural selection, racial segregation or physics simulations). Where a (simple) model of a certain phenomenon can be created this can allow students to play with the parameters of the model and experience first hand how the initial conditions can change the development and outcome of the model. Students can be given the task to set the parameters in a certain manner and observe the emerging pattern, they can be challenged to create a specific pattern by adjusting the parameters or they can be given total freedom to play with the model and try to discover interesting patterns themselves.

6 Key Takeaways

So what do we expect you, the person who has made it thus far reading this report, to get out of this project? To just throw it on the table, with no prior fuss: we do not expect you to be excited about or even want to use our new app. Don't get us wrong, we would be chuffed if you did, however that would not be the core of what we are trying to do. An explanation is now owed.

It is important to reiterate the goal we set out to achieve when embarking on designing the app of IDEA. It was to offer a different, and in many ways more interactive, educational platform in order to better highlight the current status-quo of short-media consumption on the web to the background of other possible learning paradigms. The (not very small niche) we are targeting are short (around 10 minutes) educational videos, mainly on YouTube. The fact that this became a popular habit of information consumption does not necessarily mean it naturally fell down to its intended equilibrium position. We believe that it is up to the providers of those platforms to offer a wider range of educational opportunities - which brings us to the app.

It is very possible that the current equilibrium is not the optimal one for many learners out there, and they might not even know it. Putting up a contrasting screen to the current situation may help shed light on different avenues by which people can approach learning, and thus allow them to choose their most effective path.

Therefore, if after being exposed to our project you realise that the platforms out there may not necessarily reflect your true individual style of learning, we have succeeded. If you take more of an 'active' role in learning to find the best methods for you, we have succeeded. If you simply pick up the app, play around with it without ever giving it much thought - we have failed.

7 Look into the Future

As expressed in the previous section, there are many avenues which this project could possibly advance across in the future. The field of online educational platforms can be reliably predicted to continue to incrementally dominate over the more traditional forms of learning, and therefore any such activity in this particular field is bound to yield new knowledge and experience for succeeding activities. With the distribution of a learning platform like our app, one can imagine collecting user feedback to report on effectiveness and experience in order to improve it.

Academic research can also be coupled to a distribution of such an app. As discussed above, learning is a fascinating and complex area of research that still has many unexplored aspects. Looking into the effects of different styles of learning platforms can hope to give us a better understanding of what, and who, will benefit the most from any given educational platform.

Since our original motivation for the project was partly drawn from the shortcoming of YouTube, an ideal case would be to somehow create a symbiosis of the two learning styles that we have highlighted in this project. This happened many times over, where various internet platforms joined forces (or merged...), realising that the best and most effective user experience was to provide diversity and options, rather than sucking attention only to your own platform. For example, I could be watching a YouTube video that then recommends me to approach whatever I am learning from a different angle, say our app, to get a more full experience of learning.