

KA Projects

Introduction

KA Projects a “project” framework for the Khan Academy website. Projects are activities where learners practice recently learned knowledge and skills by working for an extended period of time to investigate and respond to a complex question, problem, or challenge that builds on skills covered individually on the site. Examples of projects include creating graphs of object frequencies around the house, budgeting for an imaginary trip, and finding the volume of juice boxes. Instead of getting suggestions on what skills to master next based solely on personal skill proficiencies, site users could instead specify projects of interest and follow a learning trajectory that helps them master all the necessary skills in order to attempt the projects. This application stand on its own, but is also a proof of concept for a larger extended version that could be incorporated into the Khan Academy website itself.

Scoping

What follows is a list of major components of the KA Projects web app:

- Account creation and control
 - Account creation and authentication
 - From the login page there is a link to a create account page
 - Once the user inputs a password, name, and unique username and email, they are guided through authentication with Khan Academy (OAuth) so that the site can access their proficiency information before directing them to My Projects
 - Login
 - Whenever a user logs in, the app updates their proficiency list
 - Account control
 - Users who forget their usernames or password can retrieve them with the email associated with their account. An email is sent with a username reminder and a password reset link
 - Once logged in, users can change their name or email address via a password gated tab. They can also delete their account using this tab
- All Projects
 - The All Projects page has a list of all published projects the user has not added to My Projects
 - Each project has an easily viewed thumbnail, title, and description. Clicking the projects shows the user the full description and a list of prerequisites for the project and gives the user the option of adding the project to their queue
 - Projects can be searched by title or prerequisite
- My Projects
 - The My Projects page has the user’s projects. It has four tabs:
 - In progress: projects that have been started but not completed
 - Clicking on projects on this page bring the user to the project viewer for that project
 - In queue: projects that have been added to the queue but have not been started. Projects that have been unlocked (the user has all prerequisites) are listed first and outlined in green.

- Clicking on unlocked projects on this page bring up a modal with more information that asked the user if they want to start the project. If the user chooses the start the project they are redirected to the project viewer for that project
- Clicking on locked projects brings up a warning modal informing the user that they do not have the prerequisites required to complete this project and suggests what exercises (complete with linked to the exercises on the Khan website) to gain proficiency in to work towards unlocking the project. They can choose to start the project despite these warnings, redirecting them to the project viewer for the project
- Completed: projects user have completed and submitted. These projects are un-editable and can be viewed by anyone with the link
 - Clicking on projects on this page bring the user to the un-editable project viewer for that project
- Authored: A list of projects the user has authored, both published and unpublished, plus a button for creating new projects.
 - Clicking on projects on this page bring the user to the project editor for that project
- Visible from all four tabs is the recommended exercise box
 - The user can select to either work towards all projects, or any specific, unlocked, enqueued project
 - The box then provides links to the exercises the user needs to next gain proficiency in to make progress towards completing the prerequisites for that project or all projects, max five
 - If the suggestions look out of date (the user has gained proficiencies since last logging in), the user can update Khan info with a button below this box
- Project editor
 - The project editor has five tabs:
 - Contents
 - The content tab allows authors to create, manipulate, reorder, and delete pages.
 - Pages have a title and content
 - Page content can be text, user input, author upload, user upload, embedded videos, and exercises created using the Khan Academy perseus framework
 - Prerequisites
 - Prerequisites are skills the user is expected to understand before attempting the project
 - Authors add prerequisites from the list of all exercises users can get proficiency in on the Khan Academy website
 - Proficiencies are added with a standard search function and can be removed with a single click
 - Help videos

- Help videos are links to Khan Academy videos to help confused learners displayed in a sidebar on the project
- Authors can add help videos with a search bar and remove them with a single click
- Rubric
 - The rubric is a page that is appended to the end of the project once the learner has submitted the project to help the learner self-assess the project
- Information
 - Authors can edit the title, description, and thumbnail of their project on this tab
 - Authors can save their project with a button click from this page
 - Authors can publish their project (if it is publishable) from this tab. If it is not publishable, a modal informs the author what they must finish in order to publish the project
- Project viewer
 - ‘Pages’ as created in the project editor are viewable and able to be manipulated on this page
 - Pages that can be assessed (exercises) are checkable like Khan Academy exercises
 - Pages that are completed are marked as green in the navigation bar
 - Links to help videos are always viewable in a sidebar while completing the project
 - Users can save a project at any time while working on it. This button is disabled on completed projects
 - Users can submit a project at any time. If the project is un-submit-able, a modal will come up informing the user of what they need to complete before submitting the project. This button is disabled in completed projects

Justification

A good assignment tests what has been taught

It’s more than unfair when an assignment expects mastery of skills or concepts that have not been taught; it’s pedagogically unsound. Therefore, KA Projects uses a backwards design model to plan and create projects. The backwards design model helps avoid common pitfalls of teaching- activity oriented planning and coverage- by focusing on content and essential questions before determining an assessment and making sure the lesson plan leading up to that assessment covers all the material and skills tested by that assessment.

In the context of a learning website, backwards design cannot and should not be implemented in exactly the same way as a teacher designing a lesson plan. Khan Academy provides a flexible education experience and can be used in a variety of ways. Learners can be guided through activities by a coach (as a supplement to an in class curriculum), follow the recommended learning path and learn on their own (as if with a tutor), or choose select skills they wish to learn or review. Khan Academy does not concern itself with making a cookie-cutter curriculum for all classrooms, but sees itself as both a tutor and a tool to be used by teachers in a variety of ways.

Therefore, backwards design is not being incorporated into a large-scale curriculum or even units, as it usually would be.

So, how should backwards design be integrated into the project framework? Most importantly, projects are not islands of learning. Project designers should start by thinking about an essential question that would require multiple skills to answer. Then the project creator, before designing the project itself, should select the skills required to answer this question and mark them as 'required skills' for the project. Finally, the project creator can design the project itself, finding a way to assess and combine the required skills into one common task. The beauty of this system is it both encourages the project creator to use backwards design and it tells the learner exactly what skills they will need to have mastered to complete the project. Since the 'required skills' are already linked to the Khan Academy tree of knowledge, even if learners are far away from being able to complete a project, they will know exactly what skills they will need to have mastered in order to complete the project. For example, if a project has 'multi-digit addition' as a required skill, students who have not mastered 'single-digit addition', will be prompted to master 'single-digit addition' before 'multi-digit addition' before attempting the project.

A good assignment is a learning experience in itself

This requirement is particularly important for the Khan Academy project framework since the website can be used without the project feature and therefore students can move forward through the skill tree without demonstrating proficiency through projects. If projects are not a useful learning endeavor, for many of the learners they will hold little genuine benefit. Most students spend a non negligible time completing assessment activities, and although the importance of gathering data on how students' understanding should not be downplayed, regular assessment is a waste of student time if they are not learning from the experience as well.

For example, I would like to consider the two assessment questions explored in ["The Stereotypes about Math that Hold Americans Back"](#). The first question shows two triangles and asks, in multiple-choice format, what combination of congruent and similar they are. This question tests 4 major skills: what is a right triangle; how many degrees make up a triangle; what does 'similar' mean; and what does 'congruent' mean? If a student knows those 4 facts (and can read the question), the student demonstrates his or her knowledge by ticking the correct multiple-choice answer and moving on, without really having to wrestle with or synthesize the information at all. If the student doesn't know one of those facts, there is little they can do beyond intelligently guess an answer and move on. In contrast, the second question asks if a triangle goes through some combination of transformations, is it always, sometimes, or never congruent to the original triangle, and asks for justification for this answer. This question requires a similar subset of skills, knowledge of what rotation, reflection, translation, and dilation mean; and the knowing the definition of 'congruent'. However, if the student has mastered these skills, he or she still needs to synthesize those definitions and apply them in order to find the answer, both requiring a greater mastery of the original skills than the first questions, but also serving as a learning experience for the student who leaves with a greater understanding of how to apply those skills.

The Khan Academy project framework more closely resembles the second example than the first. Of course a lot of the responsibility for this goal falls to project creators, however, our framework makes it easy to create projects that are also learning experiences. Most importantly, the framework allows for a variety of assessment tasks, not just multiple-choice questions (in fact, multiple choice questions should be used incredibly sparingly). Some of these tasks are able to be machine graded, such as graph manipulation, open answer calculations, and other simple open-ended questions like the one above. However, to allow for greater flexibility of content creation, projects also have the option to either be coach or peer 'assessed'.

A good assignment is flexible and personalized

Not all students are the same, and good teaching should reflect that through differentiation. This is where technology really shines. In "The Differentiated Classroom", Carol Ann Tomilson states, "In a differentiated classroom, a teacher makes consistent efforts to respond to students' learning needs' She is guided by general principles of facilitating a classroom in which attention to individuals is effective' Then she systematically modifies content' process' or product based on students' readiness for the particular topic, materials, or skills; personal interests; and learning profiles." But a single teacher can only differentiate so much; he or she only has so much time.

In the case of an educational website, data driven learning can help assess students like a personal tutor. With a flexible project interface, a huge variety of projects can assess the same skills, lending itself to a differentiated global classroom Tomlinson could have hardly dreamed of! Students can build their own curriculum by selecting the projects that interest them, being prompted to add projects that fill in the gaps in their learning. Assessment can be incredibly 'ongoing' by fitting seamlessly in skill acquisition exercises and 'diagnostic' by drawing on data of previous students with a similar learning profile (making similar mistakes, interest in similar projects). Finally, the required skill framework suggested above allows personalized preparation for assessment, so every learner practices all the skills necessary at their own rate before attempting the assignment.

A good assignment requires integration of multiple skills to complete

The key word here is integration. Not only is learning to integrate skills an incredibly useful, I'd argue necessary, ability to develop in the modern world, but without assessment tasks that require integration of multiple skills learning happens in a vacuum where students have little understanding of how skills relate to each other and can be used outside the classroom. I'll be using Ralph Tyler's criteria for effective integration to assess how well the KA Project app fulfills this objective.

The Khan Academy tree of knowledge, and therefore projects, lends itself very effectively to continuity and sequence. When students master skills on Khan Academy, the website suggests logical follow-up skills that build on and recruit the skills the learner has already mastered. Additionally, the website prompts users to occasionally complete 'mastery tasks' of previously practiced skills to achieve mastery status. Projects would fill much the same role as 'mastery tasks', allowing learners to "progressively develop... understanding or skill or attitude or some

other factor” as quoted by Tyler. Once they have practiced the skills necessary to complete a project, the learner would have to wrestle with the skills on a deeper level and integrate them together in order to complete the project. For projects that are peer graded, learners will even get the extra learning experience of assessing and teaching the topic to other students after they are finished with the project itself.

Integration is in many ways absent from the current Khan Academy model. Different fields have separate knowledge trees even in topics that are in many ways dependent on each other (one for math, one for chemistry...). A well-designed project interface allows for parallels to be drawn between disciplines as required skills can be from different knowledge trees, showing students how different disciplines relate. Our current framework is only built for math curriculum, but could easily be extended to be cross-disciplinary.

A good assignment is authentic

Websites like Khan Academy, especially with the addition of my project system, provide a valuable alternative/supplement to grades for student assessment. Instead of merely looking at grades, a single letter expected to convey mastery of a concept, colleges or other institutions (which I will call ‘the third party’) deciding whom to admit or hire, could look at summaries of performance on educational websites. This has a number of advantages. Firstly, the third party can choose to look in as much or as little detail as they desire, as large a picture as ‘in what concepts has this student developed mastery’ to as detailed a picture as ‘how much does this student challenge themselves’ or even ‘how does this student deal with frustration’. Regardless of what scale the third party looks into, I would argue that they get a more ‘authentic’ assessment from an educational website than they do from grade’s largely determined by tests. Students who have demonstrated and maintained mastery of a subject get to do so at their own pace, not during a single, high stakes test and have demonstrated that mastery repeatedly, proving they have internalized the lessons over time, not just regurgitated the information and never really understood it.

A good assignment inspires intrinsic motivation

A learner’s intrinsic motivation is heavily tied to self-efficacy and interest in the material. A well-designed project interface inspires both. Learners using the Khan Academy project system can build their own personalized curriculum by selecting projects that are relevant to their interests. By working through skills required in order to accomplish projects, it’s easy for learners to see the progress they are making and applications of the knowledge they are gaining, making learning much more rewarding and interesting. Also, since the Khan Academy suggestion mechanism will guide learners through the many levels of skills necessary, learners are unlikely to attempt projects before they are prepared, meaning students will directly see the positive effect of their hard work.

There are many other techniques Jimmy Santiago Baca suggests to instill self-efficacy that can easily be incorporated into our online project platform, particularly encouraging peer and role model involvement. The coach system allows for easy parental or other role model involvement. Learners can add anyone they wish to monitor them as coaches, allowing parents to watch, encourage, and aid their children when necessary. Peer involvement can be manifested in peer-assessed

projects as suggested above, but also in active discussion rooms and tutoring boards, and by displaying previously done projects to students who have completed projects. Learners will not only deepen their knowledge by learning how other students completed the projects, but will be able to provide helpful feedback and praise to each other.

Data collection

Data collected from projects cannot only be used to personalize the experience for Khan Academy users (see project recommender), but can be used to improve education outside of the Khan Academy website. Khan Academy shares its data with education researchers already, and the data collected from projects could provide vital insight on how to motivate students (both in general and how to motivate students of different demographics more specifically) and how self-driven curriculum could be implemented at a larger scale.