Organizing Oppia's Learning Content

*2018-0*3*-*1*6 (*Final*)*

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# Related References

Functional Requirements: [link](https://docs.google.com/document/d/1xQXHLfkT0krwhKuH_DgtuNEFDvTXAWqns6cRSKPi4O8/edit#heading=h.v3bcaykcpf0w)

Overall UX and page URLs: [link](https://docs.google.com/document/d/17dowbYJxu999a-YnAl6KYIpefixq5Ss5YetR-aZMuhM/edit)

Skills breakdown: [link](https://docs.google.com/document/d/1roA6nBMwAf8p__NgCIIjGNgZUOpGz_b2LCoUm0ZbImE/edit#)

Questions breakdown: [link](https://docs.google.com/document/d/1FY4qiAhBqW6AwTmfx7Ast8J0DIxzSBDPDB4quvRZEvo/edit?ts=5aa44feb)

Topics/stories breakdown: [link](https://docs.google.com/document/d/1skUE_d2mkd2dq383jq1P03R8CCvBm45_WYsFJzaABiM/edit)

# 1 Overview

## 1.1 Background

Oppia currently primarily uses both collections and explorations to co-organize all learning content on Oppia. These activities, separately, are organized into subject categories to be displayed on the Oppia library page. There is currently work being done to introduce questions and refresher explorations as additional learning-related activities (see [here](https://docs.google.com/document/d/1KrwWFg9eu9zjAHPdNUIz8QkznTAidc0rhtByGmtMthw/edit#heading=h.paedqb6b3te) for a much more in-depth background).

This proposal aims to:

* Establish a clear, high-level goal used when organizing each aspect of Oppia's learning content (section 1.2)
* Enumerate expected user scenarios that demonstrate issues that require a solution to our goal (section 1.3)
* Propose a structure that helps lead us toward reaching this goal and solving the specific user problems (section 2)
* Briefly consider technical implications of this structure (section 3)
* Provide a pathway to future work that may continue helping us approach the goal (section 3's open questions)

## 1.2 Goal

The goal of this taxonomy is to allow learners to jump in anywhere within Oppia's educational landscape and be gently guided to where they should really start. This "course correction" is a central behavior which allows us to focus on one core piece of functionality while facilitating solutions to several expected user scenarios (discussed in section 1.3).

## 1.3 Expected User Scenarios

Following are expected personas of students using Oppia, though they are intentionally not fully fleshed out to keep their application in this document simple:

* Primary: student using Oppia inside classroom environment
* Primary: student using Oppia at home as a teacher-suggested supplement
* Primary: student using Oppia at home as a personal supplement to an enrolled class
* Secondary: student using Oppia to study content unrelated to their enrolled classes
* Secondary: non-student using Oppia to study anything

# 2 Proposed Structure

The following paragraphs define a high-level taxonomy of constructs in Oppia.

**Subject**

Subjects describe the entire universe of knowledge related to a specific subject area (e.g. Mathematics or Physics). Subjects contain one or more topics. There are no firm guidelines yet on what a subject is, or how subjects should be split into topics. Instead, we will start by having a tight set of admins create a few subjects and iterate until the Oppia Foundation has formalized clear boundaries between subjects. We will then use these as examples for future subjects.

Learners viewing a subject will see a list of topics that they can learn, with search functionality. The library page will show individual subject pages once they are available, instead of categories of explorations and collections. In the meantime, topics will be listed in admin-defined groups.

**Topic**

A topic is a high-level concept related to a certain subject (e.g. differentiation or Newton's laws of motion). There are no firm guidelines yet on what a topic is or how certain educational material should be split across multiple topics. Instead, we will start by having a tight set of admins create a few topics for a given subject, and iterate until the Oppia Foundation has formalized clear boundaries between topics. We will then use these as examples for future topics.

When learning a topic, a learner has access to a complete "package" of learning, including narratives (stories) that teach the topic in detail. Each topic may have one or more story arcs associated with it. The learner has the option, at any time, to practice what they've learned in that topic using practice sessions.

In the frontend, topics have a landing page which provides the learner with some initial context on what they will be learning, or an optional reference to the stories being taught. The landing page provides more insight into what the topic means, and aims to pique students’ interest in learning the topic.

Users may also fast-track the skills taught by a topic by opening the concept cards for each skill and practicing them directly.

**Story (Narrative)**

A story guides the learner through a journey of lessons to teach a specific topic in full. Each story helps provide additional context when learning the skills of the topic.

Lessons will be prefixed with a ~3 question, non-context-specific pre-test which will evaluate whether the learner has the expected skills to begin that lesson. This test is generated by the platform and allows learners to begin studying a topic without necessarily having all of the prerequisites needed to begin studying. If the learner cannot complete any of these questions, they will be shown a concept card reviewing that material in more detail.

Every 2-3 lessons the learner will complete a generated, non-context-specific review test of ~10 questions to double check that they understand the content covered in prior lessons in the story before moving onward. See the section on review tests below for more detail.

The learner is discouraged (but not disallowed) from skipping ahead in the story without first completing an earlier part. This is done by hiding later lessons in the story using a growing world map (where the metaphor is continued using actual animations to help improve story immersion; think Sid Meier's Civilization for world hiding and movement).

Each topic will include a list of canonical stories. These stories, taken together, should teach all the skill of the given topic (but an individual story does not need to teach every skill). It's up to the creator to decide how large or broad a given story should be.

**Lesson**

A lesson is an exploration which teaches one or more skills in depth by putting them within the context of a story. In general, each lesson is expected to teach a specific, coherent, and self-contained idea that is coherently described in the context of a topic (e.g. adding fractions, or the chain rule of differentiation).

Lessons will include questions that take place within the context of the story. These questions focus on pinning down misconceptions early. They are not taken from the question bank, but they may still be associated with a given skill. If Oppia detects that a student is struggling with a certain prerequisite skill when answering a question, the lesson may reinforce that prerequisite skill by surfacing the relevant concept card and providing a 3-question skill test that must be completed before the learner can continue.

Lessons are expected to include questions at the end to review the new content taught within that exploration before moving on to the next lesson, where wrong answers lead to the learner being guided to an earlier part of the lesson to refresh their understanding of that topic.

**Concept Card**

A concept card is a detailed overview of the material for a given skill (e.g. an explanation and learner-selected, variable number of worked examples (pre-solved questions & answers). Learners can select more worked examples as desired. The learner may also, from the concept card, begin a practice session.

**Pre-Test**

A pre-test is a variably long set of questions that has been randomly created from the list of prerequisite skills specified by a lesson. Each question must be answered correctly (possibly with the assistance of hints or a solution) before continuing. Since pre-tests are intended to gate access to a lesson until sufficient expertise in the prerequisite skills is demonstrated, a specific score needs to be earned before the pre-test is considered passed. See the Score section for details on how scores work.

Pre-tests are expected to only be around 3 questions in length, so the ideal scenario is a learner gets all three questions correct and can begin the lesson. If the right answer to a question without assistance yields 100 score points, then the passing score for 3 questions is 300. If the learner struggles and uses any hints or solutions, they will not reach the 300 points in only 3 questions. This requires the learner to try additional questions until they reach or surpass 300 points. Significant struggling will result in the learner seeing concept cards to help with any missing knowledge they may have (see the questions section for more detail).

An example pre-test of 3 questions:

* Learner gets the first question right without help, and receives 100 points
* Learner gets the second question right, but requires a hint, and receives 90 points
* Learner needs to use the provided solution to get the third question right, and receives 0 points
* The learner, now at 190 points, needs to answer a few more questions in order to reach the 300 that represent a passing score

Numerical scores are not shown to the learner in pre-tests, but we may show a gamified progress bar to indicate how much work is left to complete in the pre-test.

**Review Test**

Review tests are meant to help the learner refresh their understanding of skills they've already studied within the topic before continuing to new concepts. A review test is a variable-length set of questions that has been randomly generated from the list of acquired skills from all previously completed lessons in the story arc for that topic (skills acquired from other story arcs in the lesson are not considered).

Similar to pre-tests, review tests require a certain score to be achieved before passing them. See the Pre-Test section for details on how scoring works for tests. Oppia will detect struggling for specific questions and show a concept card to the learner, if needed (see the Question section for more details).

**Skill Test**

Skill tests are similar to pre-tests in that they must be passed in order to continue with a lesson, though skill tests may show up mid-lesson. They lack context, are generated by Oppia, and always focus on specifically one skill. Lessons require prerequisite skills in order to complete them, and if Oppia detects a learner is struggling on one of these skills it will pause the lesson in order to show the learner that skill's concept card and require the learner to pass a skill test before proceeding.

Skill tests will appear as new lesson cards (natively within the learner view) rather than redirect the learner. These cards may be specially marked to note they are part of a “temporary” skill review test.

The skill test is around 3 questions and is meant to ensure the learner has reviewed the concept card and worked examples in detail to sufficiently demonstrate they understand the topic before proceeding with their current lesson.

**Practice Session**

Practice sessions are variable-length sets of questions randomly selected from a list of skills. If the practice session is started from a concept card, the only skill used to generate the questions is the skill associated with that concept card (the learner has no choice in this context). If the practice session is started from a topic, the learner may select which skills from that topic they would like to practice. Long-term, we may introduce a "Test Me!" button (or something similar) which lets Oppia automatically pick which skills the learner should practice.

When setting up a practice session, learners may specify one of two formats:

1. Answer a specific number of questions (each question must be answered correctly before continuing to the next one)
2. Reach a specified score (visible to the learner); this is the default selected option when starting a new practice session

For the first format, the practice session does not utilize a score while the learner is playing through the questions. Regardless of how many hints or solutions are required to complete each question, once the learner completes the final question no additional questions will be asked. Oppia will show how many questions have been completed by the learner and the total number of questions they have selected to complete.

For the second format, a score progress bar will be shown and each time the learner answers a question correctly the score will go up by some amount (see the Score section for details). The learner’s usage of hints or solutions affects how many points are received. The practice session completes once the specified score is reached or surpassed. For future work, Oppia may challenge the learner to beat their last score (to encourage mastery) or perform trial runs (to encourage efficiency when solving the problems).

**Score**

A score is a value assigned to each question answered by the learner in a test. Scores are used to determine whether a learner has sufficiently demonstrated an understanding of the skills being tested.

Scores may be visible to the learner depending on the type of question set that's being shown. Scores will be shown as a progress bar with an optional animation when a score is achieved. Larger score numbers are preferred (e.g. 100 points for each correct answer without any help).

Scores may have different values depending on how much help the learner requires when answering the question. For example, a correct answer without any help may provide a score of 100. If the learner uses a hint, they may only get a score of 90 (where each hint reduces the score by 10). If the learner uses the solution in order to pass the question, they receive no score. Scores can never be negative.

**Question**

A question is a prompt and interaction with a correct answer to evaluate the learner's understanding of a specific skill. Question data comes from a configurable bank of questions and answers that allows Oppia to automatically generate a question in real-time. Oppia will be able to generate some data formulaically. Oppia will also provide hints and an optional solution to the question for cases when the learner is struggling.

If the learner is clearly struggling on a question (ie, they needed to ask for a solution to questions of the same topic several times), then they will be shown a concept card for the skill they are struggling on.

It's recommended that each skill have a large volume of potential question data to minimize the chance a learner ever receives the same question twice.

**Skill**

Skills are atomic units of learning that should represent a single concrete idea. Skills may occasionally need to be broken down further (e.g. to teach equivalent fractions, the concept of 'equivalence' may need to be separately taught) using other skills. This means skills can build on one another: equivalence in the context of fractions could block learning about equivalent fractions, but these can be modeled as separate skills.

Note that cases where a skill seems to comprise many smaller parts may actually indicate a concept that should be modeled as a topic instead. Skills occasionally need prerequisite skills to help explain them, but conceptually should remain small, specific building blocks.

Skills have an associated concept card and one or more questions. Each learner has (in the backend) a practice 'level' associated with each skill (by default this is empty) to indicate the degree of learner mastery. This will be represented as a float between 0 and 1.

Skills may be referenced as prerequisites in other topics or subjects. Oppia should seamlessly show the user the skill's corresponding concept card for outside skills in the same way it would show the concept card for skills within the context of a topic.

Some skills may entail other skills. These "entailed" skills are those which are expected as prerequisite knowledge in order to understand the skill in question. For example, if someone can count up to 100 (a priori), then they must be able to count up to 10.

As follow-up work, over time the "experience points" (achievement score/knowledge rank) a learner has earned in association with a skill will degrade. Each time a learner correctly answers an interaction that is associated with a skill (either via a question or a state in an exploration) the learner's achievement score for that skill increases. Struggling on a question (such as in the context of a pre-test or review test by using hints) may result in a smaller score being added on to the learner's overall score for that skill, and in the case where a solution is used by the learner to answer the question they will receive no score.