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# TELLab: An Experiential Learning Tool for Psychology

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**Abstract**

In this paper, we discuss current practices and challenges of teaching psychology experiments. We review experiential learning and analogical learning pedagogies, which have informed the design of TELLab, an online platform for supporting effective experiential learning of psychology concepts.

**Author Keywords**

Experiential learning, analogical learning, online experimentation

**Introduction**

Teaching psychology concepts is currently mostly done through direct instruction. In natural sciences, in contrast, more experiential methods of instructions are common: teachers often give demonstrations in lectures and offer hands-on laboratory sessions. There are also online learning tools that provide interactive demonstrations and building blocks for students to practice, such as Molecular Workbench [1] for chemistry experiments and Go-LAB [2] for physics experiments. Such hands-on experiences are less of a practice in psychology and other social sciences, particularly when human subjects are involved. Recruiting subjects and scheduling experiments are costly. It requires substantial time, effort and expenses.

Another challenge of teaching psychology experiments is to transfer the deep structures of those experiments to students. Most psychology experiments have a lot of surface information, such as vivid contexts and images, which distract novice learners from seeing the underlying mechanism that make an experiment works properly.

Let's take the Stroop Test as an example. The original Stroop test [3] presents color words that are printed in either the color that the word indicates (e.g., RED) or another color (e.g., GREEN), and subjects are either asked to name the color of the word, or to read the word. For example, if the word 'red' is printed in green color, then the subject should choose green if asked to name the color of the word and choose red if asked to read the word. The results of the Stroop test showed that people are significantly faster reading a word than naming the color it is printed in. The deep knowledge about this test is that word processing and color processing can interfere with each other, and word processing is dominant to color processing when interference occurs. If we can see this mechanism, then we can use it to test if word processing interferes with image processing, or if auditory processing interferes with image processing, or if word processing interferes with emotional processing. And we can test which processing mechanisms are dominant with respect to others. The Stroop effect is one of the best-known experimental paradigms in psychology. There are many other paradigms like Stroop test—each representing a broad underlying concept—and it is crucial for students to learn these paradigms in order to select the right one to develop new novel interesting experiments.

In this work-in-progress, we discuss the design of TELLab [4], a new platform for supporting effective experiential learning of psychology concepts. We review two pedagogies that have informed the design of TELLab. We then summarize existing resources for experiential learning of psychology concepts. Led by the theoretical discussion, we describe a conceptual design of TELLab and its key features.

### Experiential Learning and Analogical Reasoning

The Experiential Learning Model (ELM) [5] provides four steps for constructing effective experiential learning activities. In Table 1, we show these four steps and possible activities to implement them. Let's put the discussion of ELM in the context of learning a psychology paradigm. First, a student needs to generate a concrete experience of the paradigm, for example, taking an experiment that belongs to the paradigm. Second, the student needs to review the experience and reflect on it. To facilitate reflection of experience, there are some practical questions to ask [6], the questions that encourage students to think about what happened, why did that happen, and how does that relate to everyday life.

The third step is to form abstract concepts. As we have discussed above, it is hard for novice learners to grasp the deep knowledge from single experiment. Therefore, we propose to apply another learning pedagogy, Analogical Learning, to facilitate learning the deep knowledge. A central activity of analogical learning is to scaffold the process of analogical mapping—a process of finding common structures between two different examples. It has been shown that people can learn a common underlying principle and apply it to new prob-

	Steps	Activities
1	Concrete experience	Taking experiments.
2	Observation and reflection	Review results.  Answering questions about the experiment.
3	Forming abstract concepts	Comparing the experiment with other experiments that belong to the same paradigm.
4	Testing in new situations	Designing new experiment.

**Table 1.** The four steps of ELM and corresponding activities.



Figure 1. Each paradigm page shows a list of experiments (A) for students to learn. Students can copy (B) an experiment design to their workspaces and adapt it to create their own experiment. Students can tag (C) an experiment design to help improve the experiment recommendation system.

lems by comparing two examples, even if the common principle is only partially understood in either example [7].

### Resources for Experiential Learning

Online experiment platforms, such as LabInTheWild [8], TestMyBrain [9], and The Norton Psychology Labs [10], provide hands-on opportunities for students to experience psychology concepts. They also provide participants with meaningful feedback on their results. Participants can see how their results conform to or differ from the general public. This approach proved effective for attracting broad participation: LabInTheWild, for example, has more than 2 million visitors and nearly 750,000 visitors have taken experiments on the website [11]. These platforms provide experiential learning opportunities, where students are motivated to learn by taking the experiments and see their results. They get to sense the cause and effect in a phenomenon by themselves. One problem of these platforms is that each experimental paradigm is represented by a single experimental design. It would be hard for students to abstract the deep structure from taking a single experiment.

Besides demonstrative experiment websites, there are also authoring tools that can be used as learning tools. For example, *Qualtrics* [12], *Open Sesame* [13] and *Paradigm* [14], provide graphic user interfaces for novice users to design and conduct psychology experiments. Qualtrics, a survey authoring tool, is widely used among students. However, it limits the kinds of experiments that could be pursued. Open Sesame and Paradigm are both dedicated desktop tools for designing psychology and neuroscience experiments, however the experiments can only run on individual desk-

tops. It is hard to disseminate experiments and it is hard to attract participation at a scale comparable to the online experiment websites. If there is an online platform that enables easy fast psychology experiment design and holds user-generated experiments in a central space with easy access, it will help students to more easily practice designing experiments and collecting data.

### TELLab: An Experiment-Learning Tool

We are building TELLab, an online platform for students to experience and build online psychology experiments. TELLab has a curated collection of expert-generated psychology experiments, with several diverse designs for each major experimental paradigm. For example, Figure 1 shows the Implicit Association Test (IAT) paradigm page, where the Race IAT and Gender IAT are two experiments that both use the IAT paradigm. Building on the analogical learning pedagogy, TELLab encourages students to try multiple diverse instances of the same experimental paradigm. This, in turn, should divert their attention away from the surface features of each experiment and help them identify the general psychological concept underlying the instances. To provide students with hands-on experiences of designing experiments, TELLab allows students to easily copy an experiment using a copy function (shown in Figure 1B) and alter it to create their own experiment. We expect that students who come to the website as participants will eventually become creators of new experiments, and the novel interesting experiments will in turn attract more participants.

Based on the previous discussion, we also propose some design features to support experiential and analogical learning. To support reflection, the system can

prompt students to answer questions that help them reflect on their experience. Moreover, the system should prompt students to compare the experiment that they have just finished with one that they had done before. For example, when a student finishes an experiment, the system can show a snippet of another experiment under the same paradigm that the student completed earlier. And then the system can ask the student to identify the similarities and differences of the two experiments. The student can continue the analogical reasoning activity until no more experiments can be found under the same paradigm. As our system grows bigger with more user-generated experiments, students can benefit with more examples to compare.

Research has found that analogical reasoning is particularly successful when the two examples differ in surface features (i.e., salient objects and aspects of the context), but share the same underlying principle [7]. A problem with a growing collection of student-created experiments is that there may be more similar experiments under a paradigm. A mechanism is therefore needed to help students select sets of experiments that are substantially different in surface features. To make automatic selection of appropriately diverse sets of experiments possible, the system can encourage users to tag the features of any experiment using the tagging function (shown in Figure 1C). Alternatively, it can ask students to provide similarity feedback on some pairs of experiments and use the information to automatically generate sets of diverse exemplars [15].

There are many challenges in teaching and learning psychology experiments; we hope to use the TELLab design as a starting point to explore more ways to facilitate learning.

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