

Reflection before/after Practice: Learnersourcing for Drawing Support

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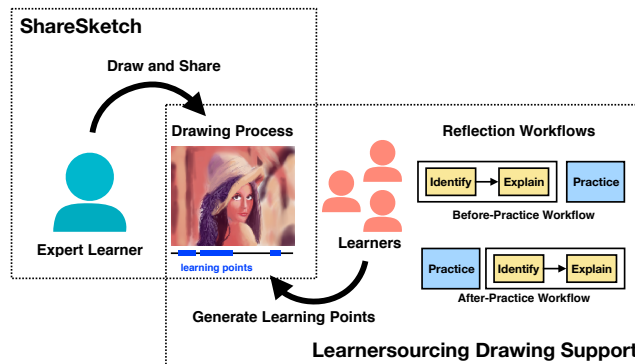


Figure 1: The overview of learnersourcing for drawing support

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Abstract

To support the acquisition of drawing skills, this research explores a learnersourcing approach to generating personalized learning points. These are annotations containing a clip of a drawing process, a description, and an explanation. This paper presents ShareSketch, a web-based drawing system that enables learners to practice drawing, review the drawing process, and share their works with others. In particular, we propose the before/after-practice reflection workflow that allows learners to generate learning points before or after each short practice. We evaluated our reflection workflows with eight self-motivated drawing learners. The results showed that our reflection workflow can guide learners to generate high-level subgoal or concept labels, low-level steps, and personalized coping strategies.

Author Keywords

Learnersourcing; Drawing support; Creative task learning; Reflection; Learnersourcing workflow.

ACM Classification Keywords

H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous

Introduction

Developing professional drawing skills requires not only time and effort but also deliberate practice based on immediate, effective feedback [2]. However, obtaining effective drawing feedback is challenging. First, drawing feedback is usually generated by experienced instructors and only available in school or in a small physical art studio. Second, instructors usually provide instant personalized visual feedback directly on the canvas or demonstrate the whole creative or revision process, along with detailed explanations. Such high-quality personalized feedback can be obtained through one-on-one tutoring, but it is costly and has a limited pool of qualified experts.

Many interactive drawing systems have been developed to support people to draw more accurately by providing automated corrective feedback, guidance, and tutorials [1, 5, 3]. The corrective feedback allows people to be aware of “knowing” the gap between the goal and the current status. Step-by-step instructions or tutorials guide people to follow the procedural steps to recreate a reference image as accurately as possible. However, good drawing support has to enable people to understand high-level conceptual knowledge rather than to memorize the low-level steps.

This work attempts to apply learnersourcing to generate personalized drawing hints for supporting future learners to develop drawing knowledge, useful skills and diverse coping strategies. Prior studies have successfully used learnersourcing to enable people to collectively generate useful annotations or hints while engaging in the learning process [7, 4]. Glassman et al. presented two workflows that allowed learners to generate personal hints based on what problems they had recently solved for engineering circuit design. Moving beyond learnersourcing personal hints for seeking optimized solutions, we tackle an open-ended,

ill-defined problem of seeking “how good the answer is” instead of simply “whether the answer is true”. In addition, we collect personal drawing hints to support learners with diverse ability levels and needs.

In this work, we explore how learnersourcing can be applied to support drawing learning. First, we introduce the concept of learnersourcing drawing support. Next, we present ShareSketch, a web-based drawing system that enables learners to practice drawing, review the drawing process, and share their works with others. Moreover, we have designed a reflection workflow that allows learners to contribute annotations about what they learned and why they consider it helpful, interesting, or difficult while watching from other’s creative process. An annotation, indicated as a learning point, consists of a clip extracted from the process, description, and explanation. Those personal learning points can benefit future learners while experiencing similar situations. More importantly, we propose *before/after-practice reflection workflow*, which is an extended reflection workflow along with each short practice. People can quickly practice lessons learned from the before-practice workflow; they also can enhance or revise their findings in the after-practice workflow.

In the pilot study, we evaluated our before/after-practice reflection workflow with eight participants recruited from Facebook. They were asked to perform two reflection tasks before and after a short practice and we compared both annotations. We found that before-practice annotations are higher level than after-practice annotations. Furthermore, participants applied their before-practice learning points as subgoals; they revised or extended more detail their findings in after-practice annotations when facing conflicts on their actual performance.

Related Work

Prior studies have developed interactive drawing assistants to support novice learners to develop drawing skills by providing automated corrective feedback, guidance, and tutorials [1, 5, 3]. They used sketch recognition [1] or automated extracting techniques [5] to generate visual guidance for helping people draw as accurate as a reference image. Through direct guidance or step-by-step instructions, learners can achieve better results after iterative modifications.

In this work, we focus on collecting personal learning points including high-level concept, low-level details, and personalized strategies while a learner watches other's drawing process. Through our workflow design, learners can both contribute useful information and enhance drawing skills by reflection and practice.

Learnersourcing for Drawing Support

We propose a framework that allows people to enhance their learning by practice and reflection, and then contribute learning points for supporting future learning (Figure 1). In the framework, people can draw and review the process for self-reflection on an online drawing system. Other people can contribute their learning points while practicing and watching a drawing process in our reflection workflows. Both drawing authors and viewers can benefit from reflection and practice.

In this work, we will introduce our online drawing system called ShareSketch and reflection workflows for enabling learners to generate useful learning points.

ShareSketch: Draw, Review and Share

ShareSketch is a web-based drawing system built with Javascript and WebGL that allows a user to create a drawing, review the creative process and share with other peo-

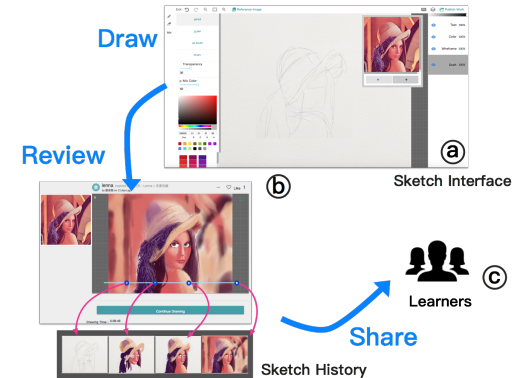


Figure 2: ShareSketch augments web-based drawing system with an interactive timeline. A user can create a drawing by a sketch interface (a), review the drawing process by an interactive timeline interface (b), and share the process to others (c).

ple. The goal is to enable people to review their drawing process for self-reflection and promote social learning. The system consists of two main components: a sketch interface, and an interactive timeline interface (Figure 2).

Sketch Interface

ShareSketch supports WACOM tablet and provides common drawing tools such as pencil, brushes, or an eraser. Users can also draw amongst multiple canvases in the sketch interface (Figure 2). The interface can record detailed drawing behaviors including position, speed and pressure of strokes, and tool usage behaviors including tool attributes, canvas transforming and undo commands. Those recorded behaviors will be used to extract some patterns for detecting abnormal events.

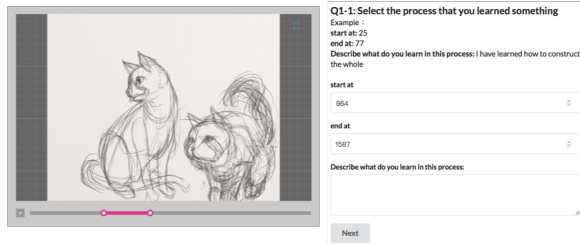


Figure 3: A learner performs a reflection task by identifying a clip and describe what it is, and then explain why they learned from the clip.



Figure 4: Learners are allowed to practice drawing based on other's creation process in a short practice task.

Timeline Interface for Sketch History

The interactive timeline interface is designed to allow a user to review the history of drawing. Users can replay the whole creative process or go back to any time point to examine the work-in-progress. It also allows people to add an annotation on a clip which is selected from the process.

Before/After-Practice Reflection Workflow

To enable people to generate learning points from watching other's creative process, we designed a two-stage reflection workflow including *Identify* and *Explain* stage. On the Identify stage, people can identify a clip from the process by selecting a start and an end point, and then describe what they learned from the selected clip (Figure 3). After three iterations, three annotations will be passed to the Explain stage. In this stage, people can choose the most helpful one from the three annotations and explain why they think it is helpful to them.

By using this workflow, we can collect three types of annotations from learners, including helpful, interesting and difficult.

Furthermore, we design a before/after-practice reflection workflow that allows learners to generate learning points before or after a quick practice. Through practice, learners can self-assess the actual level of abilities and enhance the learning effect. In the before-practice workflow, learners can reflect on their own experience and apply learning points in the short practice. Moreover, in the after-reflection workflow, learners can re-assess their current status after a short practice and provide their revised or extended findings.

In a short practice task, learners can apply their learning points, and develop better coping strategies by tackling the actual obstacles.

Pilot Study

To better understand how learners identify learning points by watching others' drawing processes, we ran a pilot study that recruited online drawing learners to perform two reflection tasks, before and after a quick practice. We recruited 8 participants from Facebook. They were 5 male and 3 female self-motivated learners, 20-23 years of age, with only one design-related major. Each person was allowed to watch one of two drawing creative processes created by two experts and complete each reflection task before and after a short practice. The short practice task should be performed in approximately 5 minutes. They can use either a mouse or a drawing tablet to perform the practice task. The total time spent was approximately 30 minutes.

In the study, each participant was asked to identify three learning points, one interesting point, and one difficult point. Finally, each participant generated five before-practice and five after-practice annotations. We compared two types of annotations and summarized our observations in the following section.

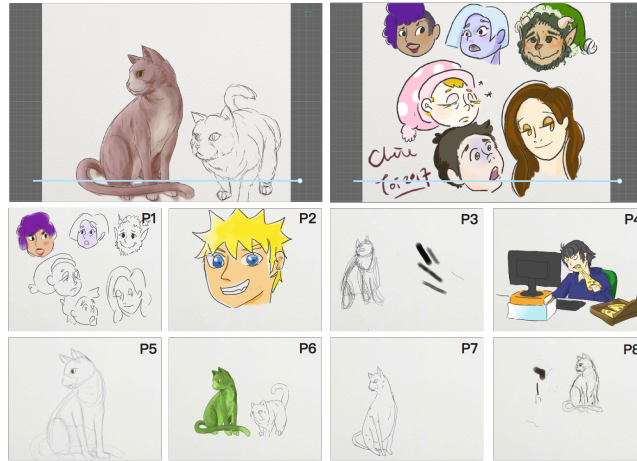


Figure 5: The above two images are two creative processes created by two experts. The below eight images are the results of participants' practices.

Results and Findings

We totally collected 80 annotations, and of those, only one was missing an explanation. The results of learners' practices are shown in Figure 5 and the findings are presented as follows.

After-practice annotation augments before-practice annotation

We found that before-practice annotations are higher level than after-practice ones. In the before-practice annotations, participants identified a longer clip and described high-level concepts, including sub-goals and a general structure of procedural steps. In addition, participants described more details in after-practice annotations.

"I have learned how to construct a cat, from outlining to drawing the details." (P3, before-practice)

"I have learned how to define the direction of a human face by drawing a cross-axis to the face." (P4, after-practice)

"I have learned how to highlight the bright side of an object by using an easier to remove the color." (P4, after-practice)

Before-practice reflection vs After-practice reflection

Participants identified new learning points based on the difference between past experiences and others' drawing processes in the before-practice reflection task. On the other hand, they changed their perspective and revise their findings based on comparisons or conflicts between original thinkings and practicing results. In addition, two participants added the details or extend the findings in the after-practice task.

"I have never learned the impasto painting technique before. It looks so cool while adding one color layer by layer to construct the three-dimensional effect." (P5, before-practice, discover new thing)

"I found the difficulty of combining the multiple colors. It's not as easier as I first think. " (P8, after-practice, change perspective)

"I learned how to create a human face with different emotion expression" (P4, before-practice);

"I have learned how to highlight the bright side of a face by using an easier to remove the color." (P4, after-practice, add the details)

Discussion

Provide scaffolding for reflection and practice

Most participants created a drawing with low completeness during a short period of time; in addition, they reported the difficulty of practicing a specific skill in the later drawing process because they lacked domain knowledge and related skills to reach the goal. In the further improvement, we will design a scaffolding mechanism that supports people to practice learning points at any stage of drawing process.

Moreover, many participants used distinct words to describe similar concepts or situations. To effectively aggregate learning points, we plan to guide people to generate consistent content use a structured interface or a rubric [6].

Learning points as feedback enhances creative task learning

Feedback is the key component to help people improve the creative process and iterate toward better results. In this work, learning points serve as feedback benefits drawing creators and learners. Creators can increase confidence or motivation by obtaining others' feedback; learners can reflect what they learn and benefit to other learners.

Future Work

We will keep improving our system and workflow design. In addition, we will explore ways to generate useful learning points and facilitate effective practice. In the end, we envision our framework can contribute to online feedback system design and support other creative tasks.

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REFERENCES

1. Daniel Dixon, Manoj Prasad, and Tracy Hammond. 2010. iCanDraw: Using Sketch Recognition and Corrective Feedback to Assist a User in Drawing Human Faces. In *Proc. CHI 2010*.
2. K. Anders Ericsson, Ralf Th. Krampe, and Clemens Tesch-romer. 1993. The role of deliberate practice in the acquisition of expert performance. *Psychological Review* (1993).
3. Jennifer Fernquist, Tovi Grossman, and George Fitzmaurice. 2011. Sketch-sketch Revolution: An Engaging Tutorial System for Guided Sketching and Application Learning. In *Proc. UIST 2011*.
4. Elena L. Glassman, Aaron Lin, Carrie J. Cai, and Robert C. Miller. 2016. Learnersourcing Personalized Hints. In *Proc. CSCW 2016*.
5. Emmanuel Iarussi, Adrien Bousseau, and Theophanis Tsandilas. 2013. The Drawing Assistant: Automated Drawing Guidance and Feedback from Photographs. In *Proc. UIST 2013*.
6. Kurt Luther, Jari-Lee Tolentino, Wei Wu, Amy Pavel, Brian P. Bailey, Maneesh Agrawala, Björn Hartmann, and Steven P. Dow. 2015. Structuring, Aggregating, and Evaluating Crowdsourced Design Critique. In *Proc. CSCW 2015*.
7. Sarah Weir, Juho Kim, Krzysztof Z. Gajos, and Robert C. Miller. 2015. Learnersourcing Subgoal Labels for How-to Videos. In *Proc. CSCW 2015*.