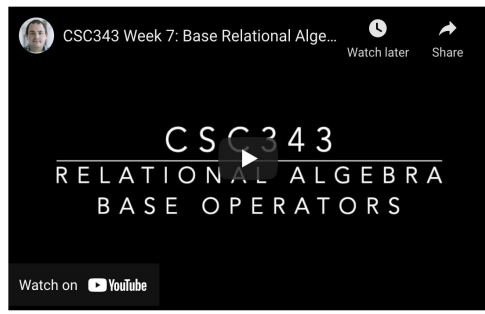


# Investigating the Effects of Voice Self-explanations in Flipped Classrooms



## Step 1: Preparatory Video Component

### RA: Base Operators



## Step 2: Reflect on concept covered and explain it.

Duration: 0:00

0:00 / 0:00 [Speaker Icon] [More Icon] [SUBMIT]

[START] [STOP] [PAUSE] [RESUME]

Alternatively, you can choose to reflect by typing.

Your Explanation

Alternatively, you can choose to explain by typing. [SUBMIT]

If I chose to explain by typing, I can write here.



## Step 3: Answer questions that check understanding of topic.

### RA: Operators I

Which of the following are base operators in relational algebra? Select ALL that apply.

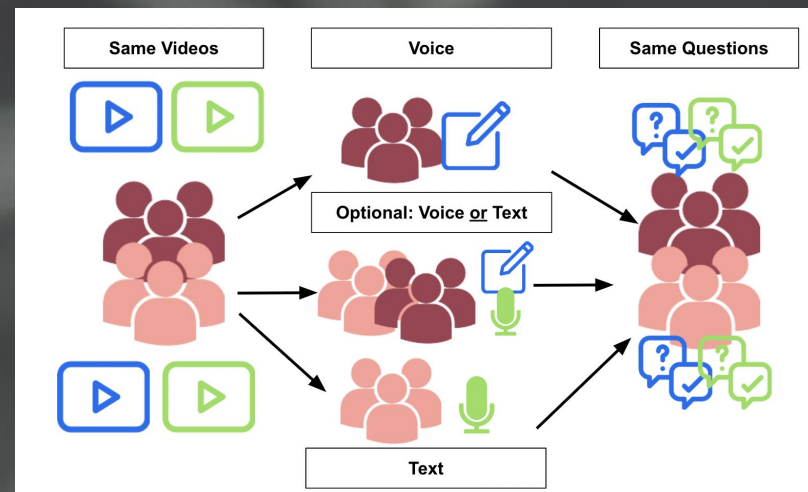
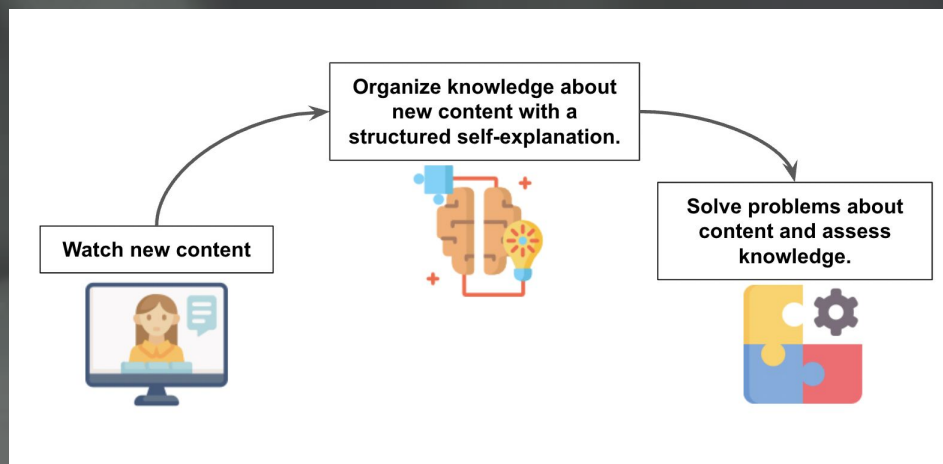
- Selection
- Natural Join
- Theta Join
- Projection
- Duplicate Elimination
- Intersection
- Cartesian Product
- Sorting
- None of the options here.

History

Submit



# Investigating the Effects of Voice Self-explanations in Flipped Classrooms



## Investigating the Effects of Voice Self-explanations in Flipped Classrooms

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### Introduction

#### Motivation

- Generating explanations for oneself can encourage self-regulation, engagement, and retention when learning new content [3].
- Previous studies have looked at using audio and video as mediums for explanations to capture different forms of expression and increase cognitive presence [9, 2, 6].
- It is unclear if the medium used for explanation impacts conceptual retention.
- A preliminary study conducted at the University of Toronto suggests that some students prefer using voice input for open-ended answers [1].

#### Our goals:

1. Examine the impact of the medium used for explanation on *student performance*.
2. Observe *student preferences* for mediums to generate explanations.

### Background

- **Definition of self-explanation:** generating explanations for *oneself* in an attempt to *make sense* of new information [4].
- Encourage students to express their thoughts in a *structured and focused* manner [5, 7].
- Provide opportunities to notice conflicts and resolve them when *new information* conflicts with *prior-knowledge* [3].

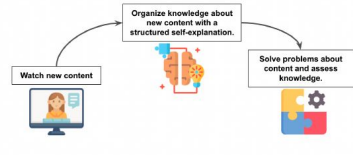


Figure 1: Self-explanation in our context.

- Prior work in a databases course indicates that students who are prompted to self-explain on a topic perform better immediately [8].
- A lot of students are resistant to self-explain, and those who don't do so appear to perform poorly on subsequent assessments.
- A previous survey done at UoT suggested that some students prefer using voice responses for open text responses [1].

### Methods

- 247 students in an Introduction to Databases course at the University of Toronto were divided into 3 groups: Voice (n = 83), Text (n = 81), and Optional (n = 83).
- Depending on the group assigned, students were asked to either self-explain by voice, text, or given the option to choose between the two mediums after watching videos in the preparatory component of the course on the learning management system. (see Figure 2)
- Students were asked to answer multiple choice and SQL questions immediately after they reflected on a topic, and then after a week (*check-in*).
- For the last video of the course (week 9), everyone was assigned to the optional condition to measure students choices when giving them the option to select their medium of self-explaining

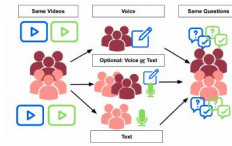


Figure 2: Treatment group division for reflection medium

### Results

- While we did not find significant evidence in immediate or check-in question grades between medium of explanation, we found that students explaining by voice and text tend to make fewer submissions than students who got a choice of medium.
- We noticed that students in the text treatment group had the highest response rates throughout the course. Students in the voice condition had the lowest response rates, which may indicate that students are hesitant to self-explain with a voice medium (Figure 3)

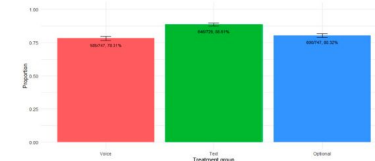


Figure 3: Reflection response rates across treatment groups

- In Week 9, 44% of the students in the voice treatment group chose to use text as their medium to reflect (Figure 4). On the other hand, only 3% of the students in the text treatment group chose to use voice as their medium to reflect (Figure 5).

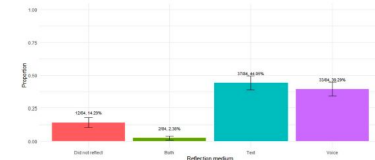


Figure 4: Reflection medium choices in Week 9 by students in the Voice Treatment Group.

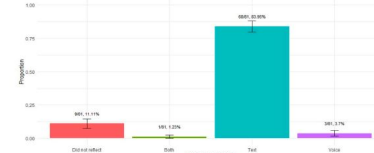


Figure 5: Reflection medium choices in Week 9 by students in the Text Treatment Group.

- According to Figure 6, most students seemed to prefer having both voice and text input as options to self-explain. While voice generally was not preferred as the only option, we also noticed that people in the voice condition slightly did not prefer having text input as the only option either. This may indicate that once students have used voice input, they may find it useful sometimes.

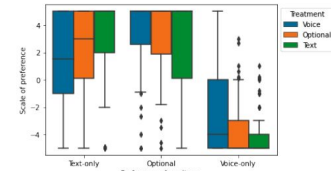


Figure 6: Student preferences in mediums for reflection, according to end-of-term survey (-5 strongly disagree to +5 strongly agree).

### Future Work

- Look at student self-explanations qualitatively to assess if student submissions are actually self-explanations and not just elaborations/summaries.
- Look into whether students explain differently on seeing a sample explanation from their instructor or another student. Do student preferences for mediums change on seeing examples?
- Allow students to choose a medium to explain early on, and see if trying a different medium influences their choice over the period of the course.

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## Investigating the Effects of Voice Self-explanations in Flipped Classrooms

**Authors:** Angela Zavaleta Bernuy, Naaz Sibia, Pan Chen, Jessica Jia-Ni Xu, Elexandra Tran, Andrew Petersen, Joseph Jay Williams, Michael Liut (University of Toronto)

### Introduction

As students shift to learning in digital environments, it is essential to understand how students can engage with content and retain what they are learning. Previously, studies have seen that students may fail to finish watching course-related videos [7], watch fewer of these videos over time [20], and may game systems to finish homework quickly [1]. In the context of flipped classroom environments, which are rising in popularity [15, 16], students may be resistant to engaging in the preparatory component before lecture and come to class unprepared [21, 17, 19]. This off-task behaviour and lack of engagement has been linked to lower learning [2]. One of the most successful strategies to encourage self-regulation and engagement includes adding reflective components as a part of homework [22, 9, 10]. Self-explanation or conceptual reflection, specifically, has been studied extensively as a constructive activity that helps students structure their ideas and make concrete models as they learn new concepts [4, 6, 18].

In this study, we investigate the addition of self-explaining while learning online content through prompts to explain via voice and text. While text explanations can have more structure [12], speaking can take less effort [14], allow ideas to flow more naturally [5], and help with generating more inferences [11]. Additionally, using voice in learning can add an effect of increased social-presence [3] which can make learners elaborate more and generate explanations as if addressing a potential audience [3, 13]. Students might feel tempted to paraphrase or be more cautious writing written self-explanations [8].

### Experimentation

All students in a Computer Science: Introduction to Databases course ( $n = 247$ ) were divided into 3 groups: Voice ( $n = 83$ ), Text ( $n = 81$ ), and Optional ( $n = 83$ ). Depending on the group assigned, students were asked to respond to the prompt: “*Explain what your key takeaways were from the video in 200-500 words*”, either by voice, text, or given the option to choose between the two mediums, after watching videos in the preparatory component of the course on the learning management system [Figure 1a]. Students were asked to answer multiple choice and SQL questions *immediately* after they reflected on a topic, and then after a week (*check-in*).

Students were asked to complete an explanation for 11 course topic videos. For the last video of the course, everyone was given an option to choose between voice or text to measure students choices when giving them the option to select their medium of self-explaining, noting how they interact with voice and text modalities over time.

We wanted to learn more about students’ preferences on choice of medium at the end of the course. Using a -5 (strongly disagree) to +5 (strongly agree) scale, we asked students to rank

their preference on providing only text self-explanations, always having a choice between voice or text self-explanations, and only providing voice self-explanations.

### Results and Discussion

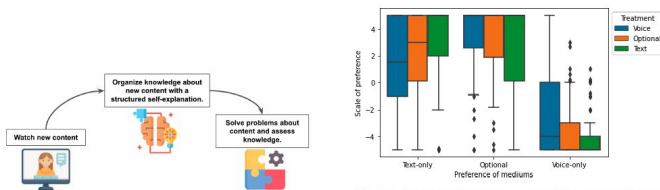
While we did not find significant evidence in immediate or check-in question grades between medium of explanation, we found suggestive differences in the number of submissions made where students explaining by voice and text made fewer submissions than students who got a choice of medium.

We noticed that students in the text treatment group had the highest response rates throughout the course. After aggregating all submissions throughout the semester, we found that the text treatment group completed 88.61% (646/729) of the explanations compared to a 78.31% (585/747) for the voice treatment group and 80.32% (600/747) for the optional treatment group. Students in the voice condition had the lowest response rates, which may indicate that students are hesitant to self-explain with a voice medium.

In the last explanation component of the course, 44% of the students in the voice treatment group chose to switch their medium of response and use text as their medium to self-explain. On the other hand, only 3% of the students in the text treatment group chose to use voice as their medium to self-explain. This shows that students are hesitant to explain by voice initially, but become more comfortable over time and tend to choose it as a medium to explain a lot more than students who have not ever used it.

As presented in Figure 1b, most students seemed to prefer having both voice and text input as options to self-explain. While voice generally was not preferred as only option, we also noticed that people in the voice response condition slightly did not prefer having text input as the only option either. This may indicate that once students have used voice input to self-explain, they may find it useful in certain occasions.

Our work shows how students may be resistant to try a new medium of responding, however, once they get to experience self-explaining by voice, it becomes the new preferred option for some students. Even though we do not find differences in performance, further work needs to be done to measure overall learning outcomes and course experiences.



(a) Self-explanation in our context.

(b) Student preferences in mediums for self-explanation, according to end-of-term survey (-5 strongly disagree to +5 strongly agree).

# VoiceEx App Demo

<http://tiny.cc/voiceExDemoVideo>