foundry10 VR pilot 2015-16
**Detailed results**
September 16, 2016

Student characteristics and understanding of VR prior to program involvement

Data was collected from a total of 390 students at the start of the program, and 352 students at the end of the program. For comparison between the beginning and end of the program, data from 176 students was used. Student ages ranged from 12 to 18.

When asked "What are you currently planning to do as a career?", the career areas with the most mentions were engineering/technology and creative/art/entertainment. Male students were more likely than females to name engineering/technology as a career plan (36% vs. 11%), and females were more likely than males to name careers in health (24% vs. 6%) and creative/art/entertainment (28% vs. 14%).
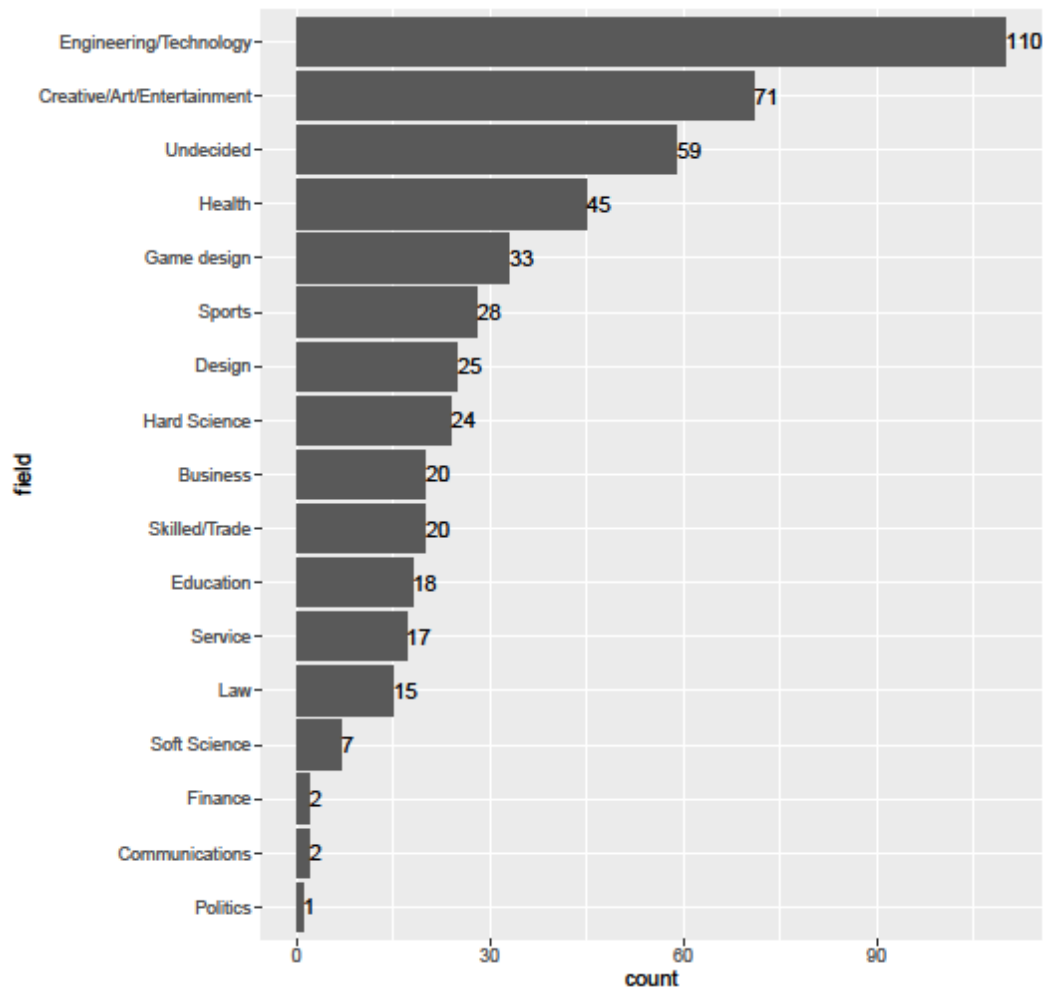
Career plans by gender:
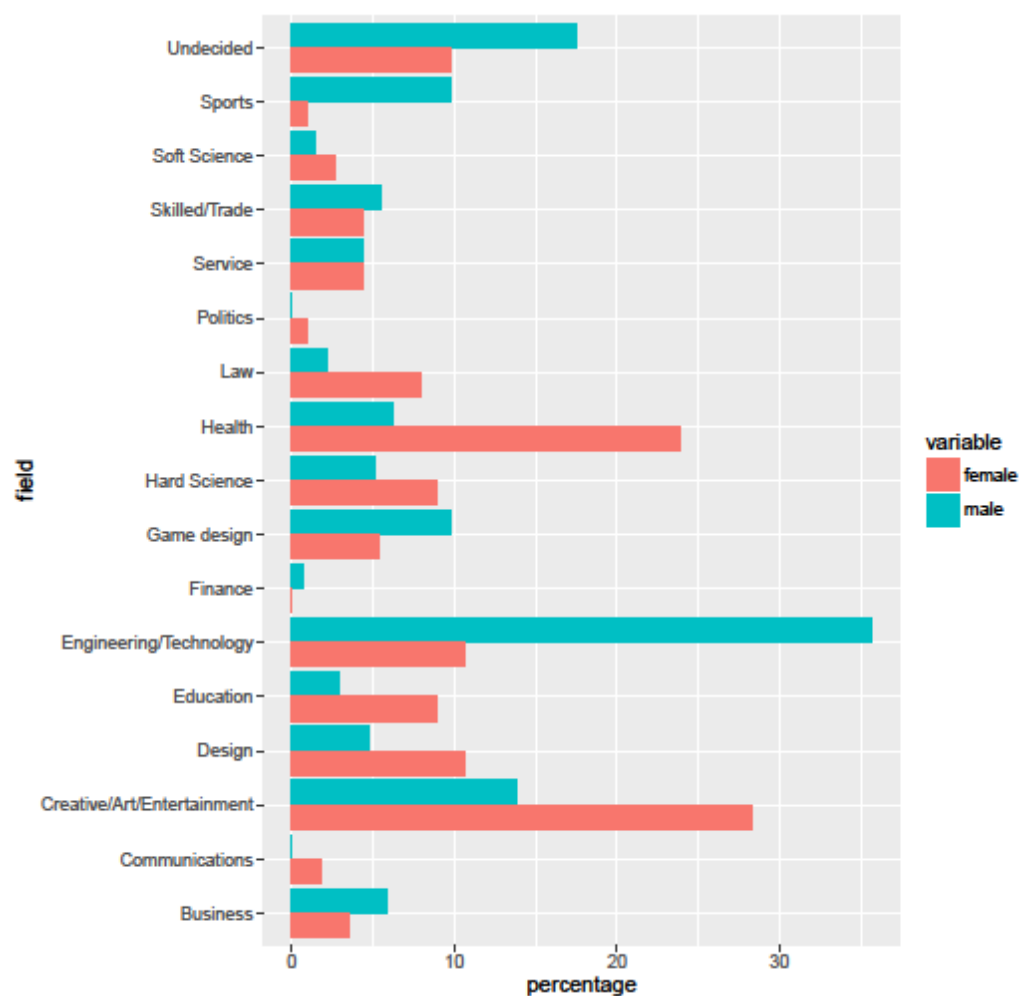
Prior to classroom exposure to VR**, the majority of students had low self-reported VR experience, but had a relatively high self-reported understanding of VR**. [The majority of students felt they understood what VR was]

Scale	PRE mean	PRE median
Experience using VR	2.92	2.0
Good understanding of VR	6.44	7.0

At the start of the study, controlling for other factors, there were observed differences between males and females. **Male students tended to rate themselves higher in VR experience, understanding of VR, preference for simulations over reading, and STEM career interest. Females had higher self-ratings overall in humanities career interest.**

| Scale	PRE		
	Estimated Difference b/t genders (On 9-pt. scale)	**S.E.**	**T-value**
Experience using VR	0.81	0.26	3.12**
Good understanding of VR	0.91	0.24	3.75***
Choose to play simulation instead of reading	1.77	0.25	7.08***
STEM Career Interest	1.07	0.30	3.60***
Humanities Career Interest	-2.32	0.26	8.82***

When thinking about VR more generally, its use in gaming was mentioned most often, but when asked specifically about potential uses of VR in the classroom, students were able describe a myriad of creative uses. To the prompt, 'What do you think of when you hear the phrase "virtual reality"?', gaming was the most reported feature of VR. High numbers of students also thought of VR as an imaginary space, a real/lifelike experience, or mentioned specific VR headsets. A relatively small number of students talked about VR as a tool for learning/training/teaching or as a tool for creating/developing.
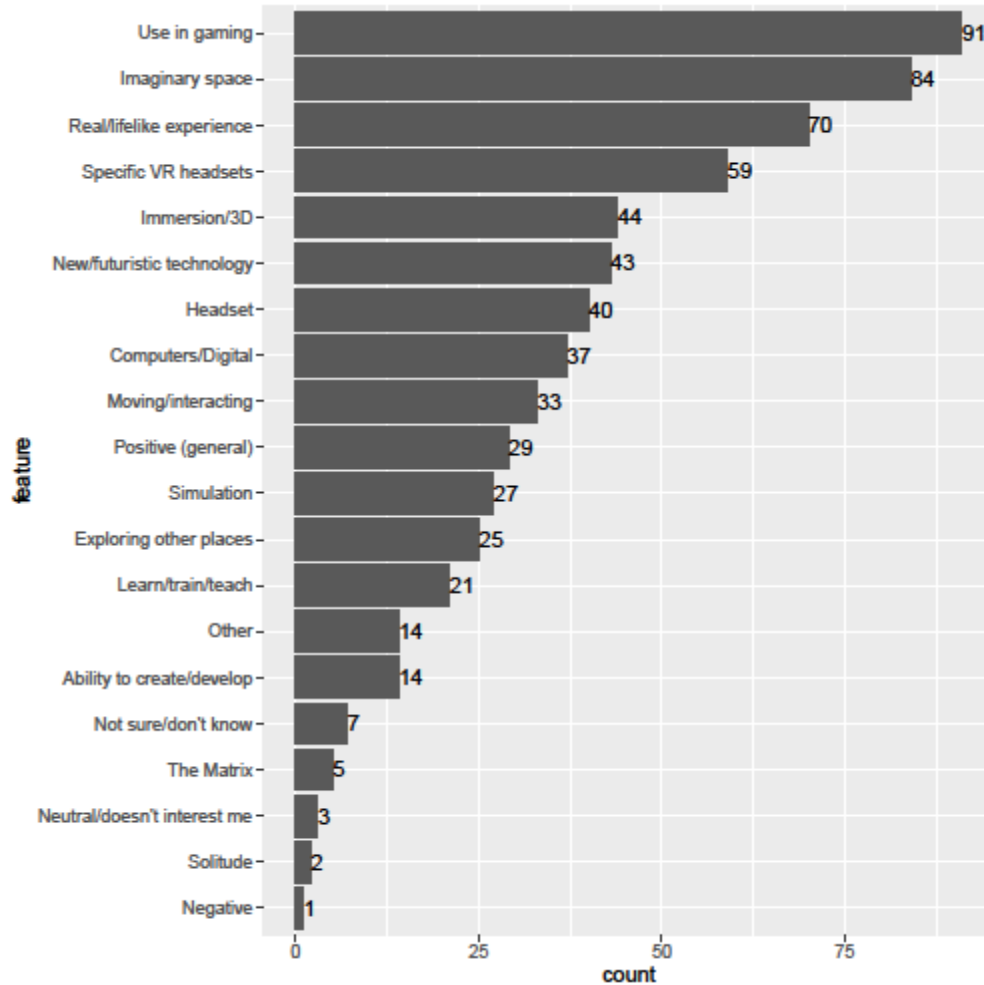
When considering the hype behind VR, a large number of students (73/390) noted that VR was hyped as a new or futuristic technology. A very small number of students thought VR had hype as a teaching tool (19/390) or as a tool for creating and developing (8/390). Female students were more likely to say they didn't know what the hype was behind VR than male students (22% vs. 9%), although a similar pattern holds with students with VR experience vs. students with little VR experience (18% vs. 8%).

When asked specifically how they hoped VR would be used in the classroom, high numbers of students mentioned using VR to provide novel experiences, improve learning, have fun, and use in history class. Females were more likely than males to mention that they hoped VR could be used to provide novel experiences (29% and 20%, respectively). Students with a strong interest in STEM careers were more likely to mention hoping VR could be used to understand/experience the technology than students with less interest in STEM careers (16% vs. 6%).

Interestingly, students mentioned that they hoped VR could be used in the classroom for creation/creativity, new perspective/understanding/empathy, and for specific learning types (hands-on, visual, personalized learning).
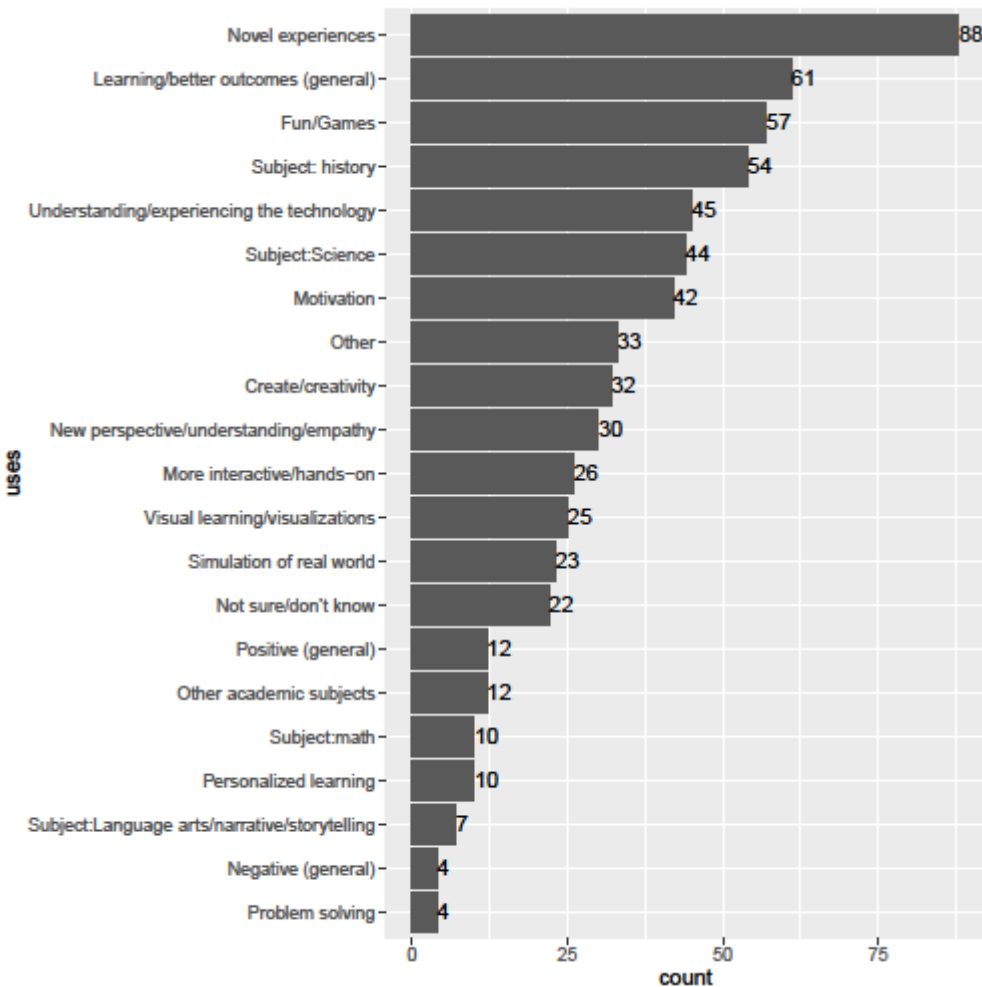

At the start of the study, there were observed differences between males and females in expectations for VR in the classroom and interest in learning more about VR. However, after accounting for school, prior VR experience, technology preference, and career interest, gender was not found to have a significant effect on these variables (i.e., **once you factor in prior experience, technology preference, and career interest, there aren't any differences between men and women for opinions about VR**.)

Results after exposure to VR

Overall, it appears that **classroom-related exposure to VR changed students' self-reported VR experience and understanding of VR**. **However, the largest change appears to be for male students and students with previous experience with VR.**

- Prior to classroom exposure to VR, the majority of students had low self-reported VR experience. After exposure, the sample had a much more normal distribution of responses to the question.
- The majority of students had a high self-reported understanding of what VR is prior to classroom exposure, but self-ratings improved with exposure. **After classroom exposure, the majority self-rated their understanding of VR at an 8 or a 9.**

Scale	PRE mean	PRE median	POST mean	POST median	T-value
Experience using VR	2.92	2.0	4.96	5.0	11.56***
Good understanding of VR	6.44	7.0	7.46	8.0	7.20***
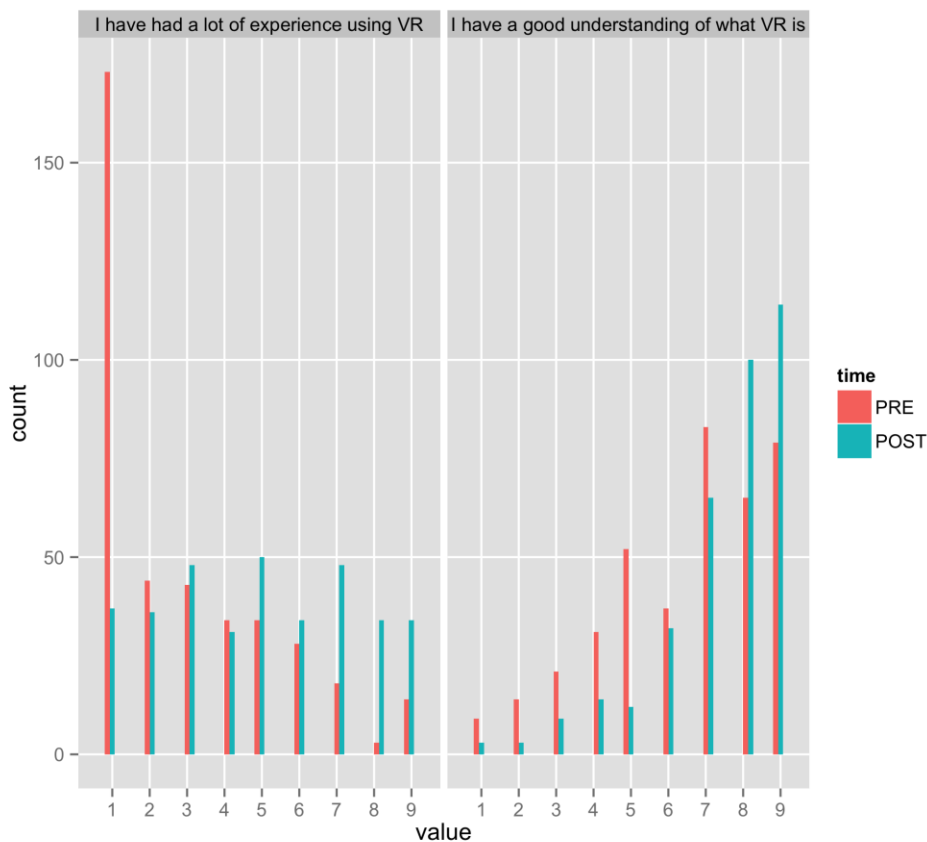
- As a whole, after controlling for other factors, **students were more likely to say they think they would learn more from class lessons if they used VR after classroom exposure to VR**.
- Looking at open-ended responses, **nearly half of the students (162/352 46%) said they had a better understanding of virtual reality after exposure to VR**. Twenty-eight percent of students

said that their experience with VR exceeded their expectations of what VR was; however, the overwhelming majority of these students were male.

- **It appears that students with prior experience with VR benefitted from the program**: students who originally reported that they had a good knowledge of VR were just as likely as students with lower previous knowledge of VR to say that VR exceeded their expectations, and were more likely to say they had a better understanding of VR.
- At the start of the study, controlling for other factors, there were observed differences between males and females in self-reported VR experience, understanding of VR, preference for simulations over reading, STEM career interest, and humanities career interest. After classroom exposure, controlling for other factors, no difference was found between males and females in self-reported ratings of VR experience, understanding of VR, or preference for simulations over reading. Additionally, males and females showed positive rating changes in their understanding of VR at similar rates (53% and 57%, respectively). **This suggests that classroom exposure to VR can bridge a gender gap in VR experience, and understanding of VR.** However, in open-ended responses, females and students without previous experience in VR were much less likely to describe a change in their understanding of VR. More than half of the female students and more than half of the students with little previous knowledge of VR reported little or no change in their understanding of VR. The disparity between Likert item results and open-ended responses is difficult to explain, but the data overall seems to support the conclusion that both male and female students are contributors to the observed changes in VR understanding.
- The difference between genders in STEM and humanities career interest persists after exposure, **suggesting that exposure to VR does not dramatically change students' career interests**.

Scale	PRE			POST		
	Estimated Difference b/t genders (On 9-pt. scale)	S.E.	T-value	Estimated Difference b/t genders (On 9-pt. scale)	S.E.	T-value
Experience using VR	0.81	0.26	3.12**	0.60	0.39	1.53
Good understanding of VR	0.91	0.24	3.75***	0.31	0.29	1.06
Choose to play simulation instead of reading	1.77	0.25	7.08***	0.55	0.30	1.85
STEM Career Interest	1.07	0.30	3.60***	1.51	0.41	3.71***
Humanities Career Interest	-2.32	0.26	8.82***	-2.53	0.40	-6.35***

Opinions towards VR were, for the most part, not observed to be influenced by student age. However, older students were more likely to have developed high expectations for VR after classroom exposure, and older students were more likely to say they were interested in learning more about VR after classroom exposure.

In addition to a better general understanding of VR, several students described having a better understanding of how VR could be used, how it works, and how to use it. Smaller numbers of students noted that VR offers a change in perspective and allows for new experiences.
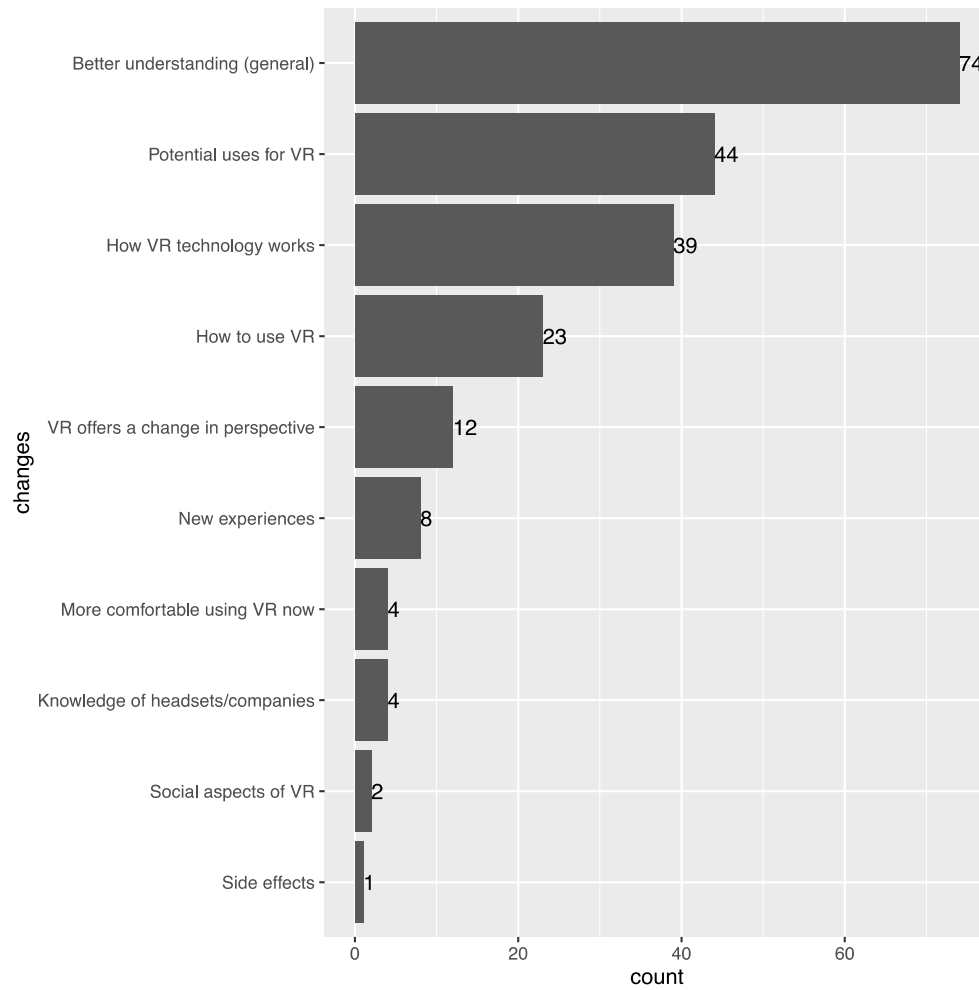
Overall, student preferences for how to use VR in the classroom changed over the course of VR classwork. When asked, "What would you like your teacher to do with virtual reality in the classroom?", **students were more likely at the end of the program to want VR to be used as a teaching tool** (42% vs. 26%), **and more likely to want VR to be used for immersion/novel experiences** (24 vs. 15%).
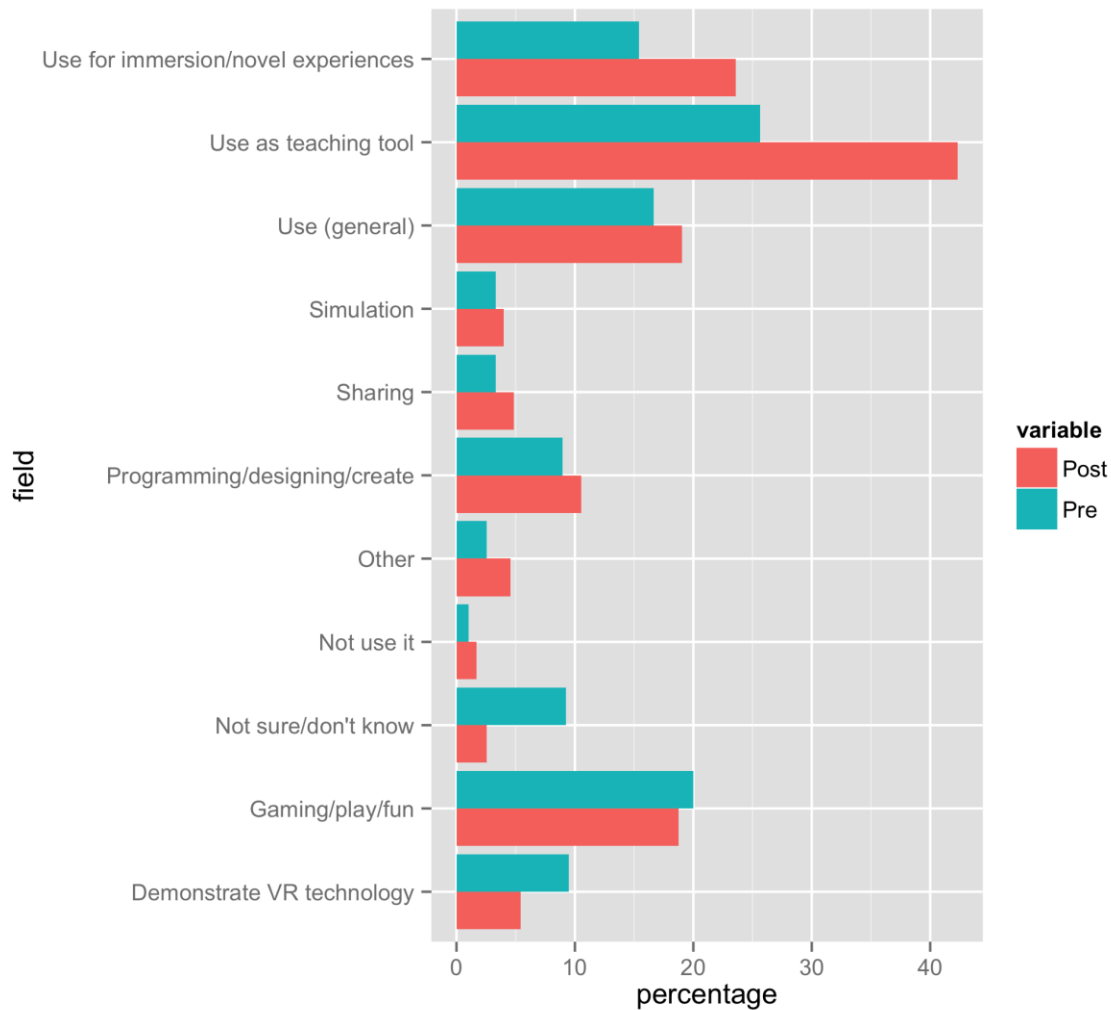
The most common practical advice was simply to try using VR, suggesting that VR is something that needs to be experienced to be understood. Students also emphasized having physical awareness while doing VR, gave advice about VR equipment, and encouraged others to take things easy at first.
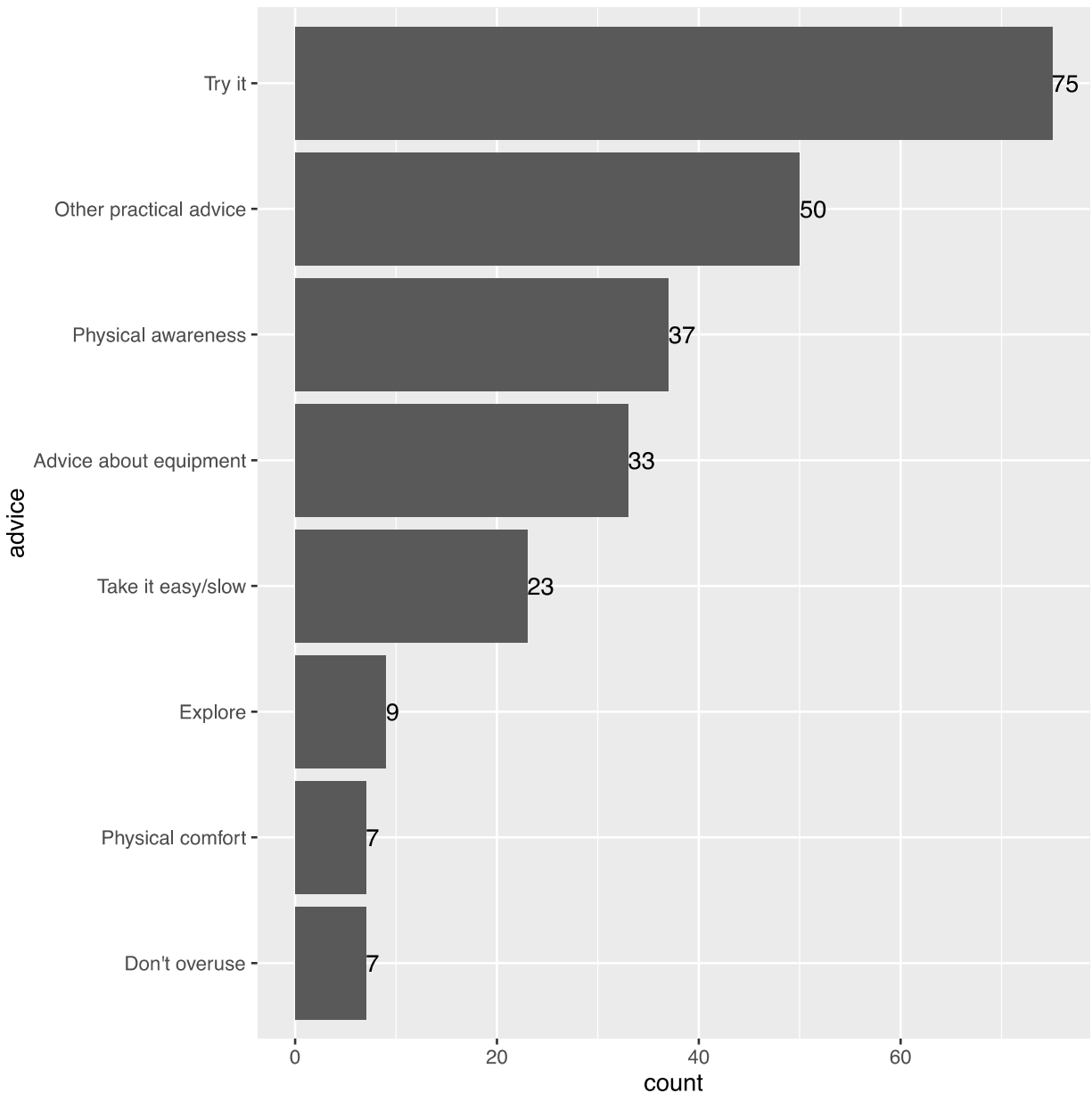
Out of 176 subjects, **31 rated a 5 or higher for the item "I have experienced VR content that felt too overwhelming for me to handle."** Controlling for other factors, students who thought they would learn more from class lessons if they used virtual reality were less likely to have an overwhelming experience. Factors such as age, gender, VR familiarity, technology preference, and STEM career interest were not found to have a significant effect on overwhelm.