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Executive Summary

WGU Labs partnered with Peerceptiv to understand how use of their double-blind, peer-review platform impacted acquisition of skills gained from giving and receiving feedback. Higher education institutions are becoming increasingly focused on helping their students acquire 21st-century skills — the skills and abilities outside of domain-specific knowledge that students need to have in order to succeed in today's workplace. These skills range from critical thinking and problem solving to collaboration and communication. It is not just education institutions who are emphasizing acquisition of these skills; the Association of American Colleges and Universities (AAC&U) recently published a report that highlights how employers also highly value these skills in the incoming workforce (Finley, 2021).

Given the growing importance of domain-general learning and career skills, the Labs research team assessed how use of Peerceptiv created opportunities for students to acquire these relevant career skills. This report summarizes the findings from a descriptive study that assessed how experiences in the peer feedback platform relate to growth in **critical learning**, **writing proficiency**, and **collaboration skills**.

RESULTS AT A GLANCE

790/0 of students reported that Peerceptiv allowed them to detect their mistakes and learn from them.



Peerceptiv's ability to connect students remotely was one feature that appealed greatly to students.

Students reported **high** scores across dimensions of usefulness, satisfaction, and ease of use. The study involved administration of online Qualtrics surveys to 143 undergraduate-level students across two courses from a large public university in the United States between January 2021 and June 2021. All students used Peerceptiv to both give and receive peer feedback on written assessments in their course. At the end of the course, 22 students responded to a survey measuring their engagement with Peerceptiv (Bourgonjon et al., 2010; Davis, 1989), how its use compared to other assessments (e.g., Planas et al., 2014), and their academic selfefficacy (Holden, Barker, Rosenberg, & Onghena, 2007).

Results indicated that:

When comparing Peerceptiv with other types of assessments, 79% of responding students (n = 15) reported that Peerceptiv allowed them to detect their mistakes and learn from them.

Across a diverse set of items, students' survey responses indicated that compared to other assessments, Peerceptiv gave them the opportunity to practice a variety of 21st-century skills. For example, the majority of students said that using Peerceptiv allowed them to view learning critically and constructively, aligning with the skill of critical learning. Additionally, when compared to other education technology that students used in their courses, students reported that Peerceptiv offered them more opportunities to interact with other students, allowing them to work on their collaboration skills.

Peerceptiv's ability to **connect students remotely** was one feature that appealed greatly to students.

When students were asked what they liked about the Peerceptiv platform, responses indicated that students especially liked the ability to connect with their peers through the product. This feature was likely more meaningful during a school year that kept them physically isolated from their peers and the social learning environment. As one student noted, "Peerceptiv was a dynamic way of interacting with peers during the pandemic on assignments."

Students reported high scores across dimensions of usefulness, satisfaction, and ease of use.

To capture different facets of students' engagement with Peerceptiv, we assessed their satisfaction with using the product, the different ways in which Peerceptiv enhanced their learning, and how easy or difficult it was to operate the platform. 58% of students who completed the survey (n = 14) said that using Peerceptiv helped them become a better student and enhanced their learning.

Students across the board found their peers' feedback to be helpful in revising their writing assignments. In fact, in both courses, students' rated the helpfulness of their received feedback highly, ranging from 84.78 - 91.53 (out of 100 points) across 3 assignments. The usefulness of giving and receiving feedback was also reflected in the survey results, where 12 students said if given the opportunity, they would use Peerceptiv again to participate in the peer feedback process. These findings may highlight the benefits of the doubleblind workflow created by Peerceptiv's platform. Because students are all blind to whose document they're reviewing and who is reviewing their document, it helps eliminate peer bias and allows students to actively engage more with their peers than if anonymity were removed.



Mean Scores Across Engagement Variables



The findings from this study highlight the unique features of Peerceptiv that set it apart from the traditional face-to-face peer feedback process. In emphasizing the importance of giving feedback (through targeted helpfulness scores) and streamlining the feedback process for both instructors and students alike, Peerceptiv serves as a novel interface for students to benefit from the peer feedback learning process.

These results—in addition to the student feedback provided on the benefits and drawbacks of Peerceptiv—preliminarily highlight the ease with which students are able to operate Peerceptiv. Importantly, the findings offer insight into the potential for students to learn important career skills through Peerceptiv's interactive feedback platform. Students consistently remarked on how useful they found the feedback they received; one student noted especially that knowing her peers were going to review her work made her more susceptible to having very polished work. These results support the idea that Peerceptiv use is linked to growth in critical learning skills, as research on peer feedback has generally demonstrated that giving and receiving constructive feedback to and from one's peers is related to increased critical thinking and

"Peerceptiv was a dynamic way of interacting with peers during the pandemic on assignments."

metacognitive strategies (e.g., Falchikov & Goldfinch, 2000; Fallows & Chandramohan, 2001; Yu & Wu, 2011).

In addition to effecting potential growth in these learning skills, use of Peerceptiv also presented opportunities to practice social skills of collaboration and teamwork. In both giving and receiving feedback, students participate in a mutuallysupportive effort to improve not only their own learning but also their peers' learning. Through this process, students expand their knowledge base and create moments for self-reflection of their own writing as they constructively review the work of their peers (e.g., Lundstrom & Baker, 2009; Topping, 2010). As Peerceptiv expands into new learning applications (e.g., higher education, K-12, workforce development), future research can continue to uncover the impact of the platform on acquisition of critical learning and career skills.

Background

Peerceptiv offers a novel, empirically-tested platform that presents students the opportunity to engage in peer feedback within their class. Research conducted by the Peerceptiv team shows that the feedback generated by students through Peerceptiv is just as reliable to that provided by teaching assistants or instructors (e.g., Patchan, Schunn, & Clark, 2011) and contains various elements of effective and high-quality feedback (Wu & Schunn, 2020).

The impetus of the current research was to offer insight into the user experience of the Peerceptiv platform. In the following study, we measured how students' use of Peerceptiv impacted acquisition of skills outside of the writing-specific skills gained from using the platform and how it compared to other assessment types currently employed in the classroom (e.g., multiple-choice tests, essay questions, etc.). Specifically, we focus this study on **user engagement**, and the relationship between Peerceptiv use and its impact on **acquisition of 21st-century skills**.

There is a growing emphasis on having students enter the workforce with more 21st-century learning skills—skills outside those that are not specific to a knowledge domain. These skills, like critical thinking and collaboration, are seen as essential 'learning skills' that highlight an individual's ability to apply their knowledge to new and novel situations and work well in a team with others, crucial skills for succeeding in the emerging 21st-century workforce (Finley, 2021).

Research on the effects of peer assessments generally shows that through engaging in the process of peer feedback, students develop their critical thinking and problem-solving skills, which are increasingly sought-after by employers (Bellanca, 2010). Additionally, the mutually-supportive act of giving and receiving feedback teaches students important skills of collaboration and teamwork that will serve them in the professional workplace.

Along with understanding the impact of Peerceptiv use on acquisition of these essential career skills, we also measured the extent to which use of Peerceptiv impacted students' reported academic self-efficacy; how does receiving feedback from one's peers, while also delivering this feedback, impact students' views of their ability to succeed in the classroom? When students engage in the assessment process with their peers, they are able to expand their own knowledge base and subsequently improve their own learning outcomes (Xie, Ke, & Sharma, 2007). The Peerceptiv platform aids in this learning process further by incorporating the unique feature of having a double-blind feedback process. By making it such that students do not know whose work they are reviewing, or who their reviewers are, the potential harm of peer bias is removed and students are able to more actively engage in the feedback process. Through pinpointing areas for feedback and making constructive suggestions in their peers' work, students themselves can transfer these insights to their own work, being more mindful now of areas in which they could also revise.

More details of the study can be found on the <u>Open</u> <u>Science Framework</u>.

Methods & Sample

A total of 143 students across two courses (literature and statistics)¹ used Peerceptiv to submit their writing assessments and provide feedback on their peers' work. All users were undergraduate students enrolled at a public, 4-year university in the United States. Across one semester, the literature students used Peerceptiv to provide feedback on one assignment, and those in the statistics course provided feedback on two assignments. For both courses, students were assigned three assignments to review (e.g., they reviewed three of their peers' writings); after students looked over their reviews, they assigned scores to the reviews based on how helpful they found them.

Prior to using Peerceptiv, students were all sent a pre-activity survey (see <u>Appendix A</u> for more information on study design and measures). After each instance of receiving their reviews, students were sent a feedback survey that assessed how they responded to the feedback received. At the end of the course, students received a post-activity survey. In total, 21 completed the pre-activity survey, none completed the feedback surveys, and 22 completed the post-activity survey.

The majority of students identified as female (59.1%, n = 13), with a mean age of 20.5 years (*SD* = 1.36). Table 1 presents the full demographic details of the sample.

¹ Of the students who completed the survey,
5 students were enrolled in a literature course,
8 were enrolled in a statistics course, and 9 did not indicate in which course they used Peerceptiv.

Variable	Overall	
Variable	(<i>n</i> = 22)	
Gender		
Female	13 (59.1%)	
Male	5 (22.7%)	
Missing	4 (18.2%)	
Race/Ethnicity		
Asian/Asian-American	7 (31.8%)	
Hispanic/Latinx	1 (4.5%)	
White	7 (31.8%)	
Other Race/Ethnicity	7 (31.8%)	
First-Generation Status		
Continuing-Generation	14 (63.6%)	
First-Generation	2 (9.1%)	
Unknown	6 (27.3%)	
Highest Education Completed		
High School/GED	10 (45.5%)	
Associate's Degree	1 (4.5%)	
Bachelor's Degree	6 (27.3%)	
Unknown	5 (22.7%)	
Age		
Mean (SD)	20.5 (1.36)	
Median [Min, Max]	20.0 [19.0, 23.0]	
Missing	7 (31.8%)	

Table 1. Demographics of the student sample who responded to the survey.

Peer Learning With Peerceptiv

To present a clearer picture of how students in the sample used Peerceptiv, we analyzed the performance of the 143 students involved in the study. Students' feedback grades are a function of both the submitter (the student who submits their draft for review) and the reviewer (the peer who reviews the submitter's work). The overall grade represents students' abilities to complete the necessary tasks assigned to them (giving feedback to peers and rating the feedback received from peers), their actual writing, and how helpful peers found their feedback. More specifically, it is a combination of the following components:



✓ OVERALL GRADE

In the literature course (n = 55), students submitted one writing assignment into Peerceptiv, while students in the statistics course (n = 88) submitted two writing assignments into Peerceptiv (See Table 2 for mean scores of assignments' grade components).

For the statistics course, we were able to analyze whether the feedback students received predicted potential growth/decline in scores on their next assignment. To correct for any differences in task difficulty between the two writing assignments, we calculated a standardized score for each assignment. Mirroring the approach used in previous analyses conducted by the Peerceptiv team, we conducted a linear regression analysis to determine how certain factors of feedback on the first assignment—number of comments received and produced, mean length of comments received and produced, and the helpfulness score given to comments produced—predict scores on the second assignment. Contrary to findings in other research conducted with Peerceptiv, our

results indicated that none of the comment features significantly predicted the score of the second draft. However, the overall draft score on the first assignment was a significant predictor of the second draft (B = .54, SE = .11, t(81) = 4.98, p < .001). This suggests that for this course, the assignments were potentially not related enough to warrant feedback on one positively benefitting the next assignment; rather, the encouragement of a higher score on the first assignment and likelihood of strong content overlap may have generally had a positive impact on students' motivation to improve on the next assignment.

For more information on how the review process functions within the Peerceptiv platform and different analytic processes used for Peerceptiv data, please refer to publications generated from the Peerceptiv team <u>here</u>.

	Literature assignment	Statistics assignment 1	Statistics assignment 2
Average grade	M = 79.25, SE = 2.99	M = 91.51, <i>SE</i> = 0.82	M = 85.28, SE = 2.03
Task completion score	M = 88.78, <i>SE</i> = 3.35	<i>M</i> = 95.66, <i>SE</i> = 1.64	<i>M</i> = 85.99, <i>SE</i> = 3.00
Reviewing score			
Helpfulness score	<i>M</i> = 86.29, <i>SE</i> = 3.32	<i>M</i> = 91.53, <i>SE</i> = 0.11	<i>M</i> = 84.78, <i>SE</i> = 3.44
Accuracy score	M = 50.80, SE = 6.57	M = 89.91, SE = 0.53	M = 82.82, SE = 3.39

Table 2. Student assignments' overall grades.



Student Perspectives of Peerceptiv

Results presented below detail the analyses performed on the primary research goals of examining the impact of using Peerceptiv on students' overall engagement with the platform, skill acquisition, and academic self-efficacy. Correlations of relevant demographic and outcome variables are presented in Appendix B.

In addition to the survey results, we also collected responses on open-ended questions which asked students to explain what aspects of Peerceptiv they liked and which aspects they would change. Responses were coded and identified the following four distinct categories in which the responses fell: giving and receiving feedback, specific product features, the interactive nature of the platform, and the ease of using Peerceptiv.

Given the limited sample size of 22 students, the following results are presented as descriptive illustrations of students' experience with the platform. It is unclear if there is bias in the responding sample (e.g., did the best 22 students across the two courses respond to the survey?); thus, we caution against drawing prescriptive conclusions from the results.

PEERCEPTIV SERVES AS A UNIQUE CLASSROOM ASSESSMENT AND TECHNOLOGY TOOL

Students were asked to compare Peerceptiv to other assessments they encountered in their courses (e.g., multiple-choice tests, short-answer questions). Survey results showed that compared to these other assessments, Peerceptiv was regarded more positively along several dimensions related to 21st-century skills (Fig. 1). For example, 79% of students (n = 15) agreed that when compared against other assessments, Peerceptiv allowed them more opportunities to detect their own mistakes and learn from these errors.

Students also remarked that Peerceptiv allowed them to view their learning critically and constructively, potentially reflecting their growth in critical learning skills. Within the open-ended responses, it is of no surprise that the most oftmentioned aspect of Peerceptiv which students enjoyed the most was the ability to give and receive feedback. Of the 21 responses received, 10 mentioned this component as something they enjoyed from the platform. Specifically, one student mentioned that they liked knowing how their peers graded their work and receiving constructive feedback to help with their revisions. Additionally, students also commented that they appreciated being able to review their peers' feedback (for example, one student said it was nice to give feedback on how much other people's review helped them).

Compared to other assessments (e.g., tests using multiple-choice, short-answer, etc.), the peer feedback assessments using Peerceptiv...



Figure 1. Student responses to questions that asked them to compare Peerceptiv to other assessments used in their courses.

By giving students the opportunity to take in constructive feedback to revise their papers, Peerceptiv allows students to revisit their work and critically assess the areas that need improving. It gives them the space to identify potential points of weakness, reflect on such points, and revise accordingly. Additionally, when students provide feedback on their *peers'* work, it allows them to also exercise the skill of critical learning—through analyzing where their peers are able to improve, they can transfer this knowledge and apply it to their own writing.

Students also reported Peerceptiv prompted them to engage more deeply with their course and proved more motivating than other assessments. This seems especially worthy to note as these students were completing their course in the midst of an online-only learning environment. Some research shows that student motivation decreased during this time (e.g., Meeter et al., 2020), so it is noteworthy that students regarded Peerceptiv as a platform that would enable them to stay more engaged with their course. This is also reflected in the open-ended responses, where three students remarked that they enjoyed the interactive nature of the platform, distinct from comments about giving or receiving peer feedback. One student said, *"Peerceptiv was a dynamic way of interacting with peers during the pandemic on assignments,"* specifically calling out how the platform facilitated interaction during a period where students were physically-isolated from each other. Another comment from a student said they enjoyed that the platform was able to stimulate in-person peer reviews.

In addition to asking students to compare Peerceptiv to other assessments, we also asked students to compare Peerceptiv to other technologies used in their courses (Fig. 2). In this comparison, Peerceptiv was rated by 79% of the students (n = 15) as the technology that allowed them to interact most with their peers. This aligns well with the skill of collaboration—by giving and receiving feedback, students were actively engaged in a cycle of collaboration.

Compared to other technology I use in my courses, Peerceptiv offered more opportunities to...



Figure 2. Student responses to questions that asked them to compare Peerceptiv to other tools used in their courses.

STUDENTS FIND PEERCEPTIV ENGAGING AND VALUABLE TO THEIR LEARNING

Students reported on various aspects of their engagement with Peerceptiv, from platform usability to satisfaction with the host. Descriptive analyses showed that across all three engagement variables (ease of use, satisfaction, perceived usefulness and enjoyment), aggregate scores of all three were above the median of the scale ($M_{Ease of Use} = 3.78$, SE = 0.33; $M_{Usefulness \& Enjoyment} = 3.43$, SE = 0.26; $M_{Satisfaction} = 3.81$, SE = 0.34; Fig. 3).

Ease and Satisfaction of Use

In the student survey, we measured whether students found Peerceptiv easy to use (Fig. 4). Across all 5 items, more than half of all students 'Somewhat agreed' or 'Strongly agreed' that the Peerceptiv platform was easy to interact with and found it easy when learning how to operate the Platform.

Mean Scores Across Engagement Variables



Figure 3. Mean aggregate responses to user engagement variables of Ease of Use, Satisfaction, and Usefulness and Enjoyment

Ease of Use



Figure 4. Student responses to Ease of Use scale.

From the open-ended responses, most students commented on the ease of navigating the platform. They mentioned that it was very intuitive to use and clear-cut, noting some of the distinct features of the Peerceptiv interface that facilitate this. One student said they liked being able to leave comments on the document while it was open, rather than having to switch between new windows. This allowed them to have a more seamless experience giving feedback. Another student commented that the flexibility in being able to return to their comments and submit as many times as needed was helpful as well.

Complementing the findings above, results on the measures of Satisfaction reveal that the majority of students agreed that Peerceptiv was useful in their course (Fig. 5). 63% of students (n = 12) even reported that if they had the choice, they would use Peerceptiv again to give and receive peer feedback.

Usefulness and Enjoyment

On the Usefulness and Enjoyment scale (Fig. 6), roughly 58% (n = 11) of students reported 'Somewhat' or 'Strongly' agreeing that using Peerceptiv helped them along a variety of dimensions: becoming a better student, enhancing their learning, and making the course more interesting. For 53% of the students (n = 10), they reported that using Peerceptiv enhanced their motivation in the course.

The interactive nature of giving and receiving peer feedback might have contributed to these results, as research has previously shown that through this process, students are actively engaged in their learning (Falchikov, 2001). Additionally, the fact that students knew their peers might see their drafts could have boosted their motivation to do well. As one student commented, knowing her peers would give feedback **"made me more susceptible of having very polished work."**

Satisfaction



Figure 5. Student responses to Satisfaction scale.

Using Peerceptiv...



Figure 6. Student responses to Use scale.

PEERCEPTIV IMPLEMENTATION RELATED TO SMALL INCREASE IN REPORTED ACADEMIC SELF-EFFICACY

We explored whether the use of Peerceptiv was related to how students viewed their academic self-efficacy, or their ability to complete the goals and tasks necessary for succeeding in their course (Bandura, 1986). Students were asked to complete items of academic self-efficacy by thinking of how they felt about their abilities to achieve in their course both at the start of the course and at the end of the course. Across the board, students reported having high self-efficacy both at the start and end of their course, with mean academic self-efficacy scores significantly greater than the scale median at both time points (p < .001) (see Fig. 7 for item-level comparisons at both timepoints).

Compared to other people, I completed most tasks very well in this course.



Figure 7. Pre-post differences at Academic Self-Efficacy item level.

When reflecting on their academic self-efficacy when starting the courses, students reported a mean of 4.19 (SE = 0.20); at the end of the course, students reported a slightly higher academic self-efficacy, with a mean of 4.38 (SE = 0.15). We see from this comparison of the academic self-efficacy items preand post-course completion that there are nominal differences between the two timepoints and that they do not statistically differ from each other (Fig. 8).

It is possible that this is due to the small sample size; perhaps surveying a larger sample of students would have yielded different outcomes. However, in looking at the relationships between academic self-efficacy and other survey measures (Appendix B), we see an interesting trend. Pre academic self-efficacy was positively correlated with a few of the engagement variables, such as Usefulness (r = .54, p < .05) and Ease of Use (r = .57, p < .05). Additionally, there was a positive relationship between students' reported self-efficacy at the start of the semester and how much more useful they found Peerceptiv compared to other classroom assessments (r = 0.62, p < .01). In other words, feeling more capable of achieving one's goals at the beginning of the semester was related to more favorable ratings of Peerceptiv at the end of the course.

It is also important to note that there are other factors outside of Peerceptiv use that could impact students' self-efficacy in the classroom. Though the peer assessment tool was used for core assessments, it is likely the instructor implemented other practices that contributed to students' learning and confidence in their abilities to perform well. Change in Academic Self–Efficacy



Figure 8. Pre and post-course reported scores of academic self-efficacy.



Conclusion

By providing students with an interactive and structured platform to provide feedback to fellow classmates, Peerceptiv gives students an opportunity to develop both their academic and 21st-century skills. In this study, we examined students' engagement with the platform in two college-level courses as well as formative impressions from students on their experience with the platform and whether they felt the Peerceptiv feedback platform encouraged more collaboration and critical thinking on their part. Preliminary results of the study suggest that: Compared to other assessments and technologies students encountered in the classroom, Peerceptiv granted more opportunities to learn critically and engage in collaboration.

Through providing feedback on peers' work, students actively involve themselves in a reflective learning process that exposes them to different perspectives (i.e., from their peer) and allows for them to accommodate and assimilate this new information, potentially into their own writing (Falchikov, 2001; Xie, Ke, & Sharma, 2007). Through this process, they can begin to look at and review their own work critically, a skill that consistently ranks as highlyvalued by employers (Finley, 2021).

Use of Peerceptiv presented opportunities to practice social skills of collaboration and teamwork, especially important during a year of isolation from peers and the learning environment.

Peerceptiv's novel feature of providing scores for the feedback provided serves as an incentive to contribute constructive and helpful feedback—rather than merely saying "Good job" or "You make a good point," students are motivated to provide more in-depth comments. For example, in the statistics course, one student provided the following thorough comment:

"I think this is a very interesting topic and I am interested to see your findings! However, I am still left with questions about where exactly you will be able to obtain this data and what exactly you will be measuring. I can infer what you are going to measure, but it would be helpful if it was explicitly stated. In addition, I am worried some of this data will not be available because it was not specifically explained...I would like to know which government agencies release this data as well as what specific data is collected and shared on these websites you have mentioned. I worry about privacy issues preventing the publishing of this type of data." In response to this comment, the student who had originally submitted the draft responded by saying that it was a **"Very helpful review, gave me a few things to think about, and gave me insights on how to make my planning more specific."** Through this focused feedback process, where students are incentivized to provide rich feedback (as they are given a 'helpfulness' score for their review), students are encouraged to participate in a mutually-supportive effort. Grades showed that across both writing and statistics classes, students rated the peer feedback as extremely helpful.

Not only does providing feedback improve their peers' work, but it also—as mentioned prior—has the potential to positively impact change in the student's own writing. Students are able to create moments for self-reflection of their own writing and learning as they constructively review the work of their peers (e.g., Evans, 2013; Li, Xiong, Hunter, Guo, & Tywoniw, 2020; Lundstrom & Baker, 2009; Topping, 2010).

Students were able to easily navigate around the Peerceptiv platform.

Across the board, students noted that it was easy to use the Peerceptiv interface and navigate their way around the different review processes. By creating a user experience that is uncomplicated and streamlined, Peerceptiv allows students to concentrate more on their assigned tasks rather than deal with the frustrations of navigating an unwieldy and difficult platform. The exploratory findings presented in this report highlight Peerceptiv's potential to inspire development of not only students' writing skills and efficiency, but also important career-related skills that are fundamental to success in today's workplace. It is especially noteworthy that students report that Peerceptiv allows them the opportunities to develop these skills more so than other assessments and technologies used in the classroom, spotlighting the unique benefits provided by the peer feedback platform. Additionally, as more instructors and administrators were exposed to the potential benefits of online learning this past year and consider tools to bring into the classroom in the future, we recommend that they especially note the ability of Peerceptiv to connect students together and replicate an important learning process in the virtual environment. As Peerceptiv expands into different learning applications (higher education, K-12, workforce development), future research can continue to uncover the impact of the platform on acquisition of critical learning and career skills, as well as how it contributes to students' confidence and growth in their abilities throughout the course.

PEERCEPTIV'S UNIQUE USER EXPERIENCE FEATURES



STUDENT PERSPECTIVE

- Helpfulness and accuracy grades given to their reviews emphasize importance of quality feedback
- Double-blind review process eliminates peer bias and anxiety
- Likert scale and open-ended responses for reviews provide well-rounded assessment of feedback



INSTRUCTOR PERSPECTIVE

- Rubric database populated by other instructors helps crowdsource potential assignment rubrics
- Seamless and quick implementation increases efficiency of instruction, especially as instruction moves toward digital and hybrid options
- Ease of mind given product is backed by years of research showing effectiveness of peer review



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Appendix A: Survey Design and Measures

DATA COLLECTION

This research was approved by WGU's institutional review board. Students were emailed a link to the following survey consent form by their instructors. Only after indicating consent were students transferred to the survey, which contained measures of academic self-efficacy, platform usability, user satisfaction, and demographic questions ¹. The survey was administered through the online Qualtrics survey platform.

MEASUREMENT

Measurement was mostly composed of previously standardized and/or validated scales. Estimates of internal consistency (α) are calculated for all scales.

Intellectual Humility (Krumrei-Mancuso & Rouse, 2017)

 $(\alpha = .82)$

IM_1	I feel small when others disagree with me on topics that are close to my heart.
IM_2	When someone contradicts my most important beliefs, it feels like a personal attack.
IM_3	When someone disagrees with ideas that are important to me, it feels as though I'm being attacked.
IM_4	I tend to feel threatened when others disagree with me on topics that are close to my heart.
IM_5	When someone disagrees with ideas that are important to me, it makes me feel insignificant.
IM_6 (R)	l am open to revising my important beliefs in the face of new information.
IM_7 (R)	I am willing to change my position on an important issue in the face of good reasons.
IM_8 (R)	I am willing to change my opinions on the basis of compelling reason.
IM_9 (R)	l have at times changed opinions that were important to me, when someone showed me l was wrong.
IM_10 (R)	I'm willing to change my mind once it's made up about an important topic.

¹ We distributed a pre-survey containing measures of Intellectual Humility and Need for Cognition, as well as intermediary surveys assessing Managing Affect (measures described below). However, we did not receive enough student responses to rigorously test moderation and mediation with these variables.

IM_11 (R)	I can respect others, even if I disagree with them in important ways.
IM_12 (R)	I can have great respect for someone, even when we don't see eye-to-eye on important topics
IM_13 (R)	Even when I disagree with others, I can recognize that they have sound points.
IM_14 (R)	I am willing to hear others out, even if I disagree with them.
IM_15 (R)	I welcome different ways of thinking about important topics.
IM_16 (R)	I respect that there are ways of making important decisions that are different from the way I make decisions.
IM_17	My ideas are usually better than other people's ideas.
IM_18	For the most part, others have more to learn from me than I have to learn from them.
IM_19	When I am really confident in a belief, there is very little chance that belief is wrong.
IM_20	On important topics, I am not likely to be swayed by the viewpoints of others.
IM_21	I'd rather rely on my own knowledge about most topics than turn to others for expertise.
IM_22	Listening to perspectives of others seldom changes my important opinions.
1 = Strongly di	sagree; 2 = Somewhat disagree; 3 = Neither agree nor disagree; 4 = Somewhat agree;

5 = Strongly agree

Need for Cognition (Cacioppo, Petty, & Kao, 1984)

 $(\alpha = .89)$

NFC_1	l would prefer complex to simple problems.
NFC_2	I like to have the responsibility of handling a situation that requires a lot of thinking.
NFC_3 (R)	Thinking is not my idea of fun.
NFC_4 (R)	I would rather do something that requires little thought than something that is sure to challenge my thinking abilities.
NFC_5 (R)	I try to anticipate and avoid situations where there is a likely chance I will have to think in- depth about something.
NFC_6	I find satisfaction in deliberating hard and for long hours.
NFC_7 (R)	I only think as hard as I have to.
NFC_8 (R)	l prefer to think about small, daily projects to long-term ones.

NFC_9 (R)	I like tasks that require little thought once I've learned them.
NFC_10	The idea of relying on thought to make my way to the top appeals to me.
NFC_11	l really enjoy a task that involves coming up with new solutions to problems.
NFC_12 (R)	Learning new ways to think doesn't excite me very much.
NFC_13	I prefer my life to be filled with puzzles that I must solve.
NFC_14	The notion of thinking abstractly is appealing to me.
NFC_15	l would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.
NFC_16 (R) —	I feel relief rather than satisfaction after completing a task that required a lot of mental effort.
NFC_17 (R)	It's enough for me that something gets the job done; I don't care how or why it works.
NFC_18	I usually end up deliberating about issues even when they do not affect me personally.
1 = Extremely 4 = Somewhat	uncharacteristic; 2 = Somewhat uncharacteristic; 3 = Uncertain; characteristic; 5 = Extremely characteristic

Managing Affect (adapted from Henderson et al., 2016) (no responses)

MAff_1 _____ How sad or happy did the comments make you feel?

MAff_2 _____ How angry or content did the comments make you feel?

MAff_3 ____ How ashamed or proud did the comments make you feel?

MAff_4 _____ How discouraged or motivated did the comments make you feel?

1 = Extremely [negative emotion]; 2 = Moderately [negative emotion; 3 = Slightly [negative emotion];

4 = Neither [negative emotion] nor [positive emotion]; 5 = Slightly [positive emotion];

6 = Moderately [positive emotion]; 7 = Extremely [positive emotion]

Perceived Usefulness and Enjoyment (adapted from Technology Acceptance Model; Davis, 1989) (*a* = .95)

Use_1 U	Using Peerceptiv made the course more interesting.
Use_2 l	Using Peerceptiv made the course more enjoyable.
Use_3 U	Using Peerceptiv made the course more fun.
Use_4 U	Using Peerceptiv enhanced my actual learning.
Use_5 I	Using Peerceptiv enhanced my motivation.
Use_6 I	Using Peerceptiv helped me become a better student.
1 = Strongly disc	agree; 2 = Somewhat disagree; 3 = Neither agree nor disagree; 4 = Somewhat agree;
5 = Strongly agr	ee

Perceived Ease of Use (adapted from Technology Acceptance Model; Davis, 1989) $(\alpha = .97)$

	Ease_1 Learning to operate Peerceptiv was easy for me.
	Ease_2 I found it easy to get Peerceptiv to do what I wanted to do.
	Ease_3 I found Peerceptiv to be flexible to interact with.
	Ease_4 It was easy for me to become skillful at using Peerceptiv.
	Ease_5 I found Peerceptiv easy to use.
	1 = Strongly disagree; 2 = Somewhat disagree; 3 = Neither agree nor disagree; 4 = Somewhat agree; 5 = Strongly agree
Sati	sfaction with Peerceptiv (adapted from Bourgonjon et al., 2010; Planas et al., 2013)

(α = .97)

Sat_1 _____ I would be happy using Peerceptiv in other courses where peer feedback is required.

Sat_2 _____ I found Peerceptiv useful in my course.

Sat_3 _____ If I had the choice, I would use Peerceptiv again to give and receive peer feedback.

1 = Strongly disagree; 2 = Somewhat disagree; 3 = Neither agree nor disagree; 4 = Somewhat agree; 5 = Strongly agree

Tech Comparison

 $(\alpha = .94)$

Tech_compare_1	Compared to other technology I use in my courses, Peerceptiv offered more opportunities to experiment with knowledge.
Tech_compare_2	Compared to other technology I use in my courses, Peerceptiv offered more opportunities to take control over the learning process.
Tech_compare_3	Compared to other technology I use in my courses, Peerceptiv offered more opportunities to stimulate transfer between various subjects.
Tech_compare_4	Compared to other technology I use in my courses, Peerceptiv offered more opportunities to interact with other students.
Tech_compare_5	Compared to other technology I use in my courses, Peerceptiv offered more opportunities to think critically.
1 = Strongly disagree; 2 5 = Strongly agree	2 = Somewhat disagree; 3 = Neither agree nor disagree; 4 = Somewhat agree;

Assessment Comparison (adapted from Planas et al., 2014)

 $(\alpha=.96)$

Compared to other assessments (e.g., tests using multiple-choice, short-answer, etc.), the peer feedback assessments using Peerceptiv:

Assessment_compare_2allowed me to view learning critically and constructively.Assessment_compare_3helped me develop skills that will be useful to me in my future career.Assessment_compare_4proved more motivating than other assessments.	Assessment_compare_1	 allowed me to detect my own mistakes and learn from them.
Assessment_compare_3helped me develop skills that will be useful to me in my future career.Assessment_compare_4proved more motivating than other assessments.	Assessment_compare_2	 allowed me to view learning critically and constructively.
Assessment_compare_4 proved more motivating than other assessments.	Assessment_compare_3	 helped me develop skills that will be useful to me in my future career.
	Assessment_compare_4	 proved more motivating than other assessments.
Assessment_compare_5 made me prepare my work better throughout the course.	Assessment_compare_5	 made me prepare my work better throughout the course.
Assessment_compare_6 caused me to engage more deeply with the course over the semester.	Assessment_compare_6	 caused me to engage more deeply with the course over the semester.

1 = Strongly disagree; 2 = Somewhat disagree; 3 = Neither agree nor disagree; 4 = Somewhat agree; 5 = Strongly agree

Academic Self-Efficacy (Chemers, Hu, & Garcia, 2001)

(pre: *α*= .97; post: *α* = .88)

Below, rate your level of agreement with the following questions based on how you felt at the START/END of the course.

SE_1	I thought I would be able to achieve most of the goals that I would set for myself in this course.
SE_2	When facing difficult tasks, I was certain that I would accomplish them in this course.
SE_3	In general, I felt able to obtain outcomes that would be important to me in this course.
SE_4	I believed I could succeed at most any endeavor to which I set my mind in this course.
SE_5	I would be able to successfully overcome many challenges in this course.
SE_6	I was confident that I could perform effectively on many different tasks in this course.
SE_7	Compared to other people, I would complete most tasks very well in this course.
SE_8	Even if things got tough, I would be able to perform quite well in this course.

1 = Strongly disagree; 2 = Somewhat disagree; 3 = Neither agree nor disagree; 4 = Somewhat agree; 5 = Strongly agree

Open-ended Questions

- What did you like about Peerceptiv and the experience of using it?
- What would you change about Peerceptiv?

Appendix B: Correlation Table

Table 2. Pearson correlation matrix of all outcome variables.

	1	2	3	4	5	6	7
1. Pre Academic Self-Efficacy	-						
2. Post Academic Self-Efficacy	0.25	-					
3. Usefulness	0.54*	0.02	-				
4. Ease of Use	0.57*	0.20	0.66**	-			
5. Satisfaction	0.50*	0.03	0.77***	0.82***	-		
6. Comparison to Other Tech	0.34	-0.03	0.84***	0.62**	0.74***	-	
7. Comparison to Other Assessments	0.62**	0.21	0.79***	0.77***	0.90***	0.81***	-

p* < .05, *p* < .01, ****p* < .001



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The **Accelerator at WGU Labs** works with early-stage education technology startups. As an accelerator born out of Western Governors University (WGU) — the nation's largest nonprofit, online university — its mission is to advance the academic, social, and career success of learners by lowering education costs, increasing learner access, and improving learner outcomes, all with a particular focus on those who are underserved and/or at-risk.



Peerceptiv is dedicated to improving learning outcomes through collaboration and innovation. Peerceptiv grew out of over a decade of research at the University of Pittsburgh's Learning Research and Development Center. Our passion for critical thinking drives us to expand Peerceptiv's technology and bring the power of peer learning to more institutions and organizations.