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Bachelor Thesis

Self-Efficacy Levels and its Influence on the Reception of Opposing Feedback

Does Students' Self-Efficacy Level Influence Whether they Accept or Reject Opposing Feedback in Quiz Activities?

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Abstract

Research has not yet investigated students' self-efficacy levels' effects on their reception of *opposing feedback* in quiz activities. More precisely, whether they accept or reject this type of feedback. Therefore, this study aims to investigate this effect via a quiz-like survey. To test this, an online quiz and self-efficacy questionnaire were created and distributed via various platforms to university students over the age of 18. Respondents were selected via a convenience sampling method due to the survey targeting a wide group. Responses were analyzed using a correlation matrix, a t-test and an ANCOVA. The results indicated that while there were various trends between self-efficacy and quiz scores, no significant differences were found between the levels of self-efficacy and opposing feedback. Furthermore, the findings denote that participants with higher self-efficacy had more correct answers given in the quiz than those with low-self efficacy. However, there is a lack of concrete evidence to ensure that self-efficacy levels play a role in their acceptance or rejection of *opposing feedback*. Therefore, it is essential to further investigate the relationship between students' self-efficacy levels and their *opposing feedback* reception. As well as how these factors may aid in future studies regarding education.

Self-Efficacy Levels and its Influence on the Reception of Opposing Feedback

Feedback has been actively studied and has been deemed to have various benefits to its recipients within multiple realms, such as in education, a business, an organization and more. Feedback has been defined in various ways; however, almost all definitions agree that it is the practice of providing information regarding performance against a certain known standard (Nicol & Macfarlane-Dick, 2004; Panadero & Lipnevich, 2022). Providing and receiving feedback is an interactive process that aims to give recipients a deeper insight into their performance (Clynes & Raftery, 2008). There are, however, certain guidelines to make feedback more efficient (Wood, 2000):

1. Feedback has to have a bidirectional relationship in which the recipients ask questions, and the feedback provider is able to explain and answer these questions.
2. It is solely based on the observation of the outcome of the recipient; therefore, it must remain unbiased.
3. Feedback is designed to be formative or summative, meaning that it aims to engage the recipients to reflect on their work or it is given at the end of the task.

Feedback in general aids in recipients' understanding of material given to them (Begley & White, 2003). Furthermore, feedback has many uses, however, for this research study, it will be examined how it is used in quiz activities. As well as if the level of students' self-efficacy affects whether they accept or reject *opposing feedback*.

Use of Quizzes as Audience Response Systems

Audience response systems (ARS) have been used in various ways in the context of education throughout the years. In this study's context, ARS' will be called quizzes. Quizzes have many purposes, benefits, contexts, and tools. They aim to improve recipients' motivation towards the subject they partake in. Furthermore, quizzes boost the understanding of concepts and allow recipients to actively engage in their process depending on the context (Cook & Babon, 2017).

Quizzes can be used in multiple contexts; one significant benefit that permits their use in multiple contexts is their immediate allowance of the results to the recipient (Gamage, Ayres, Behrend & Smith, 2019). This instant feedback allows for more lines of communication to open between both the quiz taker and the quiz giver (Rinaldi, Lorr, & Williams, 2017). Furthermore, Geary (2017) noted that another benefit is that they allow recipients to know where they went

wrong and therefore provide room for improvement and self-reflection. However, this is only done when the correctness of the answer is communicated to the quiz taker (Geary, 2017). Consequently, quizzes have multiple advantages that further allow them to have various uses.

Hillman (2012) highlights that one of the ways in which quizzes can be used is through assessing material comprehension and enhancing students' engagement. They can also be used as a tool to engage people with what they are learning. Quizzes could be served as a tool for gamification, which is defined as the use of game design elements in non-game contexts (Deterding Dixon, Khaled, & Nacke, 2011). This can be seen as a quiz tool because game design elements are embedded into the quiz to ensure the recipients are engaged, thus creating motivation for those playing (Dicheva et al., 2014).

Quizzes might be utilized as a self-assessment tool, enabling students to improve through their own insights (Schweighofer, Taraghi, & Ebner, 2019). Within educational contexts, quizzes are provided to examine multiple aspects. For example, they can be used to assess a student's level of understanding, whether they are actively studying, to help the provider identify any gaps of knowledge they are missing, and many more. Thus, there are multiple uses for quizzes. However, in order to effectively be able to assess one's progress or success in quizzes, feedback is considered to be an essential aspect. Especially providing timely and personalized feedback, which is a common characteristic of ARS.

Feedback

Studying feedback, specifically in an academic context, is of particular interest because many factors may affect how students in particular, accept or reject this feedback. In academic settings, the feedback given to students has to provide them with information that supports them in bridging the gap between what they understand and what needs to be understood (Sadler, 1989). Feedback in education can be viewed as a cycle in which goals are set to give purpose to the assignment. Students are then given a period to study or practice what is given to them to achieve this goal. After that, the students are evaluated on whether they successfully reached this goal (Schartel, 2012).

According to the model suggested by Hattie and Timperley (2007), in order for the feedback to be effective, three major questions have to be asked, either to the student or the teacher, or both. The first question is, "Where am I going/What are the goals?". The second is "How am I going/What am I doing to move towards this goal?". The last question is, "Where to next/what do I need to do to do better next time?". The researchers further emphasize the importance of ensuring the feedback given is appropriate for the recipients, in this case for the

students, therefore minimizing any discrepancies between students' "current understanding and what is desired" (p. 86). Hattie and Timperley (2007) further distinguish four different levels of feedback and how each of these levels is directed at a different process and thus affecting how effective the feedback is. The first level of feedback concerns how well the task is performed (FT). The second is feedback relating to the processing of the task (FP), specifically the underlying processes, such as the cognitive processes and strategies used for the task. The third level is feedback regarding self-regulation, which is the ability of people to self-assess how much effort they are willing to put into dealing with this feedback and seeking more, and their confidence in their response (FR). Finally, there is feedback about the self as a person (FS), rather than about the task they are perusing, such as praising the individual. Therefore, distinguishing which level of feedback is being given increases the processing of what went wrong and how to improve it. This applies to feedback in academic settings because students vary in their mental processes. Therefore, providing each student with a level of feedback that suits their mental processing is essential.

Sadler (1989) researched deeper into formative assessments and the design of instructional systems. He proposed three criteria that make feedback effective. The first is that the students' needs to identify their goal. Then they compare their level of success to that goal. Finally, they view the discrepancy between their performance and the goal and bridge that gap. He further claims that in order for students' performance to improve, they have to be able to monitor the quality of their work thus are able to evaluate it and reach for higher standards.

Nakanishi (2007) investigated the effects of different types of feedback on revision. He found that revision in all cases lead to higher scores, however, receiving the feedback from peers and superiors were the most effective in leading to the correct revision of their answers.

Collective Feedback

Collective feedback can be defined as feedback that represents what all the students collectively did. Therefore, it is not personalized; it is based on all the other answers provided by the other students. As a result, students are able to find out their peers' responses and how their answers fall into that. It is also known as aggregated feedback or tallied feedback.

A fundamental model highlighting how *collective feedback* engages students during quizzes is the Peer Instruction Model by Eric Mazur (1997). He states that there are four steps that make up this model. The first step is students giving their initial answers to multiple-choice questions, which is also called the voting phase. The second step is receiving *collective feedback* based on other students' responses. This step is done through the ARS platform that

is provided or the teacher. The third step allows the recipients to discuss their answers with neighboring peers. The final step is for the recipients to redo the ARS, which is also called the revoting phase. In this step, they redo the quiz prior to receiving final feedback or the correct answers. Furthermore, in this step, the students have to participate in a teacher-lead discussion. Therefore, this model shows the way in which *collective feedback* is used in educational settings and how feedback aids students' engagement in activities.

However, a downside that has been shown to *collective feedback* is conformity bias. *Collective feedback* might lead to students giving the most popular answer next time they encounter the same question, without understand its reasoning (Brooks & Koretsky, 2011).

Self-Efficacy

Wisniewiski, Zierer, and Hattie (2020) have researched feedback in educational settings, which was done using a meta-analysis. They found that different types of feedback affect how successfully the task was performed. They researched two types of feedback; reinforcement and punishment. In this study, *opposing feedback* is the main type used, which is the direct opposite of reinforcing feedback. They state that feedback that contains reinforcements is more powerful than those that do not and, in turn, affects how students self-regulate (Wisniewiski et al., 2020). Therefore, since self-regulation is an integral element of self-efficacy, assessing self-efficacy will provide more insight into the link between self-efficacy and *opposing feedback*.

Self-efficacy is a concept created by Albert Bandura (1994). He defines it as follows: people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives. It determines how people think, feel, motivate themselves, and behave. Self-efficacy involves four different processes: cognitive, affective, motivational and selection processes (p.71). Self-efficacy pertains to specific tasks; therefore, individuals who have high self-efficacy in one task might also have low self-efficacy in another task (Helsin & Klehe, 2006). Individuals who tend to have high self-efficacy are persistent when completing tasks, especially if there is a setback, they aim for improvement in their tasks, and are less defensive when receiving criticism (Helsin & Klehe, 2006). While those that tend to have low self-efficacy view negative feedback, or feedback that does not align with their answers, as confirmation of their incompetency. They think too much and thus undermine their problem-solving abilities and blame other people when they do not accomplish their task (Helsin & Klehe, 2006).

Margolis and McCabe (2010) studied self-efficacy in academic settings and found that students need a sufficient level of self-efficacy in order to be engaged in their learning process. Furthermore, in academic settings, it was found that usually females tended to have higher self-efficacy (Pajares, 2002). Thus, they are more organized, they recognize their goals, and they actively work towards them. Research has further suggested that individuals with high self-efficacy tend to be more motivated and inclined to achieve more than those who do not (Multon et al., 1991). Therefore, having the ability to perform tasks is not the only thing that aids students' success. They also have to believe that they are able to perform a specific task successfully.

Assessing students' sense of self-efficacy in this study will help provide insight into whether having high or low self-efficacy plays a role in how they receive *opposing feedback*. Furthermore, it will aid in examining whether this type of feedback affects people with high or low self-efficacy more. Particularly if students have the ability to self-regulate. Self-regulation in regard to self-efficacy is how much an individual believes they are capable to think and behave in a certain way that is associated to their learning goals (Usher, 2012). Students who have a high level of self-regulation are highly controlled in their learning experiences. Meaning they set goals for themselves, they actively seek help, they self-monitor their progress and are organized individuals (Artino & Stephens, 2007).

Study Motivation and Research Hypothesis

This study will focus on *opposing feedback*. This will enable research into whether *opposing feedback* affects students' efficacy levels. Whether *opposing feedback* will inject doubt into the students' answers or if it will make them confident in their answers. Based on the above theoretical considerations, the study will test the following hypothesis:

H_0: Self-efficacy will not affect how students respond to the quiz in both the voting and revoting phases.

The study will explore the following research question in order to be able to find out whether students' levels of self-efficacy, either high or low, affects whether they accept or reject *opposing feedback* in quiz settings. This is going to be conducted via a survey using Qualtrics, focusing on university students.

RQ: Does students' self-efficacy level influence whether they accept or reject *opposing feedback* in quiz activities?

Method

Participants

The study was conducted using a convenience sample method of 121 adults who volunteered to take the quiz and self-efficacy questionnaire. This study was distributed using various social media platforms, such as WhatsApp, Facebook, and Instagram, as well as the University program called SONA, and the study was available in English. In order to be able to participate, two inclusion criteria had to be met; the participants had to be 18 or older and had to be university students. These criteria were determined at the start of the study in which the participants were required to tick a box confirming they were 18 or above and consent to participate. Otherwise, they could not proceed.

Regarding participants ages in the study, they were mainly concentrated around the age range of 18 to 24, the lowest being 18 and the oldest being 44. Regarding gender, 75% of participants identified as female and 25% as male. 96% of the participants are or have completed a bachelor's degree, 2% a master's, and 2% answered other. 27% of participants were Egyptian, 24% were German, 8% were Indian, and the remaining participants varied in their nationalities.

In total, 121 people participated in the quiz, 18 people were excluded from the sample due to incomplete responses, and 2 participants were excluded because they were deemed outliers due to their answers differing more than three times the standard deviation from the mean. Therefore, the analyzed participants were 101 in total.

Materials and Instruments

Independent Variable

Self-efficacy Scale. The Online Peer Assessment Self-Efficacy Scale (OPASS) was constructed to measure students' self-efficacy in online peer assessment learning environments (Tseng & Tsai, 2010). This scale encompasses 15 different statements with three different sub-scales: six pertaining to the evaluating sub-scale, four to the receiving sub-scale and five to the reacting sub-scale.

The evaluating sub-scale measures students' confidence in their evaluation of peers' work in online activities. An example of this is 'In online PA activity, I can find the strengths of my peers' work when I review it'. Whereas the receiving sub-scale involves measuring

students' confidence in receiving peer judgments and being able to recognize their weaknesses that their peers identify. An example of this is 'In online PA activity, I can ignore unreasonable feedback from my peers'. Finally, the reacting sub-scale relates to their confidence in reacting to peer feedback, which feedback to prioritize and how to plan upcoming tasks based on that feedback. An example of this is 'When receiving peers' comments in online PA activity, I can identify which of their opinions are of more importance'. Overall, this scale was measured to have a high internal consistency ($\alpha=.90$).

Dependent Variables

Multiple dependent variables were developed from the quiz that was created. A program called Qualtrics (https://www.qualtrics.com) was used to be able to create this quiz, along with Google searches on true and false general knowledge trivia questions. Firstly, the quiz was divided into two phases: the voting and revoting phase, which were both utilized as dependent variables. These phases are based on Mazur's Peer Instruction Model (1997).

Furthermore, for the purpose of this study, the feedback administered was manufactured to imitate *collective feedback* of other student's responses to each question. This was done for the revoting phase of the quiz. There were three types of *collective feedback* created for the revoting phase: opposing, neutral and positive. These types of *collective feedback* which were created and used in the revoting phase were also operated as dependent variables.

To be able to control the type of feedback that participants viewed and ensure they answered all the quiz questions, the Qualtrics display logic option was used. For all the questions, a forced response requirement was added to ensure that participants responded to every question. Participants were given instructions at the beginning of each phase and were not given the option to go back or change their answers. The participants had to complete a question to be able to move on to the next and were not able to go back to change their answers. This was done to control for the truthfulness of the participants' answers.

For the revoting phase, the display logic option was also utilized to be able to control which feedback the participants received regarding their answers in the voting phase. Two of the same questions were coded in the revoting, and the display logic option was used to determine which feedback the participants received depending on their answers in the voting phase. For example, when *opposing feedback* was given, two of the same questions were coded into Qualtrics. Therefore, if the participant's original answer was true, they received *opposing collective feedback* that the answer 'false' was the most answered and vice versa. Additionally, the default choice option was applied for the participants in the revoting phase. This was for

the participants to view what answer they chose in the voting phase and thus be able to determine whether they would change their answer accordingly.

Quiz Voting Phase. The voting phase consisted of 10 true or false general knowledge statements. These included true and false statements such as 'Alexander Fleming discovered Penicillin' as seen in Figure 1, and 'The small intestine is about three-and-a-half times the length of your body'.
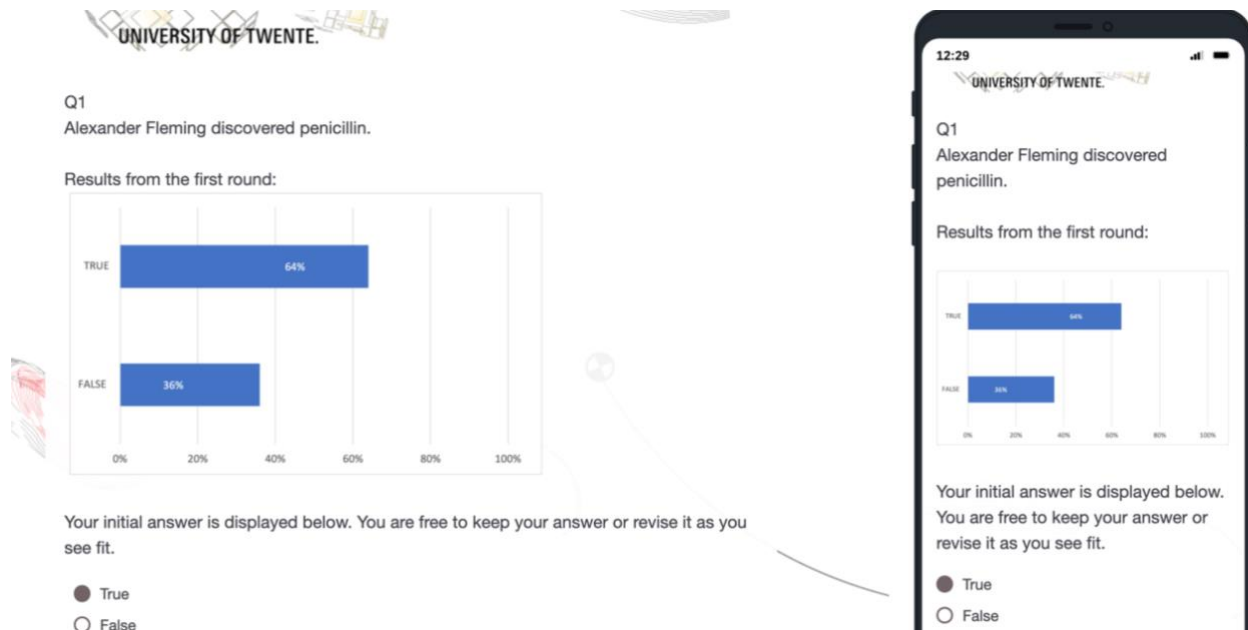
Figure 1

Qualtrics Screenshot of the Participants' View of the Statements During the Voting Phase
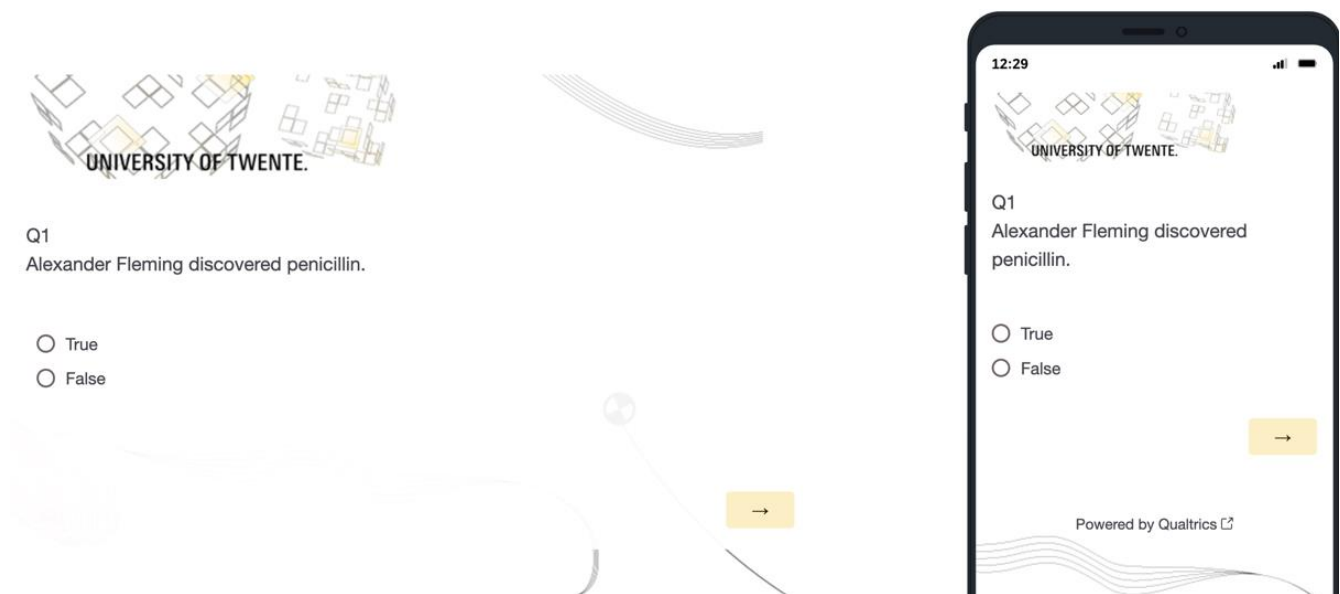
Quiz Revoting Phase. The revoting phase consisted of the same 10 true or false general knowledge statements that were in the voting phase. However, this time the *collective feedback* was visible to the participants. The feedback was provided as a horizontal bar chart (Appendix A), with different percentages shown for true and false. Figure 2 is an example of what the participants saw during the revoting phase.

Figure 2

Qualtrics Screenshot of the Participants' View of the Feedback in the Revoting Phase, in line with their Answers from the Voting Phase

Note. This figure displays an example of positive feedback that was provided to the participants.

Types of Feedback. Three types of feedback were used for the revoting phase, opposing, positive and neutral. Six out of the ten questions gave *opposing feedback* due to the nature of the study. Two were positive, and two were neutral. Figure 2 displays an example of a positive feedback question.

Figure 3

Qualtrics Screenshot of a Question that Contained Opposing Feedback Shown to the Participants in the Revoting Phase.
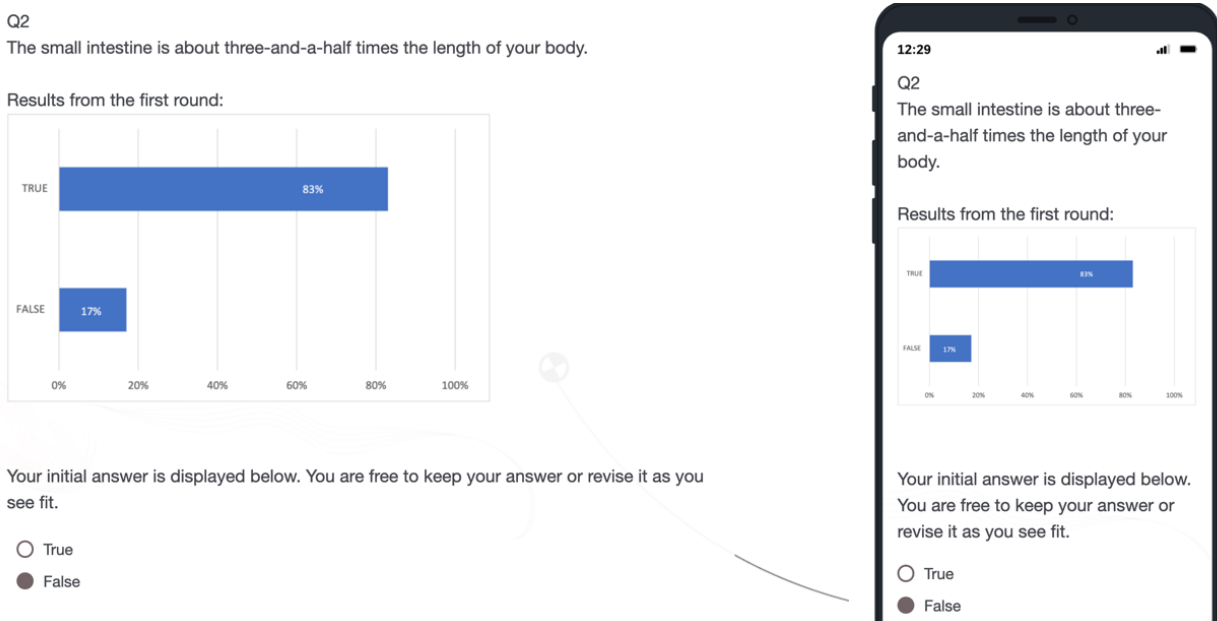
Figure 3 shows an example of *opposing feedback* given to the participants. The positive, neutral, and *opposing feedback* were randomly distributed among the ten questions. This way, the participants do not feel that all their answers were wrong due to the majority of feedback being opposing.

Study Design

This study used a within-subjects design. The independent variable is the self-efficacy score of the participants, while the dependent variables are the quiz scores of the voting and revoting phases, as well as the type of feedback that was used (opposing/positive/neutral). In other words, the scores one gets in the voting, and revoting phases depend on their self-efficacy and the type of feedback received. All participants were required to partake in the quiz, both the voting and revoting phases, as well as the fill out the self-efficacy scale.

Measures

The study included one independent variable, the self-efficacy score, which was divided into two groups, a high-scoring group, and a lower-scoring one. This was based on the scores of the top 33% and lowest 33% of participants.

In regard to the dependent variables, multiple scores were computed in order to be able to conduct the analysis effectively. These scores included the number of revisions made, the number of current revisions along with incorrect ones, the total score of the voting phase and the revoting phase along with the number of revisions made to the *opposing feedback* questions, the positive and the neutral feedback questions. These scores for the dependent variables are shown in Table 1, along with their descriptions. Furthermore, Hake's (1998) normalized gain $\langle g \rangle$ was utilized to evaluate the difference between the voting and the revoting phases.

$$\langle g \rangle = \frac{revoting\ (\%) - voting\ (\%)}{100 - voting\ (\%)}$$

Table 1 shows how the dependent variables, as well as how the acceptance and rejection of *opposing feedback*, were operationalized in regard to the hypothesis and the research question. An alpha value of .05 was utilized as a threshold in order to determine significance for the whole data analysis.

Table 1

Dependent Variables' Operationalization

Variable (Scale)	Description	Analysis
Quiz		
Voting Score	Computed total on how many out of ten questions the participants got correct in the voting phase	%
Revoting Score	Computed a total of how many out of ten questions the participants got correct in the revoting phase	%
Revision Total	Total number of answers that were revised between the voting and revoting phases	%
Correct Revision Total	Total number of revisions that the participants got correct between the voting and revoting phases	%
Incorrect Revision Total	Total number of revisions that the participants got incorrect between the voting and revoting phases	%
Opposing Feedback Revisions	Total number of revisions made to the questions that contained opposing feedback between the voting and revoting phases	%
Revoting Score on Opposing	Total number of correct revisions made to questions containing opposing feedback in the revoting phase	%
Total Gains	Performance difference between the voting and revoting phases	<g>

Procedure

Participants completed a manufactured online quiz and questionnaire that was made and shared via Qualtrics (https://www.qualtrics.com) (Appendix B) using a computer, tablet, or any other electronic device, with a stable internet connection. At first, subjects were asked to fill in a consent form and some demographic data, such as age, gender, degree of education and nationality. They were then asked about their characterization of their level of general knowledge and their level of self-confidence. All these required forced responses; this way, the participants had to answer. Otherwise, they could not continue with the study.

Afterwards, they were presented with the voting phase of the quiz, which comprised of 10 general knowledge true or false questions. They were given the instruction of 'The quiz is

about to start. You will be given a series of 10 general knowledge questions once you have answered a question you will not be able to go back. Following this round, you will be given the quiz in a second round where you will be able to see what others have answered and will thus answer the quiz a second time' and were required to answer all 10 questions. They were then given the quiz once again, the revoting phase. In this phase, they were instructed, 'You will now be given the quiz again. This time you will be able to view feedback of what other students have answered regarding these questions. The most popular answer will be displayed on top in the feedback given. You will also see the answer you gave in the first round. You are free to keep your answer or change it, as you see fit'. During this phase, they were guided to questions that showed *collective feedback* depending on their answers in the voting phase. The *collective feedback* in this phase was given in the form of bar charts with percentages of true and false out of 100% (Appendix A). The participants were then given the option to keep or change their answers based on this feedback. Following that, they were given the self-efficacy (OPASS) questionnaire, which consisted of 15 statements. They were instructed to answer as truthfully as possible. This questionnaire was given in the form of a five-point Likert scale, from "1: Strongly disagree" to "5: Strongly agree", in which participants were asked to rate how much they agreed with each statement

In the end, participants were given a debrief about the nature of the study and its aims. The debrief included how the feedback given was made-up, why that was the case, as well as informing them that this study aimed to research whether *opposing feedback* influences students' self-efficacy. The median of the duration was calculated to exclude extreme outliers; the survey took an average of eight minutes to complete.

Data Analysis

To be able to analyze the data, several calculations were made, as shown above in Table 1. They were the total scores of the voting and revoting phases of the quiz, out of ten, the total number of revisions made between the voting and revoting phases and the number of correct and incorrect revisions made between the two phases. Additionally, the number of revisions each participant made to the *opposing feedback* questions, the positive and the neutral feedback questions were calculated. The means of the "OPASS" scale and its three sub-scales were further calculated and used to group participants into high and low self-efficacy categories. These calculations were then utilized in all further data analyses conducted.

Regarding the analyses used, a paired-samples t-test between the voting and revoting phases, and the number of revisions made to each type of feedback was utilized. This was done

in order to reveal whether the means for the two quiz phases and the revisions made to each type of feedback are related. An independent samples t-test was applied for the highest and lowest-scoring groups of self-efficacies and all the variables in Table 1. This was to determine whether there was evidence to show that the means significantly differed between the two groups and the dependent variables. Finally, an Analysis of Covariance (ANCOVA) was employed to determine whether there was a significant effect between the two groups of self-efficacies and the revoting scores while controlling for the voting scores as a covariate.

Results

Descriptive Statistics

Upon analyzing the data, when answering the question "how would you characterize your level of general knowledge", 64% of the participants replied with a moderate amount, 23% replied "a lot", and the rest of the answers varied between high and low amounts. Regarding the question "how would you characterize your level of self-confidence", 45% replied stating they had a high level of self-confidence, and 39% replied that their self-confidence was not high and not low.

Inferential Statistics

A correlation table was utilized in order to be able to determine the significant effects of each variable in the study. Multiple significant effects were shown. A positive correlation was found between the voting and revoting scores, $r(100)=.536$, $p<.001$. Furthermore, a negative correlation was found between the revoting score and the number of correct revisions made, $r(100)=-.491$, $p<.001$. A positive correlation was also found between the revoting score and the number of incorrect revisions made, $r(100)=.254$, $p<.001$.

The number of opposing revisions was positively correlated to two other variables. It strongly correlated to the number of incorrect revisions made, $r(100)=.737$, $p<.001$. It was also strongly correlated to the number of correct revisions made, $r(100)=.710$, $p<.001$.

Hake's g was also correlated to multiple variables. It negatively correlated to the voting score, $r(100)= -.404$, $p<.001$ and the number of incorrect revisions made $r(100)= -.707$, $p<.001$. It positively correlated to the revoting score, $r(100)=.556$, $p<.001$, as well as the number of correct revisions made, $r(100)=.632$, $p<.001$. These effects are shown in Table 2.

Table 2.

Descriptive Statistics and Correlations for Study Variables

	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Voting Score	6.80	1.43													
2. Revoting Score	6.83	1.59	.536**												
3. Revision Total	1.71	1.56	-.102	-.169											
4. Correct Revision Total	.87	1.04	-.362**	.254*	.705**										
5. Incorrect Revision Total	.84	1.14	.177	-.491**	.750**	.101									
6. Mean Evaluation Scale	3.81	.48	-.069	.104	.049	.175	-.073								
7. Mean Recieving Scale	3.93	.50	-.037	.036	.157	.181	.069	.401**							
8. Mean Reacting Scale	3.95	.51	-.029	.023	.096	0.114	.036	.582**	.486**						
9. Mean OPASS scale	3.89	.41	-.057	.071	.115	0.190	.003	.851**	.722**	.855**					
10. Number of Opposing Revisions	1.68	1.55	-.110	-.164	.994**	.710**	.737**	.069	.166	.101	.129				
11. Number of Positive Revisions	.02	.14	-.030	.015	.072	0.087	0.020	-.192	-.088	-.099	-.161	-0.17			
12. Number of Neutral Revisions	.01	.10	.155	-.116	.147	-0.085	.279**	-.030	.014	.088	.027	0.85	-0.14		
13. Hake's g	-.04	1.46	-.404**	.556**	-.083	.632**	-.707**	.181	.075	.053	.133	-.070	0.46	-.278**	

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

An ANCOVA test was employed between the independent variable of each of the means of the 'OPASS' scores and a number of the dependent variables, as well as a paired samples t-

test and an independent samples t-test, to be able to compare the means of two measurements of the dependent variable.

T-Test Results

A paired-samples t-test was conducted between multiple dependent variables. The first was between the voting scores and the revoting scores. The 101 participants who partook in both the voting phase (*M*=6.8, *SD*=1.43) compared to the 101 in the revoting phase (*M*=6.83, *SD*= showed that 1.59) showed no difference scores, *t*(100)= -.21, *p*=.42.

A paired-samples t-test was conducted between the number of revisions participants have made to the questions that received *opposing feedback* (*M*=1.68, *SD*=1.55), versus those that received positive feedback (*M*=.02, *SD*=.14) as well as neutral feedback (*M*=.01, *SD*=.10). There was a significant result found between the opposing and positive revisions, *t*(100)=10.73, *p*<.001. A significant result was found between the opposing and neutral revisions, *t*(100)=10.89, *p*<.001. However, no significant results were found between the neutral and positive revisions, *t*(100)=.58, *p*=.28. This was due to most of the participants revising answers when given *opposing feedback*, however, there were almost no revisions made to positive or neutral feedback that was given to the participants.

An independent samples t-test was conducted for the means of participants with the lowest self-efficacy scores (*N*=33, *M*=3.44, *SD*=.19) and the group with the highest self-efficacy scores (*N*=35, *M*=4.3, *SD*=.24). This was applied for all the dependent variables described in Table 1, see Appendix C for the full table of analysis. The only variable that showed a significant difference in the mean number of positive revisions made for students' with low versus high self-efficacy, t(68)=1.44, *p*<.001.

Analysis of Covariance (ANCOVA) Results

A one-way ANCOVA was conducted to determine a statistically significant difference between the revoting score and the levels of self-efficacy the students' have, while controlling for the voting scores. No significant effects were found between the revoting score on low and high levels of self-efficacy while controlling for the voting score, *F*(1,67)= 1.801, *p*>.001.

Discussion

The results indicate that the difference between the number of opposing revisions made by students and other types of revisions made was significant. However, no significant difference was found between the voting and revoting scores, as well as the self-efficacy levels

and the number of opposing revisions made. This is in line with the null hypothesis that is stated, due to the results revealing that there is no empirical evidence to suggest a relationship between levels of self-efficacy a student possess and their reception of *opposing feedback*.

The number of revisions made to questions with *opposing feedback* compared to questions with neutral and positive feedback was found to be significant. Thus, meaning that students made the most revisions to questions that contained feedback that opposed their answers from the voting phase. This result supports evidence from Schweighofer (2019) that states that students improve their answers based on insights they were given. In this case, they were given insight into what the supposed other students had answered, and therefore changed their answers accordingly. Additionally, Hattie and Timperley (2007) articulate that the feedback given to students has certain components that must be considered in order for it to be effective. In this particular study, the considerations for the components included focusing on how the students would improve or not, depending on the type of feedback they receive. For the *opposing feedback*, the focus was whether they would change their answers based on the feedback given or whether they were confident enough in their answers from the voting phase to keep them. Therefore, this result shows that students can be heavily affected by their peers' responses.

Regarding the voting and revoting phases' scores, it was found that there was no significant difference between both scores. Therefore, meaning that there was around the same number of correct answers in both phases. This might have been due to many reasons. One of the reasons might be that the students who participated in the survey might have changed their answers from one phase to another. However, the changed answers may have balanced out their results from the first phase, therefore, having relatively the same number of correct answers to different questions. Miller et al. (2015) have found that students tended to have more correct answers in the revoting phase. However, they also have found that students tend to go from correct to incorrect or from one wrong answer to another (Miller et al., 2015). This may have been the case for this study, where students went from correct to incorrect, or vice versa. However, Perez et al. (2010) investigated the effects of the Peer Instruction Model (Mazur, 1997) on students and found that when a bar graph was introduced as feedback, students tended to interpret the answer that had the most responses as correct. Furthermore, they stated that the bar graph influences students' decision to revise their answers in the revoting phase more than discussion with peers (Perez et al., 2010; Vickery et al., 2017). This may explain the outcome of this result because the students may have revised their answer solely based on the bar graph with the most percentage instead of thinking about the correct answer. Wisniewski et al. (2020)

have also investigated feedback effects and found that engagement with the task is a strong indicator of student performance. Therefore, feedback is more appreciated if it correlates with action towards that feedback. In this study, peer feedback appeared to be given, which might have been a contributing factor to the reception of this feedback. Students may not have placed value on the peer feedback due to not knowing said peers. Thus, the feedback may have been of not value to them to abide by it to change their answers.

However, this may have also been the case because the participants had no stakes involved. Thus, meaning that the students had no reason to want to have more correct responses. They had zero incentives to do better or aim to achieve a higher score in the revoting phase. This may have affected the study because the participants may have been disengaged when completing the study or have been placing random answers to complete the study.

Finally, it was found that there was no significant effect between the levels of self-efficacy a student has and their responses to questions that contained *opposing feedback*. Therefore, revealing a student's level of self-efficacy, high or low, does not affect how they respond to *opposing feedback*. The reception of feedback, in general, is increased when students have a high level of self-efficacy (Wang & Wu, 2008). This is because they believe in their abilities and are confident, they can succeed at this given task (Multon et al., 1991). Furthermore, those with a higher sense of self-efficacy tend to show more self-regulated behaviors, such as persistence and stronger effort, especially if they face difficulties (Pintrich & Schunk, 2002). Nevertheless, the reception of this feedback, in general, leads to students to learning differently, which in turn affects their self-efficacy (Tseng & Tsai, 2007). Self-efficacy, in general, is a strong indicator of how individuals react; however, in this case, it was found that it was not a strong enough indicator. In this study, the effects were not strong enough to accurately determine the effect that self-efficacy had on students' reception of this type of feedback. As a result, it was shown that the effects between the two groups of self-efficacies were not significant enough to affect whether they accepted or rejected the *opposing feedback* given to them.

Regarding the correlation matrix, multiple patterns and trends were revealed upon analyzation. The first was that the higher the revoting score, the lower the number of revisions. This could have been because if the students scored very high in the voting phase it made it difficult to have many correct revisions. Therefore, few revisions were done in the revoting phase. This pattern is supported by the findings of Tullis and Goldstone (2020), who examined the Peer Instruction Model (Mazur, 1997) in relation to students. They found that the more correct answers a student had in the voting phase, the less likely they were to change their

answers in the revoting phase (Tullis & Goldstone, 2020). Another interesting finding within the correlation matrix was that the higher the number of revisions made to questions with *opposing feedback*, the higher the likelihood was that these revisions were incorrect. Thurlings et al (2013) have found that feedback generally guides students into changing their answers or fixing them. In this case, the students changed their answers based on the *opposing feedback* provided. Therefore, most of the revisions were made to questions that contained *opposing feedback*, thus increasing the likelihood of changing their answer to what was shown, which was incorrect. Accordingly, revealing that *opposing feedback* greatly affected students. These patterns and trends correlate to self-efficacy because the higher students' self-efficacy was, the more they reacted to the different types of feedback. Additionally, the higher the students' self-efficacy, the more likely they were to have correct revisions made during the revoting phase. Thus, indicating that self-efficacy may play a role in how feedback affects students and how they respond to that feedback.

Limitations

Despite the fact that many important findings were indicated via the analyses conducted and the correlation matrix, the study also had limitations. A limitation that affected the way the results appeared, and why many almost neared significance, was the sample size. More specifically the sample size of the participants with low and high self-efficacy. Having more participants could have shown more effects in the study. Furthermore, a larger sample size from various different universities would have made the analyses of the study more generalizable, as well as facilitated the ability to determine whether the trends seen would have been significant or not.

Another limitation found in this study was the limited number of questions in the quiz which made the feedback less effective than anticipated. In the quiz, the questions that contained *opposing feedback* were in multiple consecutive blocks. This may have discouraged the students from identifying the correct answer, as they may have felt that they received a lot of feedback that negated their answer. Additionally, the quiz scores, both the voting and revoting, did not have an impact on the participants. In other words, they had no motivation to want to increase their scores. As a result, this might have caused superficial engagement to the quiz, which might have been a reason why there were low numbers of revisions made. Furthermore, the feedback given was of peers they were unaware of, thus, there was a disregard of peer knowledge. Consequently, the was almost no value placed of the *collective feedback* to the students participating in the survey. Thus, may have also affected the results of the study.

A further limitation encountered was the time that was allocated to collecting the data for the study. The data was collected in three weeks, which was not enough time to obtain a large enough sample for the study. However, it was the time that was given, and therefore, the largest amount of data had to be collected during that time. More data could have been obtained if more time had been available to collect it.

Conclusions

Despite these limitations, these results suggest several theoretical and practical implications. It shows that there is potential for *opposing feedback* to affect how students with low self-efficacy accept or reject it in comparison to those with high self-efficacy. Furthermore, this study reinforces that in the context of education, self-efficacy plays a critical role to the type of feedback that students receive. Students with different self-efficacy levels are able to either accept and learn from feedback given to them, or they reject it and refuse to learn from their mistakes. Therefore, the ability to distinguish between students with different levels of self-efficacy may help with how teachers approach them and how they receive types of feedback.

The purpose of this study was to better understanding whether students' level of self-efficacy affects if they accept or reject *opposing feedback* in quiz activities, specifically students with high or low self-efficacy. Much work remains to be done before a full understanding of the extent that self-efficacy influences *opposing feedback* is established. However, this study provides a starting point for delving into the effects of *opposing feedback* and whether students' self-efficacy levels influence their reception of this type of feedback. The results indicate that there many cases could have been significant, but with the present sample size of those with low versus high self-efficacy, it was difficult to distinguish the full effects of these variables. This research can be seen as a first step towards finding the effects that self-efficacy has on the reception of *opposing feedback* in students.

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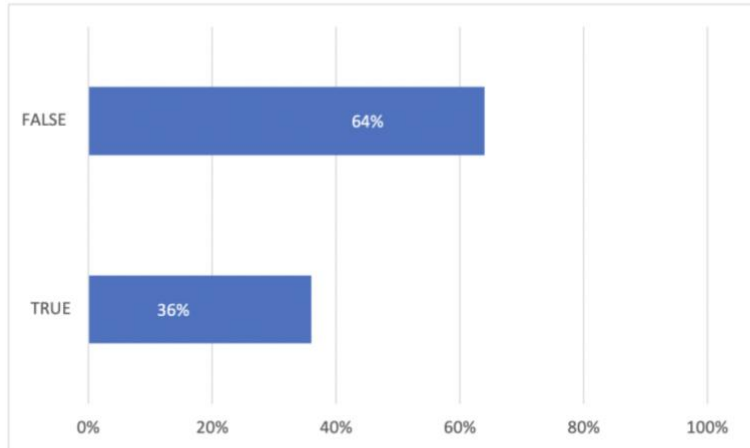
Appendix A
Bar Charts with Collective Feedback Shown for the Different Quiz Questions

Q1
Alexander Fleming discovered penicillin.
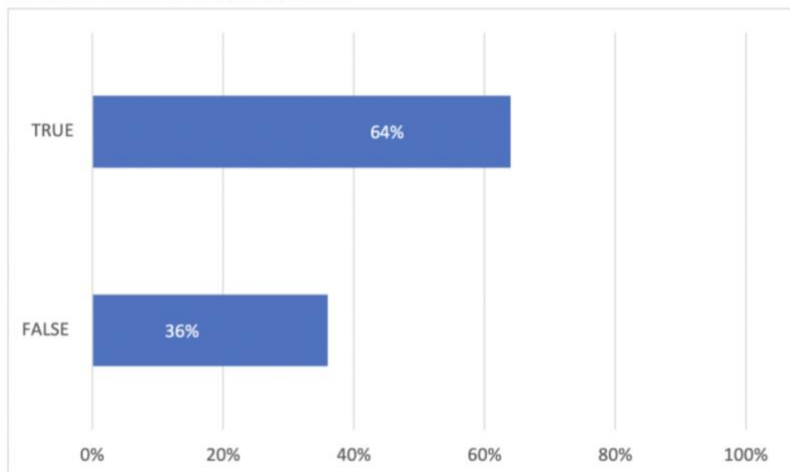
Results from the first round:

Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

○ True

◉ False

Q1
Alexander Fleming discovered penicillin.

Results from the first round:

Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

◉ True

○ False

Appendix B
Qualtrics Study (Quiz and OPASS scale)

Bachelor Thesis Project

Q79 **Welcome! :)**

This is a study regarding: Self-efficacy Levels and Collective Feedback in Quizzes

This study is being conducted by a student undertaking the Bachelor of Psychology at University of Twente and the data collected will be analyzed for Bachelor Thesis.

What is this study about?
This study aims to explore and investigate the relationship between collective feedback and a person's self-efficacy levels.

Am I eligible to take part?
The requirements of the study are that you have to be over 18 years old to take part, be a university student as well as be sufficiently fluent in English.

Do I have to take part?
It is fully your decision whether or not you want to complete the survey. You can leave this study at any time and by closing your browser all the data you will have entered will be deleted and you will not be included as a participant. If you do decide to withdraw before completion, this will not affect you in any way. However, once you have fully completed the questionnaire, we will not be able to withdraw your data, due to the fact that your participation will be totally anonymous, and we will therefore be unable to identify your data.

What will happen if I agree to take part?
If you consent to take part, you will be asked some demographic questions, however no identifiable information (for example, your name) will be taken to ensure anonymity. After these, you will be directed to a quiz that will take you about 10 minutes to complete.

What will happen to my data and to the results of this study?
The data is collected via the platform "Qualtrics", which stores the data to a very high standard of security. After downloading the data from Qualtrics, we all will use a password, protected computers and storage provided by the University of Twente in order to ensure better security. Therefore, the data is going to be treated with complete confidentiality and will not be traceable or identifiable. However, we may make the data publicly available for the benefit of the research community, such as Open Science Framework, but we reiterate that all data are completely anonymous, and you will not be personally identifiable in the data or any report based upon that. The data will be analyzed, and the results will be written by the researcher and submitted at the beginning of July of 2022. Only aggregated data will be presented, no individual responses will be shared. They may then be submitted for publication in an academic journal or at an academic conference or be used in further research into this area.

Contact details

The ethics of this study have been approved by the University of Twente ethics board. To find out more information about this study you can contact the researcher using the following email: n.mahmoud@student.utwente.nl

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B By checking this box I confirm that I have read the information given and I consent to participating.

○ Yes (1)

○ No (2)

B1 I am aware that I have the right to withdraw from this study at any point, which implies that my data will be removed if I leave before completing the questionnaire.

○ Yes (1)

○ No (2)

B4 I understand that if I complete the study that all my data will be confidential and anonymous.

○ Yes (1)

○ No (2)

End of Block: Info and Ethics

Start of Block: Demographics

c Section 1:
Demographic Information

C 1.1. How old are you?

○ 18-24 years old (2)

○ 25-34 years old (3)

○ Other (7) _____

C1 1.2. How do you describe yourself?

○ Male (1)

○ Female (2)

○ Non-binary / third gender (3)

○ Prefer to self-describe (4) _____

○ Prefer not to say (5)

C2 1.3. What degree are you pursuing or have pursued?

○ Bachelor's Degree (2)

○ Master's Degree (3)

○ PhD (4)

○ Other (5) _____

C3 1.4. What is your nationality?

_____

C4 1.5. How would you characterize your level of general knowledge? For example, think of questions you have seen on TV shows or Pub Quizzes

○ None at all (1)

○ A little (2)

○ A moderate amount (3)

○ A lot (4)

○ A great deal (5)

C5 1.6. How would you characterize your level of self-confidence?

○ Very low (1)

○ Low (2)

○ Not high and not low (3)

○ High (4)

○ Very high (5)

End of Block: Demographics

Start of Block: Voting Phase

Q81 Section 2:

The quiz is about to start.

You will be given a series of 10 general knowledge questions, once you have answered a question you will not be able to go back.

Following this round, you will be given the quiz in a second round where you will be able to see what others have answered and will thus answer the quiz a second time.

Page Break

Q1 Q1
Alexander Fleming discovered penicillin.

○ True (1)

○ False (2)

Q2 Q2
The small intestine is about three-and-a-half times the length of your body.

○ True (1)

○ False (2)

Q3 Q3
Thomas Edison discovered the law of gravity.

○ True (1)

○ False (2)

Q4 Q4
Bananas are curved because they grow upwards towards the sun.

○ True (1)

○ False (2)

Q5 Q5
The river Seine in Paris is longer than the river Thames in London.

○ True (1)

○ False (2)

Q6 Q6

Alaska is the biggest American state in square kilometers.

○ True (1)

○ False (2)

Q7 Q7

Monaco is the smallest country in the world.

○ True (1)

○ False (2)

Q8 Q8

The sum of any two opposite sides of a dice is always 7.

○ True (1)

○ False (2)

Q9 Q9

The Great Wall of China is longer than the distance between London and Beijing.

○ True (1)

○ False (2)

Q10 Q10

Your 'radius' bone is in your leg.

○ True (1)

○ False (2)

Q77 Section 3:

You will now be given the quiz again.

This time you will be able to view feedback of what others have answered regarding these questions. The most popular answer will be displayed on top in the feedback given.

You will also see the answer you gave in the first round. You are free to keep your answer or change it, as you see fit.

Display This Question:

   If Q1 Alexander Fleming discovered penicillin. = True

◉

Q11 Q1
Alexander Fleming discovered penicillin.

 Results from the first round:

 Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

○ True (1)

○ False (2)

Display This Question:

   If Q1 Alexander Fleming discovered penicillin. = False

◉

Q11 Q1
Alexander Fleming discovered penicillin.

Results from the first round:

 Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

○ True (1)

○ False (2)

Page Break ───────────────────────────────

⊙

Q12 Q2
The small intestine is about three-and-a-half times the length of your body.

Results from the first round:

Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

○ True (1)

○ False (2)

⊙

Q12 Q2
The small intestine is about three-and-a-half times the length of your body.

Results from the first round:

Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

○ True (1)

○ False (2)

Page Break

Q13 Q3
Thomas Edison discovered the law of gravity.

 Results from the first round:

 Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

◯ True (1)

◯ False (2)

Q13 Q3
Thomas Edison discovered the law of gravity.

 Results from the first round:

 Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

◯ True (1)

◯ False (2)

Page Break

⊙

Q14 Q4
Bananas are curved because they grow upwards towards the sun.

 Results from the first round:

 Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

○ True (1)

○ False (2)

⊙

Q14 Q4
Bananas are curved because they grow upwards towards the sun

 Results from the first round:

 Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

○ True (1)

○ False (2)

Page Break ───

⊙

Q15 Q5
The river Seine in Paris is longer than the river Thames in London.

 Results from the first round:

 Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

○ True (1)

○ False (2)

⊙

Q15 Q5
The river Seine in Paris is longer than the river Thames in London.

 Results from the first round:

 Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

○ True (1)

○ False (2)

Page Break ─────────────────────────────────────

⊙

Q16 Q6
Alaska is the biggest American state in square kilometers.

Results from the first round:

Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

○ True (1)

○ False (2)

⊙

Q16 Q6
Alaska is the biggest American state in square kilometers.

Results from the first round:

Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

○ True (1)

○ False (2)

Page Break

Q17 Q7
Monaco is the smallest country in the world.

Results from the first round:

Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

○ True (1)

○ False (2)

Q17 Q7
Monaco is the smallest country in the world.

Results from the first round:

Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

○ True (1)

○ False (2)

Page Break

Q18 Q8
The sum of any two opposite sides of a dice is always 7.

Results from the first round:

Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

○ True (1)

○ Flase (2)

Q18 Q8
The sum of any two opposite sides of a dice is always 7.

Results from the first round:

Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

○ True (1)

○ Flase (2)

Page Break

Q19 Q9
The Great Wall of China is longer than the distance between London and Beijing.

 Results from the first round:

 Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

- ○ True (1)

- ○ False (2)

Q19 Q9
The Great Wall of China is longer than the distance between London and Beijing.

 Results from the first round:

 Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

- ○ True (1)

- ○ False (2)

Page Break

Q20 Q10
Your 'radius' bone is in your leg.

 Results from the first round:

 Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

○ True (1)

○ False (2)

Q20 Q10
Your 'radius' bone is in your leg.

 Results from the first round:

 Your initial answer is displayed below. You are free to keep your answer or revise it as you see fit.

○ True (1)

○ False (2)

End of Block: Revoting Phase

Start of Block: Self-Efficacy Questionnaire

Q82 Section 4:

Self-Efficacy Questionnaire, please answer as truthfully as possible.

Q31 4.1. In online peer assessment activity, I can find the strengths of my peers' work when I review it.

○ Strongly Disagree (1)

○ Somewhat disagree (2)

○ Neither agree nor disagree (3)

○ Somewhat agree (4)

○ Strongly agree (5)

Q32 4.2. In online peer assessment activity, I can find the weaknesses of my peers' work when I review it.

○ Strongly Disagree (1)

○ Somewhat disagree (2)

○ Neither agree nor disagree (3)

○ Somewhat agree (4)

○ Strongly agree (5)

Q33 4.3. In online peer assessment activity, I can give helpful opinions or suggestions when I review peers' work.

○ Strongly Disagree (1)

○ Somewhat disagree (2)

○ Neither agree nor disagree (3)

○ Somewhat agree (4)

○ Strongly agree (5)

Q34 4.4. In online peer assessment activity, I can tell whether my peer has done their best or not when I review their work.

○ Strongly Disagree (1)

○ Somewhat disagree (2)

○ Neither agree nor disagree (3)

○ Somewhat agree (4)

○ Strongly agree (5)

Q35 4.5. In online peer assessment activity, I can identify the strengths of peers' work and provide explanations.

○ Strongly Disagree (1)

○ Somewhat disagree (2)

○ Neither agree nor disagree (3)

○ Somewhat agree (4)

○ Strongly agree (5)

Q36 4.6. In online peer assessment activity, I can identify the weaknesses of peers' work and provide suggestions.

○ Strongly Disagree (1)

○ Somewhat disagree (2)

○ Neither agree nor disagree (3)

○ Somewhat agree (4)

○ Strongly agree (5)

Q37 4.7. In online peer activity activity, I can recognize my weakness when I get anonymous comments from peers.

○ Strongly Disagree (1)

○ Somewhat disagree (2)

○ Neither agree nor disagree (3)

○ Somewhat agree (4)

○ Strongly agree (5)

Q38 4.8. In online peer assessment activity, I can decide whether or not to revise my work after I get peers' feedback.

○ Strongly Disagree (1)

○ Somewhat disagree (2)

○ Neither agree nor disagree (3)

○ Somewhat agree (4)

○ Strongly agree (5)

Q39 4.9. In online peer assessment activity, I can ignore unreasonable feedback from peers.

○ Strongly Disagree (1)

○ Somewhat disagree (2)

○ Neither agree nor disagree (3)

○ Somewhat agree (4)

○ Strongly agree (5)

Q40 4.10. In online peer assessment activity, I can examine the problem in my own work when I get comments from peers.

○ Strongly Disagree (1)

○ Somewhat disagree (2)

○ Neither agree nor disagree (3)

○ Somewhat agree (4)

○ Strongly agree (5)

Q41 4.11. When receiving peers' comments in online peer assessment activity, I can identify which of their opinions are of more importance.

○ Strongly Disagree (1)

○ Somewhat disagree (2)

○ Neither agree nor disagree (3)

○ Somewhat agree (4)

○ Strongly agree (5)

Q42 4.12. When receiving peers' comments in online peer assessment activity, I can identify which of their suggestions are more helpful to me.

○ Strongly Disagree (1)

○ Somewhat disagree (2)

○ Neither agree nor disagree (3)

○ Somewhat agree (4)

○ Strongly agree (5)

Q43 4.13. After receiving peers' comments in online peer assessment activity, I can make plans to improve my work by steps.

○ Strongly Disagree (1)

○ Somewhat disagree (2)

○ Neither agree nor disagree (3)

○ Somewhat agree (4)

○ Strongly agree (5)

Q44 4.14. After reading peers' comments in online peer assessment activity, I can improve my work with a good strategy.

○ Strongly Disagree (1)

○ Somewhat disagree (2)

○ Neither agree nor disagree (3)

○ Somewhat agree (4)

○ Strongly agree (5)

Q45 4.15. After reading peers' comments in online peer assessment activity, I can make better revision to my work.

○ Strongly Disagree (1)

○ Somewhat disagree (2)

○ Neither agree nor disagree (3)

○ Somewhat agree (4)

○ Strongly agree (5)

End of Block: Self-Efficacy Questionnaire

Start of Block: Debrief

D Debrief:

Thank you very much for participating in this research study.

This data will be used to explore whether students with either low or high self-efficacy reject or accept opposing feedback.

You can get more information about the study, the answers and why this was conducted this way on the 10th of May 2022 using this link: https://tinyurl.com/5n6nvce7

We would like to remind you that now you have completed the questionnaire all your data is completely anonymous and confidential. Additionally, please feel free to contact the study researcher using the following email - n.mahmoud@student.utwente.nl if you have any queries or concerns about the study.

End of Block: Debrief

Appendix C
Independent Samples T-Test Full Table of Analysis

	F	*Sig.*	*t*
Voting score	.219	.642	.773
Revoting score	.876	.335	-.666
Revision total	.134	.715	-.589
Correct revision total	.706	.404	-1.537
Incorrect revision total	.265	.608	.488
Mean evaluation scale	.083	.774	-12.633
Mean receiving scale	.017	.897	-6.759
Mean reacting scale	.000	.986	-10.228
Mean OPASS scale	2.733	.103	-16.260
Opposing revisions	.326	.570	-.747
Positive Revisions	10.017	.002	.1.480
Hake's g	.663	.418	-1.557