

# **The Influence of Test Anxiety on Students' Performance on Quizzes**

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### **Abstract**

Within higher education, Audience Response Systems (ARS), also known as quizzes, are used as a common formative assessment approach. Quizzes support learning processes and make students feel more comfortable within the classroom. Despite these potential benefits for students, students' test anxiety might negatively impact their performance on quizzes. Therefore, the current study aims to explore the correlation between test anxiety and students' performance on quizzes. In order to investigate this, an online questionnaire was constructed in which participants had to fill in a test anxiety scale and perform two quizzes. Between the two quizzes, feedback was given in two conditions. Negative feedback was given to try to induce test anxiety, in the form of showing participants a manipulated score. Neutral feedback was given to control for the effects of negative feedback. The test anxiety levels were measured using the Westside Test Anxiety Scale (WTAS). This led to a final sample of 47 participants. Although the results revealed that there was a significant improvement in quiz scores for students in both feedback conditions, it was indicated that this improvement was not significantly associated with changes in students' test anxiety levels. This study presents the intricate and nuanced nature of the problem surrounding test anxiety and it constructs a relevant and useable format for future research.

## Introduction

Within higher education, assessment is used to measure if and how students are learning (Northern Illinois University, 2012). The aim of providing assessment is to gather data about the knowledge, skills, and competencies that students have acquired (Dolin et al., 2017). Educational assessment has different purposes, e.g., student monitoring, programme evaluation, or provision of guidance (Newton, 2007). These different purposes require different designs for assessment (Newton, 2007), of which summative and formative assessment types are the most common. The goal of summative assessment is to evaluate and report students' level of learning using an existing norm, e.g., an external assessment form (Dolin et al., 2017). Formative assessment aims however to monitor learning and to provide feedback to improve learning (Carnegie Mellon University, 2022). Within formative assessment, performance is not compared to external norms but results are compared with the students' own previously achieved results. Formative assessment enables confidence in students, for instance by ensuring familiarity with testing forms or by offering the students ownership of their learning processes (Dolin et al., 2017; Jacoby et al., 2013). Formative assessment provides a way to assist learning processes (Newton, 2007) and provides various ways for implementation, e.g., through observations, reflection exercises or formative assessment tools (Northern Illinois University, 2012).

### Audience Response Systems

An example of a formative assessment tool that aims to improve learning is an Audience Response System (ARS; Rinaldi, 2017). ARSs, also known as quizzes, clickers or student response systems, are interactive tools that students use to respond to questions posed by the instructor, often with the use of a handheld device, mobile app or a web-based interface (Banks, 2006; Kay & LeSage, 2009). The instructor prepares questions to put into the ARS. Most often, multiple-choice questions are posed but open questions work as well. After that, students can enrol in the system and use the application/site/device to respond to the question (Banks, 2006; Blasco-Arcas et al., 2013; Wood & Shirazi, 2020). The instructor can almost directly view the students' answers on their screen, often in chart form (Blasco-Arcas et al., 2013; Wood & Shirazi, 2020). Subsequently, the instructor can choose to display the results to the audience along with giving further clarifications and explanations about the subject or he can use the results as input for further discussion (Kay & LeSage, 2009; Wood & Shirazi, 2020). The ARS directly thus directly provides results to the instructor, which is a

large benefit (Rinaldi et al., 2017, Stowell et al., 2010). This immediate feedback can be used to evaluate the learning processes and understanding of students (Blasco-Arcas et al., 2013; Cech et al., 2018; Hakim et al., 2023; Kay & LeSage, 2009). The instructor can potentially identify misconceptions and can alter their lecture based on that (Farhat et al., 2021; Petrović et al., 2016; Rinaldi et al., 2017). They can, for instance, give extra explanations about a concept or they can move on to another subject quicker if the ARS shows that the students already understand it (Farhat et al., 2021; Petrović et al., 2016). These factors show that an ARS thus forms a beneficial tool within education since it supports learning processes efficiently. The use of an ARS within education offers more benefits. It motivates students to attend classes and participate actively in their learning processes (Blasco-Arcas et al., 2013; Farhat et al., 2021; Kay & LeSage, 2009; Rinaldi et al., 2017). The research of Blasco-Arcas et al. (2013) showed that using an ARS facilitates understanding of concepts and that it improves student's learning processes. This is seconded by the research of Hakim et al. (2023), where the use of ARS within a large classroom led to an improvement in engagement and decision-making. The use of an ARS thus seems to positively affect academic performance (Chien et al., 2016).

Furthermore, the study by Barr (2017) found that the use of such a system increases understanding, concentration, confidence and engagement in the lecture. This motivation to engage in the lecture leads to students paying more attention (Kay & LeSage, 2009). Moreover, ARSs are used to support learning processes by providing and encouraging interaction and communication (Can et al., 2021). Students are driven by the ARS to interact with peers and with their instructor (Blasco-Arcas et al., 2013). By creating an accessible way to communicate and encouraging it, ARSs help students develop communication skills and a collaborative spirit. Using an ARS ensures that students are less likely to conform to the group, which shows a greater diversity of opinions within the group (Stowell et al., 2010). This variety of opinions may lead to more and deeper discussions. The technology of ARS thus aims to turn passive learning into active participation and to make learning accessible (Chec et al., 2016; Cook & Babon, 2016).

Most ARSs are applied according to the Peer Instruction Model of Mazur (1997). The principle of this model is the improvement of understanding concepts using formative assessment (Michinov et al., 2020; Schell & Butler, 2018). The model consists of four phases: voting phase, collective feedback, peer discussion, and revoting phase (Mazur, 1997). Within the voting phase, students give their initial answer to a proposed question. Then, they receive

collective feedback based on class responses. This feedback and given answers are discussed with peers in the third phase. Lastly, the students answer the same question again within the revoting phase. After having gone through these steps, the students receive the correct answers and potential constructive feedback from their instructor (Mazur, 1997). Within the third phase, peer discussion, students are encouraged to communicate with each other. An accessible and direct way is facilitated by the ARS to interact since students do not have to feel shame towards classmates, worry about the fear of speaking in front of the class or about the value of a question they would like to pose (Chec et al., 2018; Cook & Babon, 2016; Petrovic et al., 2016; Rinaldi et al., 2017). Students who normally avoid asking questions (e.g., because they are shy or anxious) have access to a platform where they can anonymously ask questions. Additionally, more questions can be asked in this way, which encourages communication between student and instructor. (Petrović et al., 2016; Rinaldi et al., 2017). Additionally, the instructor has an overview of what issues play a role within his class and can address them accordingly (Farhat et al., 2021; Petrović et al., 2016; Rinaldi et al., 2017). The Peer Instruction Model thus actively engages students in their learning activities by providing feedback and allowing discussion of given feedback. This helps to improve individual learning processes and it supports and encourages communication. Within ARSs, the provision of feedback is thus an essential element (Mazur, 1997; Perera et al., 2008; Rinaldi et al., 2017). The ARS enables the provision of feedback in an accessible and fast way, which makes feedback a useful concept to consider when looking at the learning consequences of ARS (Shapiro & Gordon, 2013).

Feedback is an interactive process where an agent (e.g., teacher, parent, or tool) offers the learner insights regarding their performance or understanding (Clynes & Raftery, 2008; Hattie & Timperley, 2007). The information provided includes opinions about the learner's current performance and it should contribute to options for improvement (Clynes & Raftery, 2008). Provided feedback is based on observations of the agent and it may be followed by an unbiased, analytical reflection of occurrences (Clynes & Raftery, 2008).

The effect of feedback relies on the context and circumstances in which the feedback is provided. Feedback should suit the students' current level of mental processes and understanding in order to observe results (Chen et al., 2010; Hattie & Timperley, 2007). Moreover, feedback is more effective when it is corrective, task-specific and goal-directed (Thurlings et al., 2013). In that way, students are guided to provide correct answers and to close the gap between actual and desired performance (Thurlings et al., 2013). Feedback will

then benefit the students' growth – it provides direction and helps to increase confidence, motivation and self-esteem (Clynes & Raftery, 2008).

Different types of feedback are mainly described using two groups: positive and negative feedback (Clynes & Raftery, 2008). Positive feedback has confirmatory and reinforcing concepts, while negative feedback is more constructive and corrective (Clynes & Raftery, 2008; Shapiro & Gordon, 2013). Research suggests that both types of feedback have a positive effect on exam performance (McEvoy, 2023; Shapiro & Gordon, 2013). For instance, the studies of Choi et al. (2018) and Slowiak & Lakowske (2017) found an increased performance when feedback, in general, was provided. However, both studies indicated that there existed no significant difference between positive and negative feedback (Choi et al., 2018; Slowiak & Lakowske; 2017).

When using an ARS, a moment for feedback is reserved after the voting phase, which means that feedback moments are present continuously throughout the learning process (Farhart et al., 2021). Based on observations of the voting phase, the instructor provides feedback to the students. Accordingly, he should encourage students to revise and improve their answers, in order to improve their learning outcomes. While feedback is thus an essential factor within Mazur's (1997) Peer Instruction Model, it may prevent students from free debating in the discussion phase because of the conformity bias that may occur when the majority answer is shown in feedback (Michinov et al., 2020; Papadopoulos et al., 2021). However, the research of Michinov et al., (2020) showed that the help of an instructor improved students' learning since students guided by their instructor improved their learning more by discussing the answers with their peers instead of just taking on the majority answer. Moreover, Brooks & Koretsky (2011) found that while students' answers may not have been correct, the quality of their written answers was improved on account of peer discussion that followed the received collective feedback. Feedback thus has a positive influence on learning outcomes.

Considering the scope of the current study, it was chosen to focus on negative and neutral feedback conditions. Negative feedback within the current context allows for the manipulation of achieved scores by showing a score lower than attained. Fear of negative feedback can induce anxiety (Cooper et al., 2018; McEvoy et al., 2023), while negative feedback can also motivate students to achieve higher scores on an upcoming test (Cooper et al., 2018). Since the influence of negative feedback potentially has two opposing outcomes,

the current study aims to examine varying scores during the revoting phase. To be able to investigate the feedback type effects, a neutral feedback group should be considered as well. Negative feedback may heighten anxiety, which could potentially lead to negative outcomes in the revoting phase or for the current study, the second quiz.

### **Anxiety and Performance in ARSs**

Using ARSs within higher education may reduce anxiety among students. A concerning amount of students report experiencing high levels of anxiety (Pascoe et al., 2020), which is known to have a negative impact on students' physical and mental health, and their academic performance (Molin et al., 2019; Sun et al., 2018). Anxiety often arises from academic stressors like pressure to achieve high grades or concerns about receiving poor grades (Brigati et al., 2020; Pascoe et al., 2020). An ARS provides formative assessment and is usually anonymous, these traits remove or lessen academic stressors (Stowell et al., 2010; Wood & Shirazi, 2020). Therefore, an ARS may reduce anxiety within students, and they tend to feel more comfortable in the classroom.

The American Psychological Association (APA; 2022) defines anxiety as “an emotion characterized by feelings of tension, worried thoughts, and physical changes like increased blood pressure”. Anxiety interferes with attention levels and cognitive processes and thereby affects the students' mood and performance (Sun et al., 2018). Anxiety hinders students in their learning when they recognize a lack of confidence in their cognitive abilities and a belief they will not perform well - which in turn affects their motivation and performance (Molin et al., 2019; Sun et al., 2018). Anxiety is a very broad concept, so for the purpose of the current study, the focus will be on academic-related anxiety, which is better described with the term ‘test anxiety’ (Gerwin et al., 2015), also known as exam anxiety. The study by Gerwing et al. (2015) found that 38.5% of undergraduate students self-reported test anxiety. They also found that test anxiety was greatly misunderstood because of the presence of negative and inaccurate views (e.g. it is due to laziness). The APA Dictionary of Psychology (2018) defines test anxiety as “tension and apprehensiveness associated with taking a test, frequently resulting in a decrease in test performance”. This is seconded by the study of Jung et al. (2014) who found that performance was reduced within test-anxiety-related conditions.

Test anxiety occurs when students have something important to achieve (e.g. passing an exam or assignment) and they are not sure if they are able to do so (Brigati et al., 2020). Students can be stimulated to improve their performance and are motivated to study, which

means anxiety is not necessarily bad (Brigati et al., 2020). However, high levels of anxiety, which can for instance be experienced when students are asked to answer questions verbally in class, can negatively affect academic performance (Brigati et al., 2020; England et al., 2017). High levels of anxiety can cause difficulty in remembering relevant information, leading to poor performance (Molin et al., 2019). Reduction of anxiety can improve academic achievement (Can et al., 2021; Molin et al., 2019).

Using ARSs increases participation since students can remain anonymous (Barr, 2017). Anonymity is provided through the ARS since it separates given answers from student's identities and classmates are not able to see and judge upon given answers (Stowell et al., 2010). A safe environment is created where only the teacher can see the answers and does not share who is right or wrong (Can et al., 2021). Therefore, the risk of students' weaknesses being exposed to peers decreases, and a sense of security is provided (Stowell et al., 2018; Wood & Shirazi, 2020). However, an ARS does not completely ensure anonymity because of the applied peer discussion. While given answers are not known by the whole classroom, answers often have to be discussed in small groups or pairs. While the anonymity is a bit weakened by the communicative nature of the ARS, it is still an element of ARS that is greatly appreciated by students (Farhat et al., 2021). Students will not have to worry about their possible lack of understanding and the embarrassment that can come with that when answering questions classically (Barr, 2017; Petrović et al., 2016). Because of anonymity, students thus experience less fear, pressure and anxiety during lectures (Barr, 2017).

Since ARSs provide and encourage interaction and communication, using them may reduce anxiety among students (Can et al., 2021). Stowell et al. (2010) found that students who typically experience anxiety within the classroom feel more comfortable using ARS because of the safe environment it creates. Moreover, extra discussions and explanations from the teacher about certain answers can decrease anxiety levels as well (Cooper et al., 2018; Molin et al., 2019). This is seconded by the study of Agarwal et al. (2014), in which a large majority of students reported feeling the same or less anxious when using an ARS compared to their other classes. However, 19% of students experienced greater anxiety because of the ARS (Agarwal et al., 2014). The study by Brigati et al. (2020) suggests that ARSs induce feelings of anxiety as well. For instance, Cooper et al. (2018) found that a fear of negative feedback can underlie higher levels of anxiety during the use of an ARS. Negative feedback might induce anxiety (McEvoy et al., 2023), particularly for individuals with weak metacognition skills. Metacognitive beliefs are found to predict the development of anxiety



(Capobianco et al., 2020). While metacognition can help students estimate their level of performance, poor metacognition might cause a discrepancy between the anticipated and the actual score a student receives (Silaj et al., 2021). This discrepancy can cause test anxiety and thereby negatively affect performance (Silaj et al., 2021).

### **Current Study**

For the purpose of the current study, ARSs will be called quizzes. The focus of the current study will be the relationship between test anxiety and quizzes since quizzes are theorised to affect levels of test anxiety. The direction in which this influence goes is undecided since some researches suggest that the use of quizzes decreases anxiety, while others theorise that it increases anxiety. The influence of anxiety on quizzes will be assessed through the use of feedback because feedback is a central element of quizzes. Negative feedback will be used to induce anxiety and neutral feedback will ensure control for possible effects. By manipulating the feedback, test anxiety will be induced, which influences the performance on quizzes. Assessing the influence of anxiety on quizzes will provide insights into how academic performance is affected by anxiety and whether the use of quizzes decreases test anxiety.

The role of feedback will thus be investigated with a focus on how test anxiety levels relate to academic performance. Therefore, this study will investigate the following research question: ‘Do students’ test anxiety levels influence their performance on quizzes?’

## **Methods**

### **Participants**

Participants for the current study were gathered using convenience sampling. The questionnaire was shared using the program SONA of the University of Twente and through the messaging software WhatsApp and the social media platform Instagram. Participants all voluntarily took part in the questionnaire and had to meet three inclusion criteria: participants had to be at least 18 years old, be as sufficient in English as they could understand what the study was about, and be students of Psychology at a University Bachelor or Master program. At the start of the study, participants were required to confirm they met the criteria and they had to give their consent.

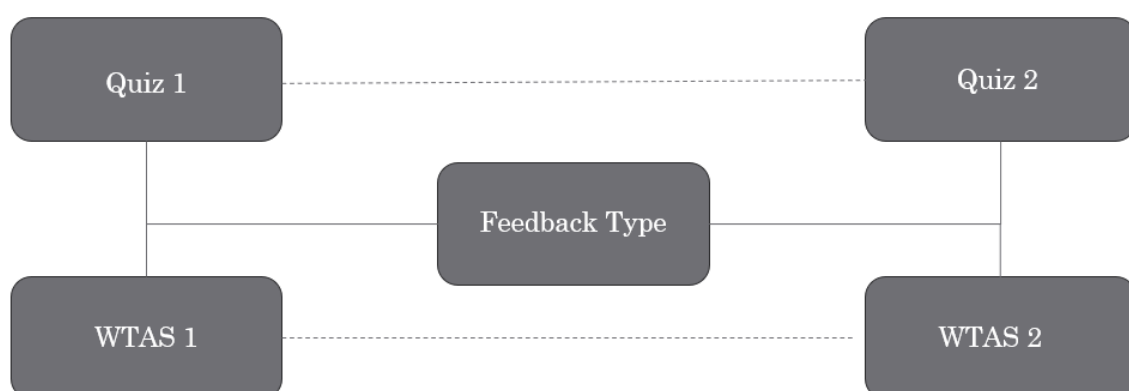
The questionnaire was filled in by 58 participants. However, not every participant gave consent or finished the study, so they were excluded from the study. The final sample consisted of 47 participants. The mean age was 20.4 ( $SD = 2.01$ ), with a range from 18 to 25. 74% of the participants identified as female, 21% as male, and 4% identified as other. Regarding nationality, 45% was Dutch, 36 % German and the remaining participants were from various European countries. Furthermore, 91% of participants studied at the University of Twente, 4% at Leiden University, 2% at the University of Groningen, and 2% at the University of Utrecht. Out of these participants, 89% are pursuing a Bachelor's degree, 6% a Master's, and 4% a different degree.

### Design

This quantitative study used a mixed-measure design. The variable of test anxiety was measured pre- and post-feedback phase using a test anxiety scale (WTAS), which is a within-subjects design. However, participants received different feedback conditions, which is a between-subjects design. The study also included two quizzes, one before and one after the feedback phase. The design is visualised in Figure 1.

**Figure 1**

*Study Design*



### Materials

In order to partake in the study, participants had to have a laptop or mobile phone with working internet. The study was conducted via the research platform Qualtrics. Within Qualtrics, the randomizer feature was used to randomly send participants to either the neutral or negative feedback block. Moreover, skip logic was used to send participants who did not consent to the end page, and display logic was used to ensure participants received the right debrief message. To guarantee that all questions were filled in, a force response requirement was added to all elements. The complete questionnaire can be found in Appendix A.

### ***Test Anxiety***

The Westside Test Anxiety Scale (WTAS; Driscoll, 2007) was used to measure anxiety. The WTAS, see Figure 2, has 10 items on which the participant has to rate how true each item is on a 5-point Likert scale, ranging from 1: not at all or never true to 5: extremely or always true. The items focus specifically on exams. It is a suitable tool for assessing test anxiety among students and has shown to be a reliable and valid measurement of test anxiety impairment (Driscoll, 2007; Talwar et al, 2019). The average score indicates the amount of anxiety one experiences.

### **Figure 2**

*Westside Test Anxiety Scale*



Please rate how true each of the following statements is of you

	Extremely or always true	Highly or usually true	Moderately or sometimes true	Slightly or seldom true	Not at all or never true
The closer I am to a major exam, the harder it is for me to concentrate on the material	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I study, I worry that I will not remember the material on the exam.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
During important exams, I think that I am doing awful or that I may fail.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I lose focus on important exams, and I cannot remember material that I knew before the exam.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I finally remember the answer to exam questions after the exam is already over.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I worry so much before a major exam that I am too worn out to do my best on the exam.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel out of sorts or not really myself when I take important exams.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I find that my mind wanders when I am taking important exams.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
After an exam, I worry about whether I did well enough.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I struggle with writing assignments, or avoid them as long as I can. I feel that whatever I do will not be good enough.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Quizzes

The questions for both Quiz 1 and Quiz 2 were set up with the use of the book Psychology, global edition, Chapter 9: Motivation and Emotion (Ciccarelli & White, 2018). Based upon that chapter, 20 were questions written and divided into two quizzes, so the quizzes both consisted of 10 multiple-choice questions with four choices (A-D). The quizzes

can be found in Appendix A and an example question is presented in Figure 3. For each correct answer, the participant received one point. The sum of received points formed the quiz scores.

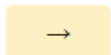
### Figure 3

#### *Example Quiz Question*



3. What are the three needs that make up McClelland's theory of motivation?

- Affiliation, power & achievement
- Love, power & achievement
- Water, food & sex
- Affiliation, safety & love



### Procedure

Participants completed an online questionnaire (Appendix A) via Qualtrics using a computer, mobile phone, or other electronic device with a working internet connection. First, they had to fill in a consent form and some demographic information, including gender, age, degree and nationality. Subsequently, the participants had to rate the 10 items of the WTAS on how true the statements were for them on a 5-point scale. Next, the participants were presented with some quiz instructions, after which Quiz 1 directly followed.

After filling in Quiz 1, the participants were directed to a feedback page which showed them their score on the quiz. Both groups saw the exact same message, but participants within the negative feedback condition received a score lower than their actual achieved score. Their score was calculated by dividing their actual score by 2, rounded up, for instance, if they would have 7/10 questions correct, a score of 4/10 was shown. The neutral feedback group received their actual score. When the participants clicked further, they were instructed to fill in the WTAS again. Subsequently, after filling in WTAS 2, the participants were asked to fill in Quiz 2 with the same instructions as the first one. When finished with Quiz 2, participants were presented with a debrief message. The nature and the aims of the study were explained by noting that different types of feedback were used to provoke anxiety in order to investigate the influence of anxiety levels. They were told if they were in the neutral or negative feedback condition and which score they received accordingly. Next to that, the debrief included the actual scores received on both quizzes and a reminder to contact the researcher if there were any concerns.

### **Data Analysis**

Before starting the data analysis, the final data sample was prepared into a usable form and variable scores were calculated according to the study variables, which are presented in Table 1. In order to determine the significance of the data analysis, an alpha level of .05 was applied.

**Table 1**

*Operationalisation of Study Variables*

Concept	Variable	Description	Measure
Test Anxiety	WTAS 1	Pre-score of test anxiety scale	5-point Likert Scale
	WTAS 2	Post-score of test anxiety scale	5-point Likert Scale
Quizzes	Quiz 1	Score of first quiz	Number of correct answers out of 10
	Quiz 2	Score of second quiz	Number of correct answers out of 10
Feedback	Feedback Type	Received type of feedback	Neutral / Negative

The Feedback Type is the independent variable. Participants in the negative feedback condition received negative feedback, they received a lower score than they achieved in the

feedback phase. The participants in the neutral feedback condition received the actual score they had on the first quiz. Before and after receiving feedback, participants had to fill in the anxiety scale and the quizzes. The study variables WTAS 2 and Quiz 2 are dependent since they are influenced by the feedback type.

To start the analyses, all test assumptions were checked. Then, independent samples t-tests were conducted for WTAS 1 and Quiz 1 for the two feedback groups. This was performed in order to inspect the validity of the random assignment of participants into the two feedback conditions, which means there should be no difference between the groups at the start of the study. Moreover, to see whether there was a correlation between WTAS 1 and Quiz 1, a bivariate Pearson correlation analysis was performed.

In order to see whether different feedback affected how participants responded, WTAS 2 and Quiz 2 were analysed. Therefore, a one-way analysis of covariance (ANCOVA) was performed. First, the score of WTAS 2 was analysed as the dependent variable, with the score of WTAS 1 as a covariate and the feedback type as a factor. Then, a second one-way ANCOVA was conducted with Quiz 2 as the dependent variable, Quiz 1 as a covariate and feedback type as a factor. These analyses were used to determine whether there was a significant effect between feedback and results on both the WTAS 2 and Quiz 2. Lastly, a bivariate Pearson correlation analysis was conducted for both feedback conditions to investigate whether there exists a correlation between WTAS 2 and Quiz 2.

Moreover, paired samples t-tests were conducted in order to investigate the difference between the two study variables for both feedback conditions. A paired samples t-test was performed between Quiz 1 and Quiz 2 for both neutral and negative feedback conditions, and paired samples t-tests were conducted between WTAS 1 and WTAS 2 for both conditions.

## Results

An overview of the scores of the study variables for the total sample and for both feedback conditions can be found in Table 2.

**Table 2**

*Summary of Scores*

	Neutral	Negative	Total
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	<i>(n = 24)</i>		<i>(n = 23)</i>		<i>(n = 47)</i>	
	M	<i>(SD)</i>	M	<i>(SD)</i>	M	<i>(SD)</i>
WTAS 1	3.18	<i>(0.77)</i>	2.92	<i>(0.71)</i>	3.05	<i>(0.74)</i>
WTAS 2	3.18	<i>(0.82)</i>	2.91	<i>(0.82)</i>	3.05	<i>(0.82)</i>
Quiz 1	4.46	<i>(1.79)</i>	5.17	<i>(1.27)</i>	4.81	<i>(1.58)</i>
Quiz 2	5.83	<i>(2.04)</i>	5.83	<i>(1.50)</i>	5.83	<i>(1.77)</i>

The independent samples t-test revealed no significant differences between students in the two feedback conditions regarding WTAS 1 ( $t(45) = 1.19, p = .24$ ) and Quiz 1, ( $t(45) = -1.57, p = .12$ ). Since no significant differences are found before receiving the different forms of feedback, the conditions are considered to be comparable at the beginning of the study.

The bivariate correlation analysis showed a significant positive correlation between Quiz 1 and Quiz 2,  $r(45) = .38, p = .008$ , as well as a significant positive correlation between WTAS 1 and WTAS 2,  $r(45) = .96, p = <.001$ . There is no correlation found between WTAS 1 and Quiz 1 ( $r(45) = -.13, p = .38$ ). The correlation between WTAS 2 and Quiz 2 was investigated separately within the two feedback conditions. There was no correlation found between WTAS 2 and Quiz 2 for the neutral feedback condition,  $r(22) = .003, p = .99$ . For the negative feedback condition, no correlation was found either,  $r(21) = -.19, p = .37$ .

A one-way ANCOVA was used to analyse the effect of the feedback type on WTAS 2, using WTAS 1 as the covariate,  $F(1, 44) = .00, p = .99$ . A second one-way ANCOVA was used to analyse the effect of the feedback type on Quiz 2, using Quiz 1 as the covariate,  $F(1,44) = .44, p = .51$ . In both cases, the feedback type did not have an impact on students' score.

The paired samples t-test showed a significant difference between Quiz 1 and Quiz 2 for the neutral feedback condition,  $t(23) = -3.14, p = .005$ . The effect size for the difference was calculated using Cohen's  $d$ , which indicates a medium effect for this difference,  $d = 0.72$ . For the negative feedback condition, there is also a significant difference,  $t(22) = -2.09, p = .05$ . The difference is considered a medium effect as well,  $d = 0.47$ . Both groups improved their quiz scores significantly. The paired samples t-test for WTAS 1 and WTAS 2 did not show significant results for the neutral feedback condition,  $t(23) = -.19, p = .85$ . For the negative feedback condition there is no significance either,  $t(22) = .16, p = .87$ .

## Discussion



The current study looked into the problem of test anxiety levels among students in higher education. The negative influence anxiety has on physical and mental health (Sun et al., 2018) shows the importance of finding a fitting tool that could help decrease test anxiety. Therefore, this study aimed to investigate the relation between test anxiety levels and students' performance on quizzes. In order to explore the effects of test anxiety, negative feedback was used to try to induce test anxiety in students and neutral feedback was used to control for effects. The purpose was to provide insights into how academic performance is affected by test anxiety. The focus was on the research question: 'Do students' test anxiety levels influence their performance on quizzes?'

### **Key Findings**

The results suggest that the participants had difficulty taking the quizzes since, on average, about half of the questions were answered correctly. The scores on Quiz 2 were however slightly better compared to Quiz 1. The measures of test anxiety before and after the feedback phase were very similar, even though the participants did not answer in the exact same way. The overall test anxiety level was moderately high.

Positive significant correlations were found between Quiz 1 and 2 as well as WTAS 1 and 2. This means that individuals who performed well in the first quiz maintained similar performance in the second quiz, and those who were initially anxious remained so after the second round of measurement. These results are understandable considering that the participants are the same and no effective intervention was provided to significantly alter their behaviours.

The data analysis indicated that there was no correlation present between the test anxiety levels and quiz scores. This implies that the level of anxiety does not affect or predict performance on quizzes, since neither a positive nor negative correlation was found. Test anxiety levels did thus not seem to influence students' performance on quizzes. In addition to that, the one-way ANCOVA revealed no main effect. This means that the feedback type did not influence anxiety levels, nor did it impact the quiz scores. Although students' performance did improve from Quiz 1 to Quiz 2, the type of feedback did not play a role in this improvement. The current study thus suggests no influence of test anxiety on performance, but similar studies indicated that a correlation between test anxiety and quiz scores was present. Agarwel et al. (2014) found for instance an influence of anxiety on

performance, both positively and negatively. According to Cooper et al. (2018), especially negative feedback can underly higher levels of anxiety.

An explanation for these current findings may be that, within this study, there was nothing at stake for the participants (e.g., no grade). Anxiety arises when students have something important to achieve (Brigati et al., 2020), which was not the case in the current study. Therefore, they may not have felt pressure to answer correctly and anxiety may not be induced. This effect could be enlarged since the study was fully online. Doing a test online means that students have control over their testing environment, perceived control might reduce anxiety and the student can choose an environment with no or less anxiety-provoking stimuli (Stowell & Bennett, 2010).

An improvement has been shown in students' performance on quizzes from Quiz 1 to Quiz 2. This improvement was present in both feedback conditions, with a higher effect size and thus a stronger relationship for the neutral feedback condition. No effect was found from WTAS 1 to WTAS 2, which implies that anxiety was neither increased nor decreased within the current study. The improvement from Quiz 1 to Quiz 2 seems to have nothing to do with the type of feedback. This improvement could be due to various factors, like becoming familiar with the question types, experiencing a memory recall, warmup effect, etc.

In line with Chien et al. (2016), current findings indicate that the participants improved their quiz scores, and thus the use of quizzes can positively affect performance. Contrary to the current finding that no main effect of feedback on quizzes was found, the research of Choi et al. (2018) found that feedback does play a role in learning outcomes. An increased performance when feedback was provided was found by Shapiro & Gordon (2013) and Slowiak and Lakowske (2017) as well.

### **Limitations and Recommendations**

Since there are no high stakes present for the students within the current study, future studies should integrate the current format into an existing course. This would ensure that anxiety is induced and effects may be evident since anxiety can be tested regarding real assignments and/or exams. Future studies could also mimic the conditions of such a study environment. A method like this would establish that there is something at stake for the students.

Furthermore, the difficulty of the quizzes was not validated since that is beyond the scope of this study. This could however be relevant to consider since the results showed that quiz scores were improved for Quiz 2 against Quiz 1. The two quizzes consisted of different questions, so it is plausible that the difficulty differed between the quizzes. Since difficulty indicates how hard or easy a question is, the difficulty should be determined beforehand. Then it can be ensured that two quizzes consist of questions with comparable difficulties. For the current study, it was expected that Quiz 1 and Quiz 2 were of equal difficulty because they were designed using the same source material. Moreover, the quizzes were checked by peers. However, an equal difficulty level of questions between the two quizzes is not guaranteed, potentially violating the validity. To prevent this, the quizzes could be randomised, so half of the participants will first get Quiz 1 and then Quiz 2, and the other half vice versa. Moreover, it would be advised to ensure the difficulty of quizzes is comparable before establishing the questions within the study.

Another limitation of this study is the time constraint. With more time for the study design, for instance, the difficulty of the questions could have been considered. Moreover, the available time for data collection was three weeks, which was insufficient time to obtain a large study sample. The current sample was not large enough to support generalisability for the findings of this study. Generalisability should be ensured in order to apply findings to a broader population. Since this is not achieved within the current study, no conclusions can be drawn regarding the population. It is recommended to establish generalisability in future research by replicating the study in various contexts with a larger sample size, including participants with different backgrounds.

Nonetheless, the strengths of the current study are that it exhibits the relevance of the subject of anxiety regarding academic performance. Through the literature view especially, it was shown that there could be various explanations for the relationship between anxiety and academic performance. Even when the current findings do not indicate an existing correlation, the study presents the intricate nature of the subject. To explore the nuance surrounding this subject further, additional research should be performed for comprehension and deeper understanding. This study could not distinguish the effect of the study variables because of the small sample size. However, this study, with the given recommendations and adaptations, could be used as a format for further research.

## **Conclusion**

Within the current study, no impact from test anxiety was found on performance on quizzes. Test anxiety levels did not influence students' performance on quizzes. The feedback type had an effect on neither the test anxiety level nor the quiz score. However, the study did find that the participants improved their quiz scores from Quiz 1 to Quiz 2. Despite the limitations, some insights and practical implications arose and were discussed and connected to existing literature.

This study constructs a relevant and usable format for future research, taking into account the current limitations and recommendations. Within a future study, the current format should be integrated into an existing course to ensure there is something at stake for the students. When that is the case, students are expected to experience higher anxiety, and it could thus be investigated whether anxiety influences performance on an exam. If a correlation is found between test anxiety and performance on quizzes, it could prove the influence of test anxiety on quiz performance, after which tools could be used to lessen test anxiety.

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## Appendix A

### Qualtrics Study

#### Bachelor Thesis

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##### Start of Block: Consent Form

Welcome

This study aims to investigate the relation between test anxiety and the performance on quizzes. This study is being conducted by a student undertaking the Bachelor of Psychology at University of Twente and the data will be analysed for a Bachelor Thesis.

#### Participation

To take part in this study, it is required that you are 18 years of age or older. Moreover, you have to be a university Psychology student and you have to be sufficient in English.

It is fully your decision whether or not you want to complete this questionnaire. You can stop this study at any time by closing your browser. The data you have entered will be deleted and will not be included in analyses. If you do decide to withdraw before completion, this will not affect you in any way. However, once you have completed the study, your data cannot be identified and it will thus be impossible to delete your data.

If you consent to take part, you will get some demographic questions. No identifiable information will be taken from you to ensure anonymity. Then you will be asked to fill in an instrument on anxiety and two small theory tests. The study will take about 20 minutes of your time to complete.

#### Data and results

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. The data will be analyzed, and the results will be written by the researcher and submitted at the end of January 2024. Only aggregated data will be presented, no individual responses will be shared.

#### Contact details

This study has been reviewed and 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: [m.g.reedijk@student.utwente.nl](mailto:m.g.reedijk@student.utwente.nl)

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By checking this box I confirm that

- I have read the information given, am allowed to participate and I consent to participating.
- I am aware that I have the right to withdraw from this study at any point.
- I understand that if I complete the study all my data will be confidential and anonymous.

Yes (1)

No (2)

*Skip To: End of Survey If By checking this box I confirm that - I have read the information given, am allowed to participat... = No*

**End of Block: Consent Form**

---

**Start of Block: Demographics**

How do you identify yourself?

Male (1)

Female (2)

Non-binary / third gender (3)

Prefer not to say (4)

Prefer to self-describe (5) \_\_\_\_\_



How old are you?

\_\_\_\_\_

---

What degree are you pursuing or have you pursued?

Bachelor's Degree (1)

Master's Degree (2)

PhD (3)

Other (4) \_\_\_\_\_

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At which university are you studying or have you studied?

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What is your nationality?

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**End of Block: Demographics**

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**Start of Block: Text Anxiety 1**

Please rate how true each of the following statements is of you

	Extremely or always true (1)	Highly or usually true (2)	Moderately or sometimes true (3)	Slightly or seldom true (4)	Not at all or never true (5)
The closer I am to a major exam, the harder it is for me to concentrate on the material. (1)					
When I study, I worry that I will not remember the material on the exam. (2)					
During important exams, I think that I am doing awful or that I may fail. (3)					
I lose focus on important exams, and I cannot remember material that I knew before the exam. (4)					
I finally remember the answer to exam questions after the exam is already over. (5)					

I worry so  
much before  
a major exam  
that I am too  
worn out to  
do my best  
on the exam.

(6)

I feel out of  
sorts or not  
really myself  
when I take  
important  
exams. (7)

I find that my  
mind  
wanders  
when I am  
taking  
important  
exams. (8)

After an  
exam, I  
worry about  
whether I did  
well enough.

(9)

I struggle  
with writing  
assignments,  
or avoid them  
as long as I  
can. I feel  
that whatever  
I do will not  
be good  
enough. (10)

End of Block: Text Anxiety 1

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Start of Block: Voting Phase



The first quiz is about to start. The quiz consists of 10 questions about the theory from Chapter 9: Motivation and Emotion from Psychology, global edition (Ciccarelli & White). Once you have answered a question you will not be able to go back.

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Page Break

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1. What description fits the definition of motivation best?

Motivation is what moves people to do the things they do (1)

Motivation is the process of setting and achieving goals (2)

Motivation is a driving force that propels individuals to overcome obstacles, face challenges, and pursue excellence (3)

Motivation is the process of starting, directing, and continuing activities to fulfill needs or wants (4)

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Page Break

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2. Which term is most relevant in the evolutionary approach to understanding motivation?

Needs (1)

Drives (2)

Incentives (3)

Instincts (4)

---

Page Break

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3. What are the three needs that make up McClelland's theory of motivation?

Affiliation, power & achievement (1)

Love, power & achievement (2)

Water, food & sex (3)

Affiliation, safety & love (4)

---

Page Break

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4. In the context of the incentive approach, why would a person choose a candy bar over a salad despite being hungry?

The candy bar has less appeal than the salad (1)

The candy bar provides instant satisfaction (2)

The candy bar is more accessible than a salad because of the cost (3)

The candy bar has more pull as a rewarding external stimulus (4)

---

Page Break

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5. At which level of Maslow's hierarchy do individuals pursue growth and creativity?

Physiological (1)

Love/Belonging (2)

Self-actualisation (3)

Esteem (4)

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Page Break

---

6. According to the self-determination theory, what are the three universal needs that help people gain a complete sense of self and form healthy relationships?

Safety, Esteem, Love/Belonging (1)

Autonomy, Competence, Relatedness (2)

Physiological, Safety, Social (3)

Recognition, Affiliation, Achievement (4)

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Page Break

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7. Which areas of the hypothalamus have a role in controlling eating behaviour?

Ventromedial hypothalamus and lateral hypothalamus (1)

Dorsomedial hypothalamus and anterior hypothalamus (2)

Ventromedial hypothalamus and dorsomedial hypothalamus (3)

Lateral hypothalamus and anterior hypothalamus (4)

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Page Break

8. What impact does an increase in food variety have on eating behaviour?

It increases the attractiveness of eating (1)

It decreases overall food consumption (2)

It leads to eating beyond physiological need (3)

It promotes healthier eating habits (4)

---

Page Break

9. Which part of the brain is more active when people identify emotions on another person's face?

Left hemisphere (1)

Right hemisphere (2)

Occipital lobe (3)

Parietal lobe (4)

---

Page Break

10. Which theory of emotion has the following form: stimulus - bodily arousal and labelling of that arousal - emotion

- The James-Lange theory (1)
- The Cannon-Bard theory (2)
- The cognitive arousal theory (3)
- The cognitive-mediational theory (4)

**End of Block: Voting Phase**

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**Start of Block: Feedback**

For the first quiz, you have received a score of  $\frac{\text{\$}\{gr://SC\_ezCQCaN9ARzYeRo/Score\}}{10}$

**End of Block: Feedback**

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**Start of Block: Feedback**

For the first quiz, you have received a score of  $\$e\{\text{round}(gr://SC\_ezCQCaN9ARzYeRo/Score /2)\} /10$

**End of Block: Feedback**

---

**Start of Block: Text Anxiety 2**

Now that you have completed the first test and have received feedback, would you please think again about how true each of the following statements is of you?

	Extremely or always true (1)	Highly or usually true (2)	Moderately or sometimes true (3)	Slightly or seldom true (4)	Not at all or never true (5)
The closer I am to a major exam, the harder it is for me to concentrate on the material. (1)					
When I study, I worry that I will not remember the material on the exam. (2)					
During important exams, I think that I am doing awful or that I may fail. (3)					
I lose focus on important exams, and I cannot remember material that I knew before the exam. (4)					
I finally remember the answer to exam questions after the exam is already over. (5)					

I worry so  
much before  
a major exam  
that I am too  
worn out to  
do my best  
on the exam.

(6)

I feel out of  
sorts or not  
really myself  
when I take  
important  
exams. (7)

I find that my  
mind  
wanders  
when I am  
taking  
important  
exams. (8)

After an  
exam, I  
worry about  
whether I did  
well enough.

(9)

I struggle  
with writing  
assignments,  
or avoid them  
as long as I  
can. I feel  
that whatever  
I do will not  
be good  
enough. (10)

End of Block: Text Anxiety 2

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Start of Block: Revoting Phase

The second quiz is about to start. The quiz also consists of 10 questions about the theory from Chapter 9: Motivation and Emotion from Psychology, global edition (Ciccarelli & White). Once you have answered a question you will not be able to go back.

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Page Break

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1. Intrinsic motivation is characterised by

- Performing an action to avoid unpleasant outcomes (1)
  - Performing an action without any specific goal in mind (2)
  - Performing an action because it is fun, rewarding, or challenging (3)
  - Performing an action to receive rewards like working to earn money (4)
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2. What is the function of homeostasis in the context of motivation?

- Homeostasis regulates emotional stability by ensuring that individuals maintain a constant state of happiness and contentment (1)
  - Homeostasis maintains a steady state in the body and stimulates behaviour to bring the body back into balance (2)
  - Homeostasis is the tendency of the body to seek external rewards (3)
  - Homeostasis is a psychological tension associated with acquired drives (4)
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3. What does the Yerkes-Dodson law explain in the context of arousal theory?

- The relationship between stimulus intensity and arousal level (1)
  - The relationship between task performance and arousal level (2)
  - The determination of different arousal levels (3)
  - The influence of arousal levels on making risky decisions (4)
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4. Which of the following is the correct sequence of Maslow's hierarchy of needs, starting from the most basic to the highest level?

Self-actualisation, esteem, safety, love/belonging, physiological (1)

Physiological, safety, love/belonging, esteem, self-actualisation (2)

Safety, physiological, love/belonging, esteem, self-actualisation (3)

Physiological, safety, self-actualisation, love/belonging, esteem (4)

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5. In Maslow's theory, how often do people reach a point of self-actualisation?

Most people reach a state of self-actualisation before they reach adulthood (1)

Most people reach a state of self-actualisation as they finish adolescence (2)

Seldom, although there are times in a person's life when they are self-actualised at least temporarily (3)

No one ever reaches self-actualisation, our motivations express themselves in how we try to attain it (4)

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6. What happens to the insulin level after eating, and how does it relate to hunger?

Insulin decreases after eating, reducing hunger (1)

Insulin increases after eating, causing a feeling of more hunger (2)

Insulin remains constant after eating, having no effect on hunger (3)

Insulin is not related to hunger (4)

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7. How do cultural factors influence eating habits?

Cultural factors have a direct influence on individual's metabolic rates (1)

Cultural factors influence eating habits through genetic predispositions, e.g. food intolerances (2)

Cultural factors determine the availability and affordability of certain foods, influencing specific food choices (3)

Cultural factors affect when, why, and under what circumstances people eat (4)

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8. Which three elements characterise emotion?

Physical arousal, behavioural expressions, and inner awareness (1)

Internal processes, physical arousal, and outer behaviour (2)

Thoughts, conscious awareness, and behavioural expressions (3)

Emotional stimuli, inner awareness, and physical arousal (4)

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9. What are display rules in the context of emotional expressions?

Universal facial expressions observed in all cultures (1)

Genetic predispositions influencing emotional behaviour (2)

Emotional responses that are biologically predetermined (3)

Learned ways of controlling displays of emotion in social settings (4)

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10. What does the facial feedback hypothesis propose?

Facial expressions cause emotions by sending signals to the brain (1)

Facial expressions are a consequence of emotions (2)

Facial expressions are influenced by emotional experiences (3)

Facial expressions have no impact on emotions (4)

**End of Block: Revoting Phase**

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**Start of Block: Debrief**

*Display This Question:*

*If For the first quiz, you have received a score of  $\$e{\text{round}(\text{gr}://\text{SC\_ezCQCaN9ARzYeRo}/\text{Score}/2)}$  /10 Is Displayed*

Thank you very much for taking part in this study.

The data will be used to investigate whether anxiety levels influence performance on quizzes. In order to investigate this, different types of feedback were used. To provoke test anxiety, some participants received a lower score than they had actually accomplished in the feedback phase after the first quiz (test group). The rest of the participants received their actual scores (control group).

You were part of the test group, and thus you received a score of  $\$e{\text{round}(\text{gr}://\text{SC\_ezCQCaN9ARzYeRo}/\text{Score}/2)}$  /10. Your actual score on the first quiz was  $\$\{\text{gr}://\text{SC\_ezCQCaN9ARzYeRo}/\text{Score}\}$  /10.

For the second quiz, you received a score of  $\$\{\text{gr}://\text{SC\_bsdNdGcDf1FF5IO}/\text{Score}\}$  / 10

Lastly, a small reminder to contact the study researcher if you have any queries or concerns about the study using the following email: [m.g.reedijk@student.utwente.nl](mailto:m.g.reedijk@student.utwente.nl)

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**End of Block: Debrief**

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