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Quite Eye training technique to improve seafarers' physical performance

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Abstract

This study aimed to compare the efficacy of Quiet Eye (QE) training versus conventional methods in improving sailors' knot-tying performance under induced stress. Participants performed corresponding training regimens developed from earlier studies after being divided into QE and conventional groups. Heart rate variability (a physiological response), error incidence (a measure of precision), and time taken (a measure of efficiency) were the three main outcomes that were measured. Over the course of three tries, the QE group consistently showed more predictable and effective results in all criteria. The two main drawbacks were the lack of an eye tracker and the potential for inaccurate heart rate monitoring. Subjectively, participants who used the QE technique reported feeling more focused and finding the training to be helpful. The results of the study showed a significant link between the subjective assessments of the participants and their actual performance. Overall, QE training shows its promise for work requiring accuracy and efficiency under challenging circumstances.

Language: English
Key Words: Quiet Eye method, Knots, Bowline, Stress, gaze, focus,

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1. Introduction

Athletes and other professionals performing certain tasks accurately can be affected because of the high-stress nature of their profession. In these high-pressure situations, their attentional focus can become scattered, and they may struggle to execute their skills effectively. This is where the Quiet Eye (QE) technique comes in - it is a technique used to enhance motor skill performance by helping athletes and performers focus their attention on the critical elements of their task. QE is a technique that involves directing one's visual attention (gaze) towards a specific location or target, such as a golf ball or basketball hoop, for a period of time before executing a motor skill. This aiming fixation of the gaze was later termed the quiet eye (Vickers, 1996). Sustained gaze on the target is thought to optimize the subjects' motor planning and execution, resulting in improved performance. QE technique has been shown to be effective in a wide range of sports and motor tasks, including golf, basketball, archery, and surgery. This technique has been used by athletes and performers at all levels, from beginners to elite professionals. By improving motor skill performance, the QE technique can have a significant impact on athletes and performers, not only in terms of their success in competition or performance, but also in terms of their self-confidence. It is particularly useful for those who perform under high-pressure conditions, such as in competition or when performing in front of an audience. However, the technique can be applied to any motor task and can benefit anyone looking to improve their performance.

When seafarers are performing tasks such as knot-tying, lowering a lifeboat or life raft, their ability to perform these motor skills accurately can be critical to the safety of the vessel and its crew. In such situations, their focus can become dispersed, and they may struggle to execute their skills effectively. The control of gaze has been shown to improve accuracy in the performance of motor tasks (Land, 2009). QE is a technique which can be used to enhance motor skill performance by helping seafarers focus their attention on the critical elements of their task.

Vickers was the first to conduct studies in this concentration method. Vickers had shown the importance of keeping gaze steady which will be implemented in this study for seafarers. The sailors will be performing a bowline knot, focusing their gaze on the intersection where the initial loop overlaps, which they will be executing from the initiation of the task followed until the completion of the task. Vickers had proposed that the longer the gaze will be fixated at a point of concentration (QE duration), the better the outcome will be.

According to the study conducted by Vickers (Vickers, 1992)on expert and novice golfers, experts kept their eyes steady on the back of the ball for around two seconds prior to the initiation of the back swing and maintained this gaze until the putter contacted the ball.

Vickers and colleagues' research has demonstrated that both expert and novice performers may be trained to build longer and more effective QE periods, which will lead to performance increases (Adolphe.;LaPlante;& Vickers, 1997). For instance, Harle and Vickers (Harle & Vickers , 2001) looked at the results of a QE training program designed to help near-elite basketball players regulate their gaze and make accurate free throws. The QE-trained team not only improved their free-throw percentages by 12% and QE durations from an average of 300-900 Ms in a laboratory setting, but they also increased their competitive free-throw percentage by 22.6% after two seasons.

Further knowledge on how training interventions might improve performance may come from research on disruptions in gaze control during pressured performance (Behan & Wilson , 2008). Anxiety has a negative effect on effective gaze control, as measured by the QE, which affects performance on tasks requiring far-aiming (Vickers & Williams, 2007); (Behan & Wilson , 2008); (Wilson;Vine;& Wood, 2009). Vickers and Williams (Vickers & Williams, 2007) discovered that top athletes who were able to keep their QE lengths constant under stress were less prone to choke, meaning they were less likely stop due hesitation. The authors hypothesized that the athletes were protected from the typically incapacitating effects of anxiety by directing attention externally to crucial task information (through the QE). Based on these studies later more research done on golfers under induced stress showed increased performance with QE trained elite golfers putting performance (Vine;Moore;& Wilson, 2011) This is relevant for this specific study on seafarers performing motor tasks under artificially induced stress situations. Their conclusion, in line with prior findings and predictions, the QE intervention helped golfers avoid the crippling effects of anxiety on their performance by ensuring they were able to maintain efficient gaze control (QE durations) in a stressful situation. A significant improvement in competition putting performance of 1.92 putts per round and 5% more putts that were holed by the QE-trained group. The results from an applied standpoint imply that QE training may offer a helpful psychological strategy, as part of a pre-performance routine, to boost performance under pressure and enhance performance in competitive contexts.

This raises the question if the same strategy can be applied to seafarers under stress and can this be used to minimize anxiety of seafarers in real life situations to improve their capability to execute motor tasks which are essential for a ship's functionality. In this study, the simple task of tying a recognized knot; Bow line, performed by trained seafarers under stress. In addition to the study done with elite golfers putting performance under (Vine;Moore;& Wilson, 2011), this study will be in line with the research done on surgeons' knot tying performance with QE training comparison with conventional training (Causer;Vickers;Snelgrove;& Arsenault, 2014). This study showed, when compared to a conventional technical method, QE training greatly enhanced learning, retention, and transfer of surgical knot tying. Using QE modelling, teaching, and feedback, performance effectiveness and movement efficiency (hand movement durations) were both enhanced.

This opens the discussion to analyse the motor skill performance of seafarers under induced stress following the previous research done on various other fields of study and how QE training can be applied to the seafarers training to enhance the effectiveness and precision of the tasks executed. This raises the question if the same strategy can be applied to seafarers under stress and can this be used to minimize anxiety of seafarers in real life situations to improve their capability to execute motor tasks which are essential for a ship's functionality. In this study, the simple task of tying a recognized knot; Bow line, performed by trained seafarers under stress. In addition to the study done with elite golfers putting performance under (Vine;Moore;& Wilson, 2011), this study will be in line with the research done on surgeons' knot tying performance with QE training comparison with conventional training (Causer;Vickers;Snelgrove;& Arsenault, 2014). This study showed, when compared to a conventional technical method, QE training greatly enhanced learning, retention, and transfer of surgical knot tying. Using QE modelling, teaching, and feedback, performance effectiveness and movement efficiency (hand movement durations) were both enhanced. This opens the discussion to analyse the motor skill performance of seafarers under induced stress following the previous research done on various other fields of study and how QE training can be applied to the seafarers training to enhance the effectiveness and precision of the tasks executed.

2. Aims and Hypothesis

2.1 Participants

In this project, the participants were sea captain students from Novia University of Applied Sciences. To be eligible for the study, participants were required to have completed the ship maintenance and seamanship courses. In our opinion, this established a fair benchmark for the study's objective, which was to assess the effectiveness of the instructional strategies used. The target number of participants was 20, and they were divided into groups 1 (QE training) and 2 (conventional training) at random. This was done by making a list of the participants registered for the experiment and choosing 10 random names for QE group and the rest for the conventional group. A survey was developed in order to compare the subjective results from questioners to the outcome of the experiment.

2.2 Apparatus

We used a music studio for the study's purposes to introduce visual and audio distractions. An environment resembling that of a ship in rough seas was created using speakers and mood lighting. The speakers played noises of a strong wind, breaking waves, and alarms. The LED lights were tuned to replicate the poor lighting conditions frequently found in real-life emergency situation on a sea going vessel and had varying brightness intervals to reflect how lighting could alter as a ship moves in choppy waters. Additionally, we were recording the time to instill a sense of urgency.

Item list:

- Speakers (surround sound system)
- LED lights
- Stopwatch
- Rope
- Sports watch (monitor heart rate)

3. Method

All candidates participated in the experiment on a voluntary basis, and they were provided with consent forms. They were free to withdraw from the experiment at any time. All participants remained anonymous to protect their privacy. For the group selection process, all were assigned a number (up to 20), and seafarers were randomly selected to be in the QE group or the conventional group. Taking each participant in separately minimized contact between the two separate groups, and they were asked not to disclose the teaching to participants from the other group at any time. A pre-task questionnaire was provided to all participants after separated into groups. This provided a baseline for the experiment on a qualitative scale.

All participants from both groups had a basic refresher on the bowline knot, so they tied the knot in the exact same way across the experiments. For this, the researcher gave a live demonstration of the knot, step by step. This was the same method of performing the knot that was taught in the maritime academy. After that, both groups tried the task given. Here, the baseline data was recorded for every participant, with time, heart rate, and accuracy through the number of mistakes they made.

The QE group was trained by first introducing what QE was and a brief history of the method. After that, they had training on the practical application of the method to performing a task. Here, it was shown how they could apply it to this specific task so that their gaze was focused on a target part of the knot. (See training protocol.) The participants had a chance to discuss any feedback at this stage. The training consisted of practicing the QE method 3–5 times during the training session before going to the measured experiment with the induced pressure.

The conventional group was taught in the same method that the maritime academy, Novia UAS, had taught them to perform the knot. Here, after the example of defining the stages of the knot, they went straight into practicing 3–5 times before having a chance for feedback discussion. After that, they entered the induced pressure experiments, where the data was obtained.

First, the QE group participants were taken to a private studio with controllable audio located in the center of Turku, Finland. Each participant came to the studio at a specific time, so only one person went through the stress stage at a time (2-hour window). The participant was briefed about the stress stage and was asked to follow the steps from the QE training to focus the gaze. To monitor the state of anxiety through the heartbeat, the participant wore a heart rate monitoring device on the wrist. To monitor the accuracy of the bowline tying process, the number of mistakes were marked. The time of completion was recorded with a stopwatch. The participants had to self-assess the QE time of their gaze.

After the briefing, the participants got three attempts to perform the task, with a 4–5-minute break in between each try. The conventional group participants had the same process of measurements: state of anxiety with a heart rate monitor, time with a stopwatch, accuracy through the photo recording, which was later examined, and the number of mistakes or tries to complete the task. This also took place in the same location, the private studio. They were asked to follow the conventional method without being asked to fix their gaze at the same location on the piece of rope. After each turn (a total of 3 tries with 4–5-minute breaks in between). The conventional group also went through the same procedure of artificially inducing stress with distractions and was urged to complete the task disregarding them. (See pressure manipulation.) After both groups had completed the experiment, they filled out the post-experiment questionnaire for further qualitative data.

3.1 Training protocol

The training techniques were adapted from previous QE research done by Vine, Moore, and Wilson, (Vine;Moore;& Wilson, 2011),and was focusing on the knot-tying performance of sailors. Both training groups started by getting an introduction to the knot and steps to complete it with a live demonstration. Next, for the QE group, after completing a knot-tying attempt to establish the baseline, the researcher explained the benefits of manipulating the gaze to increase concentration and limit distractions, known as critical QE, as observed in previous gaze research (Vickers, 1992), (Vickers & Williams, 2007). Subsequently, the QE-trained group received specific guidance from the instructor on how to hold the focus through the QE method and where in the knot they should lock onto and follow through until both knots are completed. The gap space between the completion of the first knot and the starting of the second knot was acknowledged, and the participants were to break their gaze and re-establish the QE for the second bowline. Consistent with previous QE training research done by Harle, Vickers (Harle & Vickers , 2001) and Vine, Wilson (Vine;Moore;& Wilson, 2011), the following points were adapted from Vickers's (Vickers & Williams, 2007) research.

Seated stance and align the ropes on the ground so that your gaze is focused on the specific area. After setting up the knot-tying task, fix your gaze on the critical area; here, it was on the first loop. Below on figures 1 and 2, the red highlighted part is the focus point.

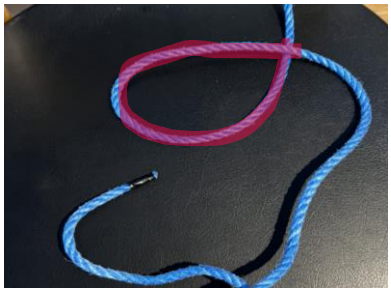

Figure 1: initial loop: critical area

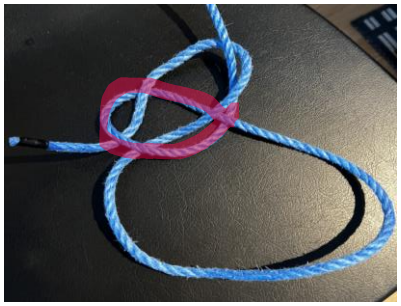

Figure 2: Complete bowline with the highlighted initial loop.

The final fixation should be QE in the critical area, the red highlighted area on the above figures 1 and 2. The onset of the QE should occur before initiating the knot-tying motion and should last for 2 to 3 seconds.
Avoid shifting your gaze to other parts of the rope during the knot-tying motion.
Maintain the QE on the critical area for 200 to 300 ms after completing the knot-tying motion.

The QE-trained group was asked to improve aspects of their gaze control based on the provided feedback from the instructor. This was to further steady the gaze and keep focus while the knot was tied. The groups then performed an additional 3 knot-tying attempts, during which performance and gaze control measures were recorded under induced pressure.

The conventional method group received the same information after the induced pressure test was complete and the data was recorded. So, all the participants who attended the experiment regardless of the groups both received QE training. But for the purpose of this experiment only the QE group received it before the induced pressure test. This technique can be used in any physical or precision activity so attending this experiment may help them in their day today life going forward.

3.2 Pressure manipulation

Adopted from previous research, a few different techniques were used to create high levels of cognitive anxiety for the pressure test (Vine;Moore;& Wilson, 2011). Both the experiments and the training took place in a private studio. This was designed to increase the anxiety of an unfamiliar space by giving the researcher the ability to add loud noises at a safe rate. At the experiment, a fire alarm on a ship or a general alarm was used, and being a seafarer, hearing the general alarm sound at a certain loudness will bring a sense of alarm and anxiety.

To further add pressure to the situation the instructor told the participants their bowlines would be compared with other participants knots and photographed, which gave them more incentive to perform better and added a sense of competitiveness.

4. Data Analysis

Comparative Analysis of Heart Rate Change, Error Incidence, and Time Taken in Knot-Tying Tasks: Conventional vs. QE technique.

This research, involving seafarers from Novia UAS who have completed Ship Maintenance and Seamanship 1, aims to unfold a thorough comparative analysis focusing on the implementation of the Quiet Eye (QE) technique versus conventional teaching methods in knot-tying tasks. The participants, divided into two distinct groups of ten each, underwent assessment over three attempts to ensure consistency and reliability in the derived data. It keenly zooms into three pivotal parameters: Heart Rate Change (HRC), error incidence, and time taken difference (TTD), thereby offering a multifaceted understanding of the impacts of each teaching method.

To dive further into the difference between conventional and QE technique, in hopes to prove the potential benefits of Quiet Eye technique, we concocted a series of questions pre-task & post-task. The intention with these questions is to find out how, if at all, correlations between subjective response and outcome of task exist, and in what manner.

Analyzing statistical data:
To start off the process of our data analysis we organized our data into an excel table (see appendix 7 table 1 & 2). The data displayed is divided into 3 main groups:

- Baseline data (one attempt for all participants)
- Conventional group (data across 3 attempts)
- Quiet Eye group (data across 3 attempts)

The idea behind the baseline data is to use it as a reference to compare it against the performance of conventional and QE group, across 3 attempts. This enables us to make a comparative analysis of the afore-mentioned groups, which is done by comparing box plots and bar graphs.

Box plot graphs are an excellent tool because they can express a myriad of information in a single image, i.e., mean, median, standard deviation (SD), interquartile range (IQR), lower quartile(Q1), upper quartile(Q3) and outliers.

4.1 Heart Rate Change (HRC)

Heart rate change is the physiological reaction the body has towards different stimuli. It is measured in beats per minute (BPM). By altering the conditions set in our environment and using a heart rate monitor, we can detect and write down our findings. This in turn guides us to asking the right questions that help us navigate towards the answers we are seeking:

- How did the BPM change relative to the baseline?
- Was there improvement between the attempts?
- What factors might explain the variability in heart rate changes between participants?
- Are there any outliers or extreme cases in the data?
- How do the results compare to one another?

To answer these questions, we will delve into the box plots for the HRC of both groups:

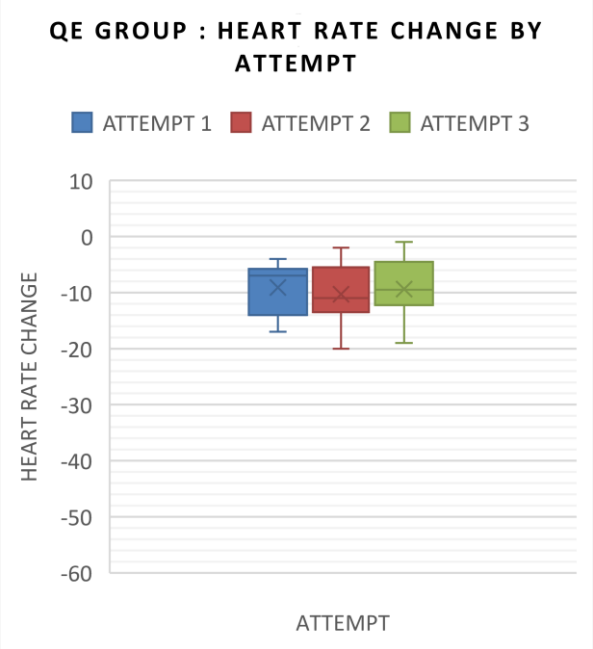

Figure 3: HRC box plot, QE group

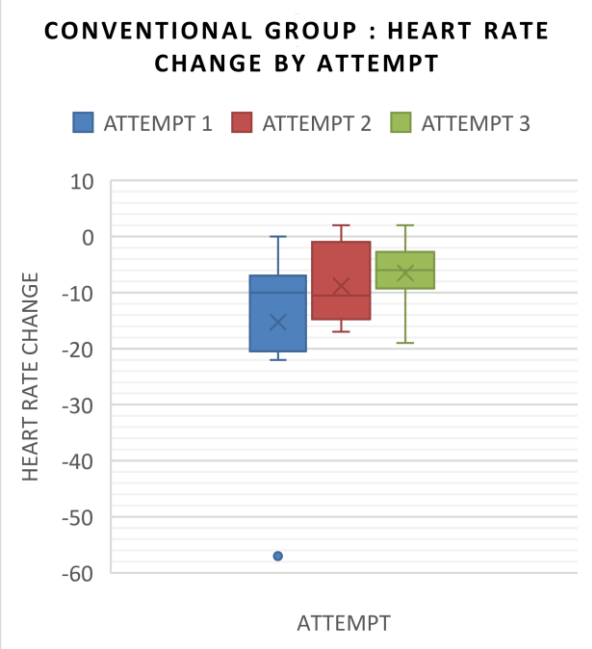

Figure 4: HRC box plot, conventional group

Above you find a box plot for the 3 attempts made by both groups. As you can see there is a lot to digest, so to break it down here is a description of the information displayed per attempt, side by side, in junction with the baseline values:

Attempt 1:

CONVENTIONAL	QE	BASELINE (ALL PARTICIPANTS, NO STRESSORS, SINGLE TAKE)
Range of Heart Rate Changes: 7.25-18 bpm	Range of Heart Rate Changes: 6-13.25 bpm	Range of Heart Rate Changes: 5.75-12.25 bpm
25% Experienced ≤ 7.25 bpm Change	25% Experienced ≤ 6 bpm Change	25% Experienced ≤ 5.75 bpm Change
25% Experienced ≥ 18 bpm Change	25% Experienced ≥ 13.25 bpm Change	25% Experienced ≥ 12.25 bpm Change
Average Change: 15.3 bpm	Average Change: 9.1 bpm	Average Change: 9.45 bpm
Median: 10 bpm	Median: 7 bpm	Median: 10 bpm
Standard Deviation: 15.99 bpm	Standard Deviation: 4.56 bpm	Standard Deviation: 4.53 bpm

Attempt 2:

CONVENTIONAL	QE	BASELINE (ALL PARTICIPANTS, NO STRESSORS, SINGLE TAKE)
Range of Heart Rate Changes: 3.5-13.75 bpm	Range of Heart Rate Changes: 6.75-12.75 bpm	Range of Heart Rate Changes: 5.75-12.25 bpm
25% Experienced ≤ 3.5 bpm Change	25% Experienced ≤ 6.75 bpm Change	25% Experienced ≤ 5.75 bpm Change
25% Experienced ≥ 13.75 bpm Change	25% Experienced ≥ 12.75 bpm Change	25% Experienced ≥ 12.25 bpm Change
Average Change: 8.8 bpm	Average Change: 10.3 bpm	Average Change: 9.45 bpm
Median: 10.5 bpm	Median: 11 bpm	Median: 10 bpm
Standard Deviation: 7.22 bpm	Standard Deviation: 5.33 bpm	Standard Deviation: 4.53 bpm

Attempt 3:

CONVENTIONAL	QE	BASELINE (ALL PARTICIPANTS, NO STRESSORS, SINGLE TAKE)
Range of Heart Rate Changes: 3.25-8.75 bpm	Range of Heart Rate Changes: 6-11 bpm	Range of Heart Rate Changes: 5.75-12.25 bpm
25% Experienced ≤ 3.25 bpm Change	25% Experienced ≤ 6 bpm Change	25% Experienced ≤ 5.75 bpm Change
25% Experienced ≥ 8.75 bpm Change	25% Experienced ≥ 11 bpm Change	25% Experienced ≥ 12.25 bpm Change
Average Change: 6.5 bpm	Average Change: 9.4 bpm	Average Change: 9.45 bpm
Median: 6 bpm	Median: 9.5 bpm	Median: 10 bpm
Standard Deviation: 5.68 bpm	Standard Deviation: 5.5 bpm	Standard Deviation: 4.53 bpm

4.1.1 Taking a closer look

Upon analyzing the data a few things become apparent.

First, the range of the HRC for conventional group in attempt 1 is considerably higher than that of QE group. As is the standard deviation, which implies greater variability in the outcomes of participants. An explanation for this would be the outlier (participant 4) seen on the boxplot. This individual seemed to have a difficult grasp of how to perform under stress. Looking at appendix table 3, the pre-task questionnaire provides a possible explanation. He was not well rested, very stressed out, lacked focus, felt physically unwell and didn't have a great sense of confidence in his ability to tie the knot. Interestingly, his HRC improved over the course of the attempts which suggests adaptability towards the stressors. However, his attempts did fluctuate from one another.

On broader inspection, both groups generally resulted in narrower ranges of heart rate changes over the course of each attempt. This might be the effect of the first introduction towards the external stressors causing a noticeable increase in heart rate that later lessen as they get familiar with the environment.

The average heart rate changes varied across attempts but showed no consistent trend of improvement or worsening.

The QE group consistently showed less variability in heart rate changes compared to the conventional group, indicating more consistent responses among participants.

In summary, these findings suggest that the quiet eye technique tends to produce more consistent heart rate responses compared to conventional group across different attempts, potentially indicating a level of effectiveness in maintaining stable physiological responses in a stress-inducing environment. More data samples would be required to increase the statistical significance of this experiment.

4.2 Time taken difference (TTD)

Another important metric we used to identify differences between groups' performance was the use of time. We hypothesized that due to the QE-technique, the participants in QE group would show greater improvement in time taken to execute the task. This is because the QE-technique enforces a practice of calming the mind before execution.

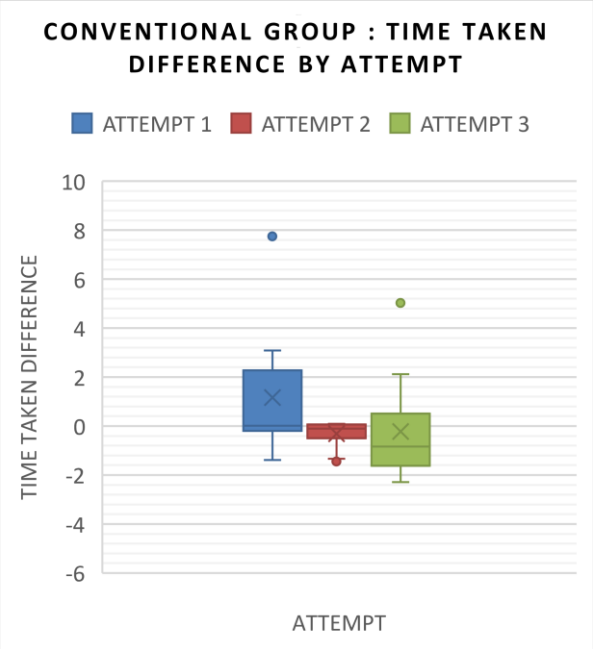

Figure 5: TTD box plot, Conventional group

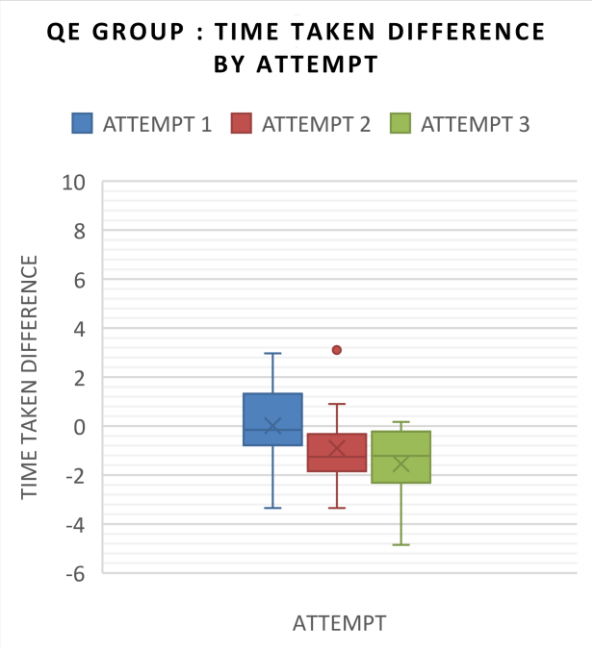

Figure 6: TTD box plot, QE group

Attempt 1:

Method	50% Range (sec)	25% Improvement (sec)	25% Decline (sec)	Average Change (sec)	Median Change (sec)	Standard Deviation (sec)
Conventional Method	-0.12 to +1.67	≥ 0.12	≤ -1.67	1.16	0.01	2.64
Quiet Eye Technique	-0.59 to +0.83	≥ 0.59	≤ -0.83	0.02	-0.16	1.74

Conventional Method:

- The 50% range of time taken changes is from -0.12 to +1.67 seconds.
- 25% of participants experienced an improvement in time taken of 0.12 seconds or more.
- 25% of participants experienced a decline in time taken of -1.67 seconds or more.
- The average change in time taken was 1.16 seconds, indicating an overall increase in time.
- The median change was 0.01 seconds, suggesting that half of the participants improved slightly, while the other half showed minimal changes.
- The standard deviation of 2.64 seconds indicates considerable variability in time taken changes among participants.

Quiet Eye Technique (QE):

- The 50% range of time taken changes is from -0.59 to +0.83 seconds.
- 25% of participants experienced an improvement in the time taken of 0.59 seconds or more.
- 25% of participants experienced a decline in time taken of -0.83 seconds or more.
- The average change in time taken was only 0.02 seconds, suggesting minimal overall change.
- The median change was -0.16 seconds, indicating that half of the participants improved slightly, while the other half showed minimal changes.
- The standard deviation of 1.74 seconds is lower than the Conventional method, indicating less variability in time taken changes among participants.

Attempt 2:

Method	50% Range (sec)	25% Improvement (sec)	25% Decline (sec)	Average Change (sec)	Median Change (sec)	Standard Deviation (sec)
Conventional Method	-0.21 to +0.07	≥ 0.21	≤ -0.07	-0.31	-0.11	0.58
Quiet Eye Technique	-1.66 to -0.85	≥ 1.66	≤ 0.85	-0.9	-1.26	1.67

Conventional Method:

- The 50% range of time taken changes is from -0.21 to +0.07 seconds.
- 25% of participants experienced an improvement in time taken of 0.21 seconds or more.
- 25% of participants experienced a decline in time taken of -0.07 seconds or more.
- The average change in time taken was -0.31 seconds, indicating an overall decrease in time.
- The median change was -0.11 seconds, suggesting that half of the participants improved slightly, while the other half showed minimal changes.
- The standard deviation of 0.58 seconds is relatively low, indicating relatively consistent time taken changes among participants.

Quiet Eye Technique (QE):

- The 50% range of time taken changes is from -1.66 to -0.85 seconds.
- 25% of participants experienced an improvement in time taken of 1.66 seconds or more.
- 25% of participants experienced a decline in time taken of 0.85 seconds or less.
- The average change in time taken was -0.9 seconds, indicating an overall decrease in time.
- The median change was -1.26 seconds, suggesting that half of the participants improved significantly, while the other half also showed substantial improvements.
- The standard deviation of 1.67 seconds indicates moderate variability in time taken changes among participants.

Attempt 3:

Method	50% Range (sec)	25% Improvement (sec)	25% Decline (sec)	Average Change (sec)	Median Change (sec)	Standard Deviation (sec)
Conventional Method	-1.46 to -0.19	≥ 1.46	≤ -0.19	-0.22	-0.83	2.21
Quiet Eye Technique	-2.07 to -0.48	≥ 2.07	≤ 0.48	-1.54	-1.21	1.52

Conventional Method:

- The 50% range of time taken changes is from -1.46 to -0.19 seconds.
- 25% of participants experienced an improvement in time taken of 1.46 seconds or more.
- 25% of participants experienced a decline in time taken of -0.19 seconds or less.
- The average change in time taken was -0.22 seconds, indicating an overall decrease in time.
- The median change was -0.83 seconds, suggesting that half of the participants improved significantly, while the other half also showed substantial improvements.
- The standard deviation of 2.21 seconds is relatively high, indicating considerable variability in time taken changes among participants.

Quiet Eye Technique (QE):

- The 50% range of time taken changes is from -2.07 to -0.48 seconds.
- 25% of participants experienced an improvement in time taken of 2.07 seconds or more.
- 25% of participants experienced a decline in time taken of 0.48 seconds or less.
- The average change in time taken was -1.54 seconds, indicating an overall decrease in time.
- The median change was -1.21 seconds, suggesting that half of the participants improved significantly, while the other half also showed substantial improvements.
- The standard deviation of 1.52 seconds indicates moderate variability in time taken changes among participants.

In these three attempts, it's evident that the Quiet Eye Technique (QE) generally leads to smaller changes in the time taken to complete the task and lower variability compared to the Conventional Method. This suggests that participants using QE tend to exhibit more consistent and stable performance in terms of time taken.

In Attempt 2, the use of QE resulted in substantial improvements in the time taken to complete the task. This indicates that participants who applied the QE technique were able to complete the task more efficiently and with less time variation. This substantial improvement may be attributed to the specific focus and control that QE provides over visual attention, potentially leading to better performance.

In contrast, in Attempt 1 and Attempt 3, both methods (Conventional and QE) showed improvements in the time taken, but with varying degrees of variability. This suggests that participants using either method experienced some degree of performance enhancement, yet the outcomes varied among individuals. The variability could be attributed to several factors, such as individual differences, the complexity of the task, or external factors that might have influenced performance.

If we look at appendix table 3, attempt 1 for participant 9 (conventional group), we can see that they had increased their time to complete the task by 7.75s. This might be attributed to the fact that it was his first attempt under stressful conditions and that he made a mistake. Additionally, looking at his response to the pre-task questionnaire he seemed to be not so well rested and felt somewhat stressed out. Similarly, participant 13 (QE group) increased their time of completion by 2.97s, felt not so well rested and quite stressed. What is interesting to see here is that although both didn't feel they were at their best, participant 13 did manage to get rather favorable outcomes.

Looking at the same appendix table, attempt 3 for participant 8 (conventional group), they experienced an increase in TTD of 2.12s. This was surprising because their previous attempts were significantly better, and they were well rested and confident in their knot-tying skills. Although they were confident, they were moderately stressed, lacked focus and did happen to make a mistake. As for the other outlier in the conventional group, participant 4, they had an increase in TTD of 5.03s. This was attributed to the fact that he made 2 mistakes, was not well-rested, very stressed, lacked focus, was not confident in his knot-tying ability and felt great discomfort.

Overall, the data implies that QE has the potential to offer more consistent and efficient performance in specific tasks, as evidenced by smaller changes and lower variability in time taken. However, it's important to consider that the effectiveness of QE may depend on the specific nature of the task and the individual characteristics of the participants.

4.3 Error incidence

The final metric that we used to compare performance between two teaching methods was the number of mistakes made. A mistake was defined when the knot didn't tie up properly after being pulled tight, and when the instructor noticed the participant restarting the knot of their own initiative. This standard was used because a knot not tied properly would be unsafe for use.

The bowline knot is a basic knot taught to seafarers, so the assumption was that everyone would know how to tie it. However, what we were interested to find out was the effect of external stressors upon participants when they attempted the task. The following questions are what we sought the answer' for:

- Does the introduction of external stressors influence the number of mistakes made?

- What effect did mistakes have on the results in terms of heart rate change (HRC) and time taken difference (TTD)?
- Were there unexpected results?
- How did the performance of participants who made mistakes compare to one another?

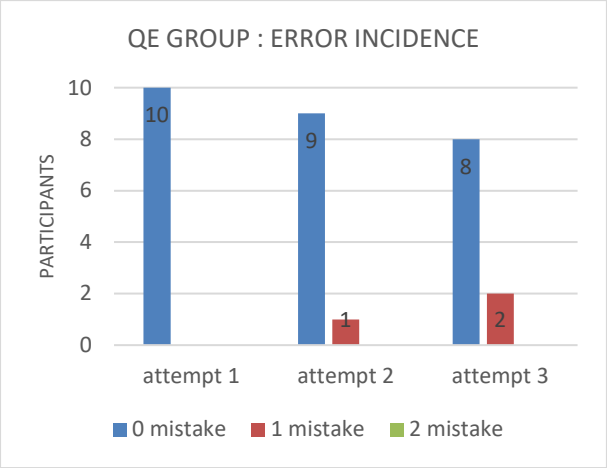

Figure 7: QE group error graph

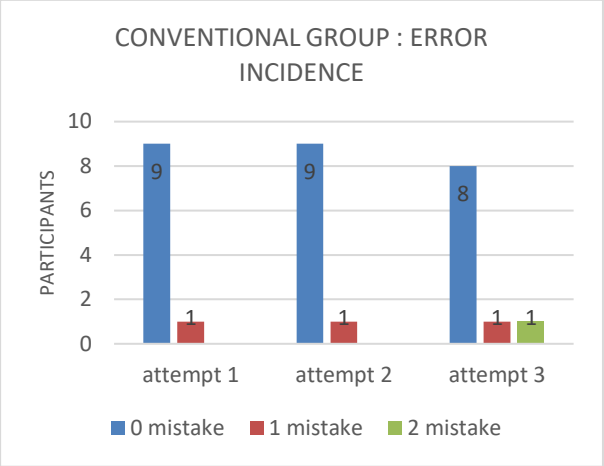

Figure 8: Conventional group error graph

Error incidence Data table

Participant	Attempt	Mistakes	Time taken difference	Heart rate change (task)
P1	2	1	0.07	2
P4	3	2	5.03	-10
P8	3	1	2.12	-7
P9	1	1	7.75	-9
P13	3	1	0.17	-19
P16	2	1	3.1	-6
P16	3	1	-0.3	-10

Looking at the distribution of mistakes made by the number of participants, it can be said that 30% of the total participants made a mistake. This would suggest that most individuals weren't affected by the external stressors present. However, looking at the values from another perspective, the total mistakes made relative to the number of participants was 40%. This is nearly half of the participants, which is a rather alarming amount. To fully understand what is happening in the data we will break down the bar charts and table one attempt at a time.

Attempt 1:

- Conventional Group: One mistake, Participant 9, with a TTD increase of 7.75s.
- HRC increased by 9bpm.
- QE Group: No mistakes observed.

Attempt 2:

- Conventional Group: One mistake by Participant 1, with a TTD increase of 0.07s.
- HRC decreased by 2bpm, indicating a positive effect.
- QE Group: One mistake by Participant 16, TTD increased by 3.1s.
- HRC increased by 6bpm.

Attempt 3:

- Conventional Group: Two mistakes by Participants 4 and 8, with TTD increases of 5.03s and 2.12s.
- Participant 4's HRC increased by 10bpm, while Participant 8's decreased by 3bpm.
- QE Group: Two mistakes by Participants 13 and 16.
- Participant 13's TTD increased by 0.17s, with an unexpected HRC spike of 19bpm.
- Participant 16 showed TTD decrease by 0.3s, with an HRC increase of 10bpm.

4.3.1 The effect of error incidence on TTD

Participants making mistakes generally demonstrated an increase in Time Taken Difference (TTD). For example, in the third attempt, Participant 4 of the Conventional Group experienced a substantial increase in TTD by 5.03s compared to their baseline attempt. This exemplifies a slower performance resulting from mistakes. Conversely, in the QE Group, despite making a mistake in the third attempt, Participant 16 showed a decrease in TTD of 0.3s, indicating a unique response to mistakes.

4.3.2 The effect of error incidence on HRC

The effects of mistakes on Heart Rate Change (HRC) were diverse and not uniformly linear. In the third attempt, Participant 13 from the QE Group exhibited a surprising spike of 19bpm in HRC despite a relatively small TTD increase of 0.17s. This unexpected result highlights the individual variability in physiological responses to errors and the complex relationship between mistakes and HRC.

4.3.3 Unexpected Results

The analysis uncovered unexpected results within the dataset. For instance, in some instances, participants demonstrated improvements in performance despite making

mistakes. Participant 16 from the QE Group, after making a mistake in the second attempt, showed a decrease in TTD by 0.3s in the following attempt. This unexpected finding emphasizes the nuanced nature of individual responses to external stressors and mistakes.

4.3.4 Variability in Performance Among Participants Making Mistakes

The performance of participants who made mistakes exhibited notable variability. TTD changes differed among individuals. For example, in the third attempt, Participant 8 of the Conventional Group had an increase in TTD by 2.12s, while Participant 16 from the QE Group experienced a decrease by 0.3s, illustrating diverse responses to mistakes. Similarly, HRC responses were inconsistent. Participant 4 of the Conventional Group had a substantial increase in HRC by 10bpm in the third attempt, whereas Participant 16 from the QE Group exhibited a consistent increase across attempts, even when not making a mistake.

4.4 Analyzing subjective response:

These pre and post task questionnaires were created to further investigate the credibility of our hypothesis. Here we compare the two groups 1 and 2, QE and conventional respectively, with the participants' own opinion. Both sections, pre and post task questionnaires were designed through the 5-point Likert scale (Likert, 1932) this gave the participants to express their feelings on a broader scale comparing to a binary scale. For each question the answers to choose from were tailor made regarding the Likert scale.

The pre-task questions were designed to uncover any hidden anomalies or factors which could have affected the results of the experiment.
The post-task questions were designed as a self-assessment of the participants and to compare the groups to the data collected. This was also a way to assess their gaze control or focus.

Pre-task questionnaire

Conventional group below:

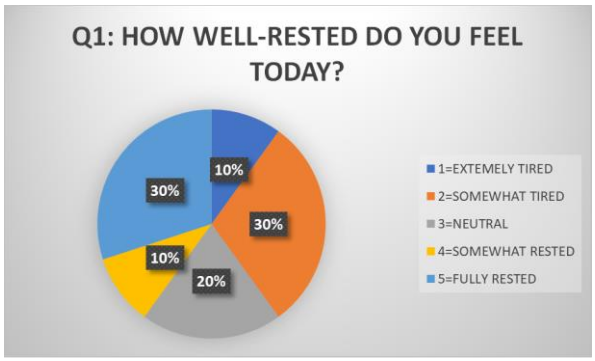

Figure 7: Question 1 answers, Conventional group

QE group below:

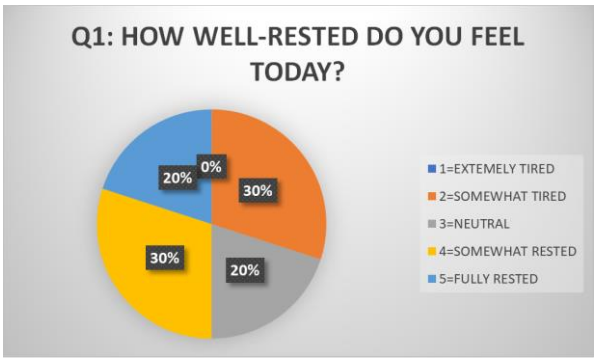

Figure 8: Question 1 answers, QE group

Starting from the 10% answers, which translates to just one person for Conventional group, here you can see some participants reported that they were already extremely tired pre-task compared to QE group participants. QE group had no such cases reported. Another major difference of the groups is the "somewhat rested" participants. In the QE group they have a 30% share of the answers while in conventional group it's only 1 participant (10%). Both groups have similar answer rates on the "neutral" section and in the "somewhat tired" answers.

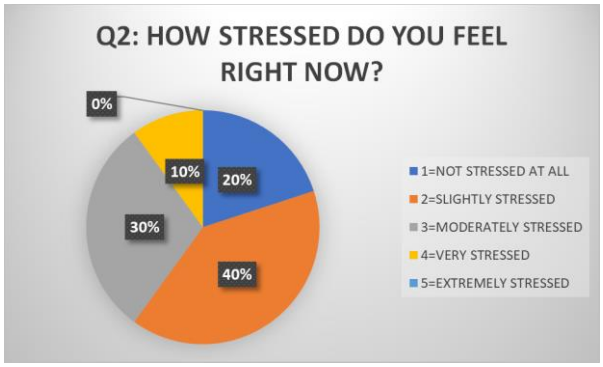

Figure 9: Question 2 answers, Conventional group

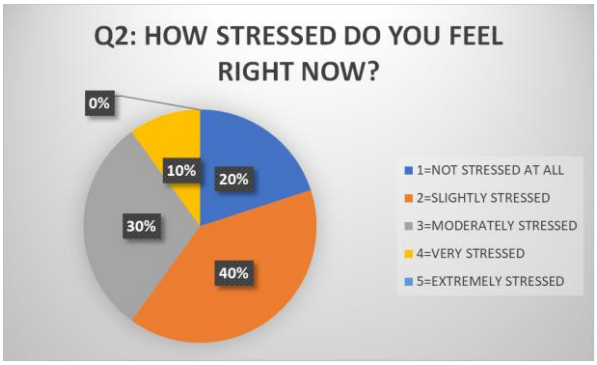

Figure 10: Question 2 answers, QE group

For question 2 both groups had similar responses. The answers were clearly different in order but the percentages as a collective show similar result. For individual answers please refer to table 3 and 4 in the appendices section. This shows all participants were at a similar level of stress going into the experiment. The majority were slightly to moderately stressed and then 10% of each group felt extremely stressed. Contrasting to this extreme the percentage of participants who were "not stressed at all" were double in percentage than the "extremely stressed" participants across both groups.

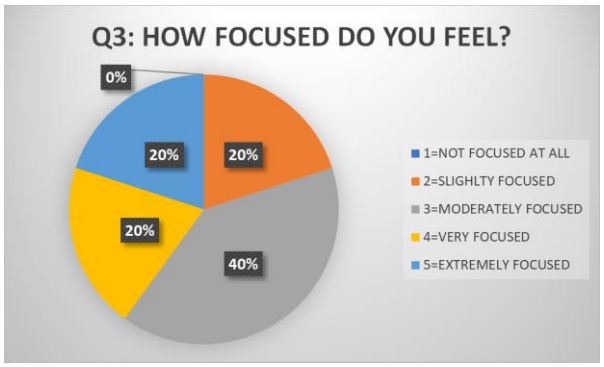

Figure 11: Question 3 answers, Conventional group

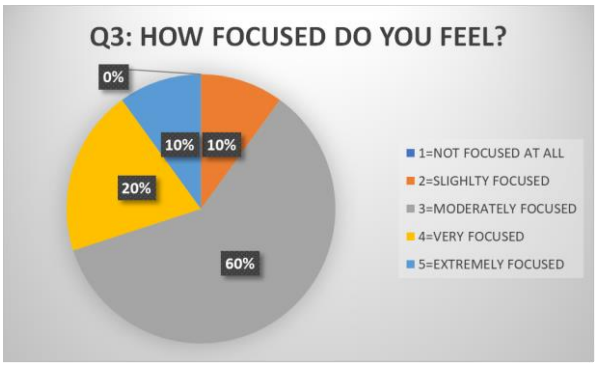

Figure 12: Question 3 answers, QE group

Focus level answers across both groups are similar in percentage with both groups having no participant saying they are “not focused on all”. Both groups went into the experiment with 20% of participants assessing themselves as “very focused” but the group 2 assessed themselves double the amount of “extremely focused” participants. This is the same when it comes to participants saying they are “slightly focused” which is a similar result in QE and conventional groups.

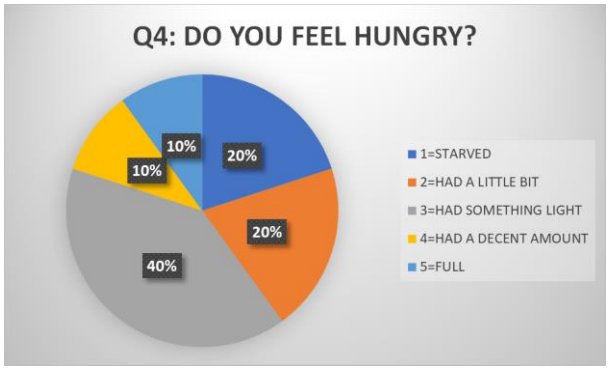

Figure 13: Question 4 answers, Conventional group

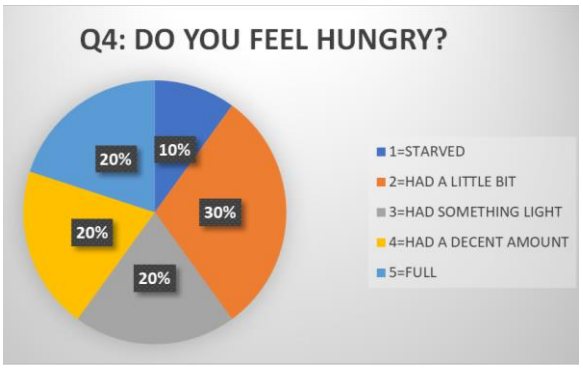

Figure 14: Question 4 answers, QE group

Comparing question 4 between the QE group and the conventional they had quite different food intake according to the answers above. In a broader scale only a few participants, which is 2 participants (20%) in conventional group and 1 participant (10%) in QE group came into the task starved out of 20. All the rest of the 17 participants had some sustenance going into the stress test.

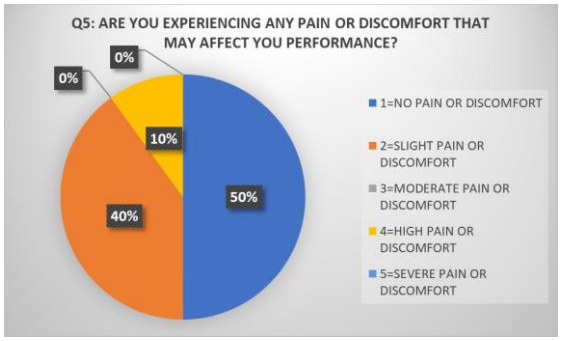

Figure 15: Question 5 answers, Conventional group

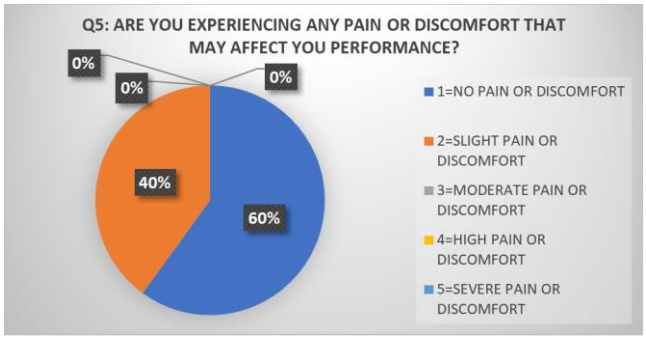

Figure 16: Question 5 answers, QE group

For this question, 1 person from conventional group was at “high discomfort” which could have directly correlated in their performance (P4 in the appendices table X). Otherwise, 40% from each group reported that they feel “slight discomfort” mostly due to the anticipation of the stress test or state of anxiety the subjects expected during the experiment. Most of the participants said to be feeling no discomfort at all going to the experiment.

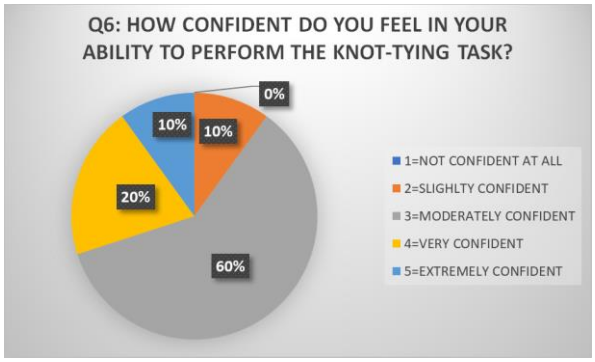

Figure 17: Question 6 answers, Conventional group

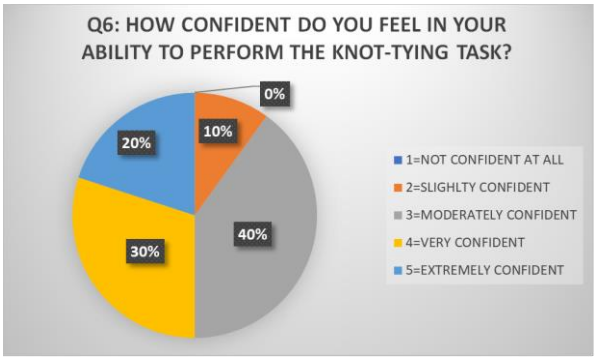

Figure 18: Question 6 answers, QE group

The results for this question can be explained since all seafarers participated here have learnt this knot prior to attending the experiment. Therefore, none answered that they are “not confident at all”. Both groups had only one person each said that they are below moderately confident performing the knot tying task. So, this is in line with the fact that all participants are experienced seafarers who have prior experience which supports the benchmark to attend this experiment mentioned in the “2. Aims and hypothesis – 2.1 participants”. Looking at the number of participants who made a mistake and the number of mistakes made in total, as mentioned in error incidence, clearly the induced external stressors were in play in contrary to the self-assessment.

Post-task questionnaire

Conventional group below:

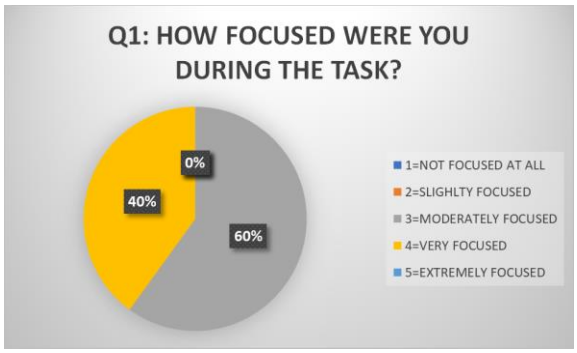

Figure 19: Question 1 answers, Conventional group

QE group below:

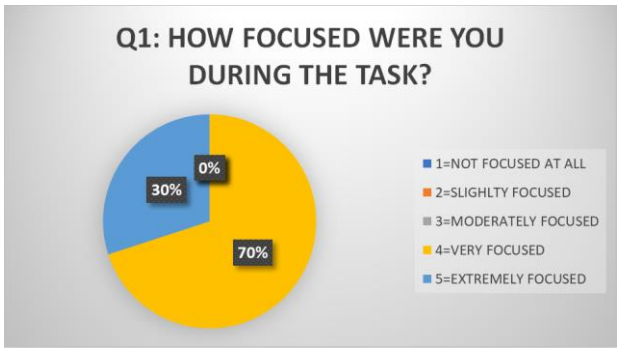

Figure 20: Question 1 answers, QE group

Question 1 post task answers were binary just like the rest of the questionnaire. But a major difference between the QE group and conventional group here on question 1 was the number of participants who assessed their focus to be “moderate” and the participants said that they were “extremely focused”. All participants in the QE group said that they were either very or extremely focused, directly supporting the hypothesis.

Unlike the previous QE experiments here in our experiment, our only measure of focus was self-assessment so there can be a placebo effect of knowing that they are using a new method of focus could result in more self-confidence. However, looking at the results from heart rate change above they do give a more stable and consistent numbers which could have resulted in more gaze control and focus which could support this self-assessment results.

Figure 21: Question 2 answers, Conventional group

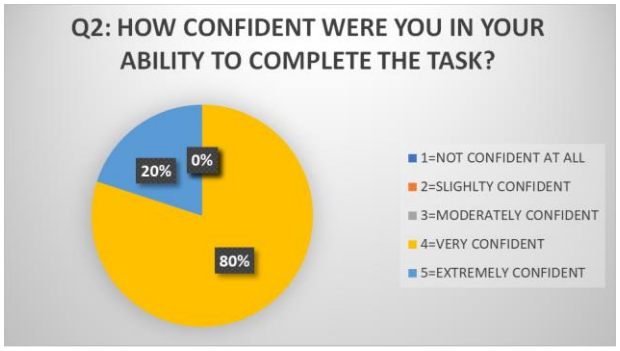

Figure 22: Question 2 answers, QE group

Moving onto the second post task question, a similar trend can be seen from the previous question. Here just like a previous question, more people on the conventional group have

assessed themselves with “moderately confident” while the QE group said to have been “very confident”.
Similar theory about placebo effect can be applied here to explain these results taken from question 1. Seen here that more participants came out of the task feeling very to extremely confident which can be an effective tool to get through a stressful situation. Also as mentioned on the performance data analysis the QE group remained very stable in the heart rate change table which might also give a sense of self confidence to perform a task comparing to the conventionally trained group.

This also can be backed up by the performance times recorded. Overall QE participants had more improvements and more consistency in time taken as shown above (Data analysis, HRC, TTD). This is consistent with the self-assessment of the participants of QE and conventional groups.

Figure 23: Question 3 answers, Conventional group

Figure 24: Question 3 answers, QE group

Similar answer trend to the first two questions continues. The conventional group answered to be more moderately calm, and 3 participants (30%) claimed to be slightly calm. QE group answered to be significantly calm with 80% claiming to be “very calm” with 2 participants being “moderately calm”.

Throughout the post task questionnaire, the QE group have said to have more focus, stayed calm, and have had more self-confidence. And this is consistent with the performance results elaborated in the data analysis section which is a steady heart rate and improvement in time taken to complete the attempts as a group. As for the conventional group, what seems a bit controversial is that although they responded to be less calm, they did in fact improve greatly in their HRC over the attempts. Looking at their TTD as well they seemed to be doing nearly as well as QE group, although answering more modestly.

Same principles of overestimated self-confidence can be applied to explain this self-assessment results because looking at the quantitative results from both groups they don’t have such a drastic change as much as mentioned above in these self-assessments.

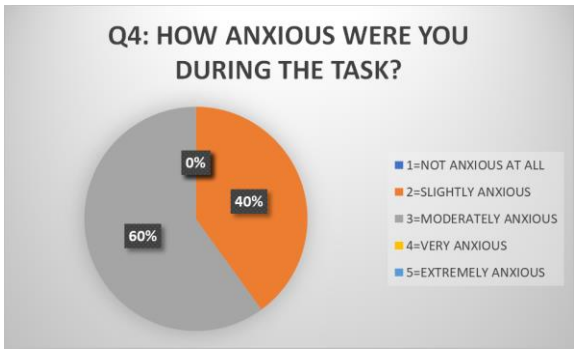

Figure 25: Question 4 answers, Conventional group

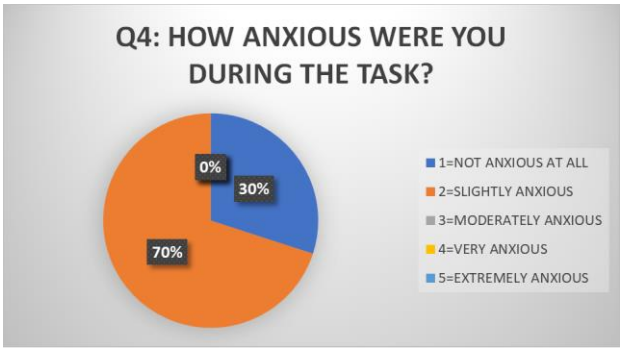

Figure 26: Question 4 answers, QE group

The trend continues with binary answers with the conventional group answering to be "moderately" and "slightly anxious". Interestingly the majority of QE group said that they felt "slightly anxious", and there were no participants who said that they are "moderately" anxious while 3 participants said they were "not anxious at all". The high number of participants who say they were slightly anxious can be explained due to the unfamiliar setting with induced stress through alarms and other pressure manipulation techniques used (refer to pressure manipulation section). Through this self-assessment questionnaire, we can prove that the pressure manipulation necessary for this experiment has been a success.

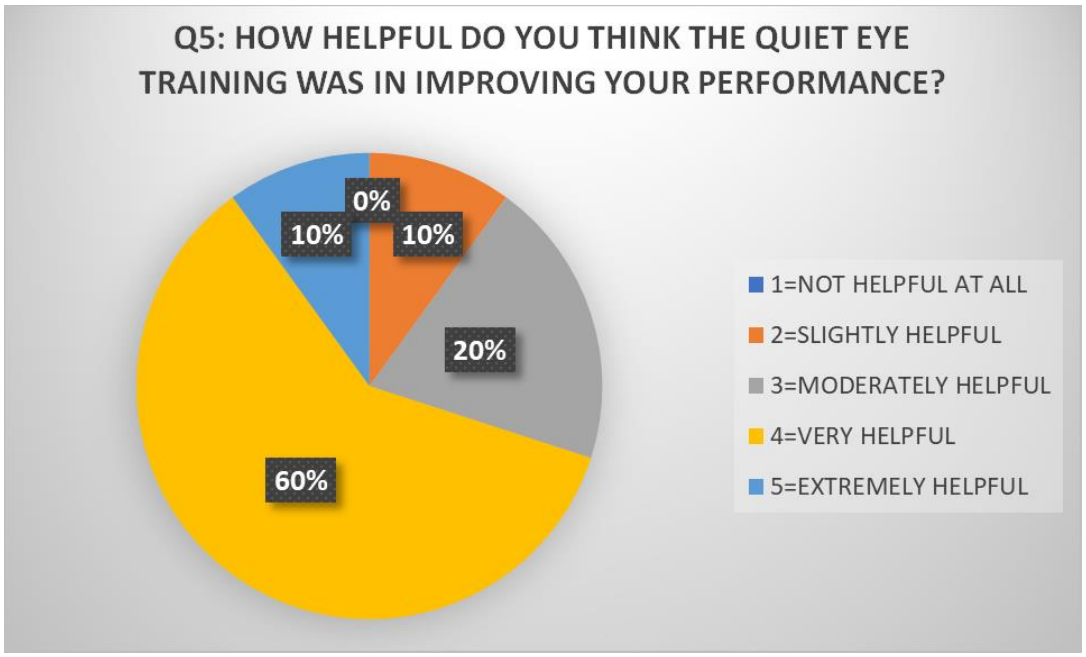

Figure 27: Question 5 answers, QE group

This last question (5) only was given to QE group participants. Post-test subjective responses indicate that participants perceived the QE training as beneficial for enhancing their performance, with 60% rating it as very helpful and another 10% as extremely helpful. This

positive subjective evaluation is consistent with the objective data, which indicates enhanced performance (time taken to complete the task) and minimal heart rate fluctuations when utilizing the QE technique.

4.5 Relation between statistical data & subjective response:

The heart rate data from the first attempt suggests the Conventional method's potentially demanding nature because of its novelty to the participants. In contrast, the QE method delineated a more temperate response, even with the same level of unfamiliarity. Across subsequent attempts, the Conventional method demonstrated pronounced adaptability or task familiarity, while the QE method maintained marginal consistency, seeing more stability in responses.

Analysing error rates, the QE method, despite its consistent heart rate response, provided a slight edge in performance accuracy, especially under stress. The consistency of the QE group in error minimization, particularly the absence of multiple mistakes, underscores its potential in ensuring accuracy under challenging conditions.

The data on the time taken to complete the knot-tying task suggests that the QE method outperforms the Conventional method across all three attempts, both in terms of average time improvement and consistency, as evidenced by the standard deviations, which implies the fluctuation of responses between participants in a group. The median times indicate that most QE technique participants showed improvement even when the average change was near zero.

4.5.1 Relationship Between Subjective Evaluation and Objective Performance

The data indicates that on average, participants who utilized the QE technique experienced a smaller variation in heart rate across all attempts and displayed better time performance, especially in the second and third attempts. This suggests that the QE technique aided in enhancing performance and potentially reducing stress, as reflected by the minimal heart rate fluctuations.

Subjectively, participants generally felt a moderate level of focus, confidence, and calmness during the task, and a majority found the QE training to be highly beneficial. This is consistent with the objective data, as a sense of calmness and focus can lead to minimal heart rate variations and enhanced performance.

4.5.2 Effect of QE Training on Subjective Experience and Performance

Post-test subjective responses indicate that participants perceived the QE training as beneficial for enhancing their performance, with 60% rating it as very helpful and another 10% as extremely helpful. This positive subjective evaluation is consistent with the objective data, which indicates enhanced performance (time taken to complete the task) and minimal heart rate fluctuations when utilizing the QE technique.

4.5.3 Difference Between Subjective and Objective Measures

There does not seem to be a significant difference between the subjective and objective measures. The participants' subjective feelings of focus, calmness, and confidence are consistent with the objective measures of performance and heart rate variations. However, it is important to note that while the objective measures indicate a clear improvement with the QE technique, the subjective responses vary slightly. For instance, even though the objective data indicates enhancement, 20% of participants found the QE training to be only moderately helpful.

4.5.4 Predictive Capacity of Subjective Responses

Before the test, the subjective responses indicated that participants were moderately focused, slightly to moderately stressed, and moderately confident about their ability to perform the task (refer to pre-task questionnaire). These initial responses may have some predictive capacity for the overall performance as the objective data indicates that participants indeed performed better with the QE technique. However, the subjective responses after the test are probably more predictive of the objective performance as they directly reflect the participants' feelings during the task. For example, the high percentage of participants who found the QE training to be very or extremely helpful is predictive of the objective improvements observed in performance and heart rate variations.
In summary, there seems to be a strong relationship between the subjective evaluations and objective performance, with both indicating that the QE technique is effective in enhancing the physical task performance of seafarers. The subjective responses before and after the test have some predictive capacity for the objective measures, but the post-test responses are probably more predictive as they directly reflect the participants' experiences during the task.

5. Conclusion

Combining insights from physiological responses, error rates, and time taken, this analysis provides a holistic view of task performance dynamics under the two methods. While both methods indicate a learning curve or task adaptability, the QE method demonstrated more consistency comparing the conventional methods variability. External factors, such as induced stress and participant fatigue, could have been the reasons for evident outliers in the results. Overall, the QE method demonstrates notable potential for tasks requiring precision and efficiency, especially under stressful conditions with short term outcomes compared to the conventional method. Yet conventional group´s performance was as consistent and efficient if it wasn't for the resulted outliers.

As for the reasons for the resulted outliers we have recognized a few limitations present. Biggest limitation would be the fact that we did not have an eye tracker comparing to the previous studies on the same subject. This would have been useful to understand the focused gaze of the participants. Another limitation we faced because of lack of eye tracking was the self-assessment of the gaze which could have been biased according to the participant.

Second limitation was the sample size and bigger sample size could have resulted in more diverse data set. The sports watch which measured the heartrate was fluctuating a lot so the accuracy of the heartbeat monitor could have been more stable.
These limitations might have resulted outliers which can be seen in the statistical analysis section.

Considering the results, we have gathered there is an improvement in self-confidence which is clearly shown in the self-assessment questionnaires. This can potentially improve performance of seafarers in their work environment. With increased self-confidence and a calm deminer they can execute tasks in stressful situations such as: working aloft, routine maintenance in awkward places, and even emergency situations with QE. According to the statistical analysis the QE group had more consistent results which also can be tied down to the fact that they were more focus due to the above-mentioned (refer to post-task questionnaire) self-confidence factor.

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7. Appendices

7.1 Appendix table 1, Conventional group

participant	attempt	heart rate resting	heart rate post task	time taken(s)	mistakes	heart rate resting baseline	heart rate post task baseline	time taken baseline	time taken difference	heart rate change (task)	heart rate change (baseline)
P1	1	92	92	17	0	80	95	15	2	0	-15
P1	2	77	75	15.07	1	80	95	15	0.07	2	-15
P1	3	71	90	13.08	0	80	95	15	-1.92	-19	-15
P2	1	80	102	14.01	0	92	102	14.35	-0.34	-22	-10
P2	2	90	98	13.01	0	92	102	14.35	-1.34	-8	-10
P2	3	81	90	14.33	0	92	102	14.35	-0.02	-9	-10
P3	1	78	89	14.09	0	78	89	15.48	-1.39	-11	-11
P3	2	73	90	14.03	0	78	89	15.48	-1.45	-17	-11
P3	3	72	80	13.19	0	78	89	15.48	-2.29	-8	-11
P4	1	67	124	23.09	0	77	81	20	3.09	-57	-4
P4	2	77	90	20.07	0	77	81	20	0.07	-13	-4
P4	3	71	81	25.03	2	77	81	20	5.03	-10	-4
P5	1	81	101	18.01	0	80	90	17.35	0.66	-20	-10
P5	2	79	93	17.13	0	80	90	17.35	-0.22	-14	-10
P5	3	92	90	16.5	0	80	90	17.35	-0.85	2	-10
P6	1	80	92	18	0	75	92	18	0	-12	-17
P6	2	76	93	18.09	0	75	92	18	0.09	-17	-17
P6	3	77	82	16.48	0	75	92	18	-1.52	-5	-17
P7	1	90	97	19.04	0	82	90	19.1	-0.06	-7	-8
P7	2	82	84	19	0	82	90	19.1	-0.1	-2	-8
P7	3	79	82	18.28	0	82	90	19.1	-0.82	-3	-8
P8	1	78	85	13.07	0	77	82	13.21	-0.14	-7	-5
P8	2	80	92	13.09	0	77	82	13.21	-0.12	-12	-5
P8	3	73	80	15.33	1	77	82	13.21	2.12	-7	-5
P9	1	81	90	27.05	1	68	80	19.3	7.75	-9	-12
P9	2	68	77	19.11	0	68	80	19.3	-0.19	-9	-12
P9	3	77	81	18.03	0	68	80	19.3	-1.27	-4	-12
P10	1	70	78	16.22	0	72	78	16.2	0.02	-8	-6
P10	2	72	70	16.25	0	72	78	16.2	0.05	2	-6
P10	3	68	70	15.5	0	72	78	16.2	-0.7	-2	-6

7.2 Appendix table 2, Quiet Eye group

participant	attempt	heart rate resting	heart rate post task	time taken(s)	mistakes	heart rate resting baseline	heart rate post task baseline	time taken baseline	time taken difference	heart rate change (task)	heart rate change (baseline)
P11	1	78	92	11.1	0	75	93	14.45	-3.35	-14	-18
P11	2	70	90	11.1	0	75	93	14.45	-3.35	-20	-18
P11	3	73	89	9.6	0	75	93	14.45	-4.85	-16	-18
P12	1	75	80	13.4	0	73	85	14.05	-0.65	-5	-12
P12	2	70	81	12.3	0	73	85	14.05	-1.75	-11	-12
P12	3	72	81	11.1	0	73	85	14.05	-2.95	-9	-12
P13	1	73	81	23	0	71	73	20.03	2.97	-8	-2
P13	2	68	80	19.3	0	71	73	20.03	-0.73	-12	-2
P13	3	66	85	20.2	1	71	73	20.03	0.17	-19	-2
P14	1	76	80	17.1	0	77	81	15.1	2	-4	-4
P14	2	76	80	16	0	77	81	15.1	0.9	-4	-4
P14	3	77	82	15.1	0	77	81	15.1	0	-5	-4
P15	1	78	89	18.1	0	80	88	18.1	0	-11	-8
P15	2	77	88	16	0	80	88	18.1	-2.1	-11	-8
P15	3	70	81	16	0	80	88	18.1	-2.1	-11	-8
P16	1	77	83	18.4	0	78	82	17.3	1.1	-6	-4
P16	2	73	79	20.4	1	78	82	17.3	3.1	-6	-4
P16	3	73	83	17	1	78	82	17.3	-0.3	-10	-4
P17	1	71	77	13.3	0	67	73	13.4	-0.1	-6	-6
P17	2	70	72	12.1	0	67	73	13.4	-1.3	-2	-6
P17	3	70	73	12.4	0	67	73	13.4	-1	-3	-6
P18	1	76	82	16	0	78	88	16.22	-0.22	-6	-10
P18	2	75	90	15	0	78	88	16.22	-1.22	-15	-10
P18	3	79	80	15	0	78	88	16.22	-1.22	-1	-10
P19	1	76	93	13.3	0	76	90	14.48	-1.18	-17	-14
P19	2	77	90	13.1	0	76	90	14.48	-1.38	-13	-14
P19	3	73	84	12.5	0	76	90	14.48	-1.98	-11	-14
P20	1	68	82	14.1	0	70	83	14.5	-0.4	-14	-13
P20	2	68	77	13.3	0	70	83	14.5	-1.2	-9	-13
P20	3	70	79	13.3	0	70	83	14.5	-1.2	-9	-13

7.3 Appendix table 3: Conventional group pre-task questionnaire

participant	well rested	Stressed?	Focused?	Eaten in last hour?	Pain affecting performance?	Confidence in knot-tying?
P1	5	1	4	3	1	4
P2	5	2	3	3	2	3
P3	2	2	3	1	1	3
P4	1	4	2	2	4	2
P5	2	2	5	3	2	5
P6	4	1	3	5	1	3
P7	3	3	4	2	2	3
P8	5	3	2	1	2	4
P9	2	3	3	4	1	3
P10	3	2	5	3	1	3

7.4 Appendix table 4: QE group pre-task questionnaire

participant	well rested	Stressed?	Focused?	Eaten in last hour?	Pain affecting performance?	Confidence in knot-tying?
P11	5	1	3	2	2	4
P12	4	4	4	5	1	5
P13	2	2	3	4	1	2
P14	2	3	2	3	1	3
P15	4	2	4	1	1	3
P16	3	2	3	2	2	4
P17	5	3	5	4	1	3
P18	2	1	3	5	2	5
P19	4	3	3	3	1	4
P20	3	2	3	2	2	3

7.5 Appendix table 5: Conventional group Post task questionnaire

participant	How focused?	Rate your performance?	Rate your calmness?	Rate your anxiousness?
P1	3	3	3	3
P2	3	3	3	3
P3	4	3	3	3
P4	3	3	2	2
P5	4	3	2	3
P6	3	4	3	2
P7	3	3	3	3
P8	4	3	2	3
P9	3	4	3	2
P10	4	3	3	2

7.6 Appendix table 6: QE group post-task questionnaire

participant	How focused?	Rate your performance?	Rate your calmness?	Rate your anxiousness?	How helpful did you find the QE method?
P11	4	4	4	2	3
P12	4	4	3	2	4
P13	5	4	4	1	4
P14	4	4	4	2	3
P15	4	5	3	2	2
P16	5	4	4	1	4
P17	4	4	4	2	5
P18	4	5	4	1	4
P19	5	4	4	2	4
P20	4	4	4	2	4