Does simulator-based learning promote overconfidence in the minds of students?

Alan Bury (Liverpool John Moores University, Department of Maritime and Mechanical Engineering)

1. Introduction

From 2015-2018 a series of interviews were conducted with senior serving officers in the Merchant Navy. A wide range of subjects were touched upon. Amongst the body of anecdotal evidence that was generated the suggestion was often made that the current generation of junior officers are 'inferior' to those that went before them. This criticism specifically took the form of senior officers believing that today's junior officers have a higher level of confidence than their ability warrants. What is more, it was also claimed that this was never a problem in the past, before the introduction of simulation-based training.

In 2019, to balance out the findings of the work with senior officers, a series of interviews of junior serving officers in the Merchant Navy were undertaken. Many junior officers were upset when informed that they were perceived as inferior to their predecessors. Ultimately, many of the participating junior officers expressed the opinion that senior officers were looking back upon their own seagoing experience through rose-tinted glasses.

If the opinion of senior officers is accurate, this is not a new phenomenon. In 1999, David Dunning and Justin Kruger found that people are poor at objectively evaluating their own competence [1]. Although this can take a number of different forms the Dunning-Kruger (DK) effect refers to one particular cognitive bias in which those who have a low ability at a task assess their own ability to be significantly higher than it actually is. Exactly the situation that senior ranked seafarers believe pervades the junior ranks.

2. Methodology

As they entered the last two months of their three year programme of Merchant Navy officer training, 124 (soon to qualify) junior officers were surveyed through a questionnaire. At the commencement of a five-week course of simulator-based training, and once again at its culmination, participants were asked a single question:

"On a scale of 1 to 5 (1 being very low, 3 being moderate, 5 being very high), rate your ability as a watchkeeping officer".

Whilst this was an effective tool to establish an individual's level of confidence (how good they think they are at something) what about their competence (how good they actually are at something)? This was established by asking a similar, single question to an industry practitioner who had been tasked with assessing the students:

"On a scale of 1 to 5 (1 being very low, 3 being moderate, 5 being very high) rate the ability of this individual as a watchkeeping officer".

A comparative study was then conducted in which the students' and assessor's 'before training' and 'after training' values were compared. The results were presented as a difference score where a 'plus' value denotes a degree of over confidence on the part of the student.

3. Results

Fig.1: The students' rating of their own ability before and after training.
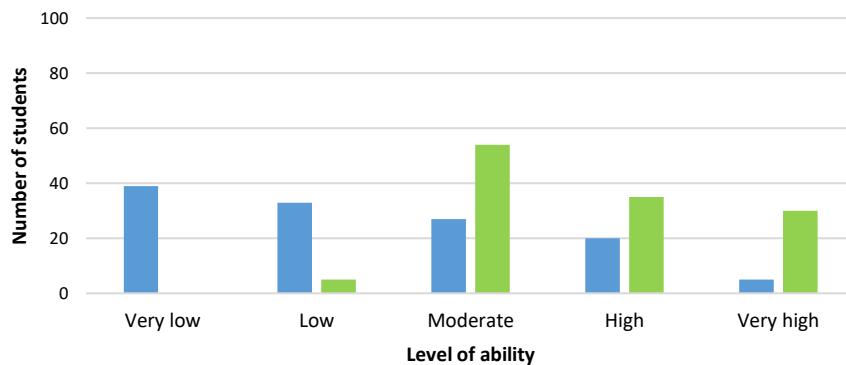
Fig.2: The assessor's ratings of student ability before and after training.
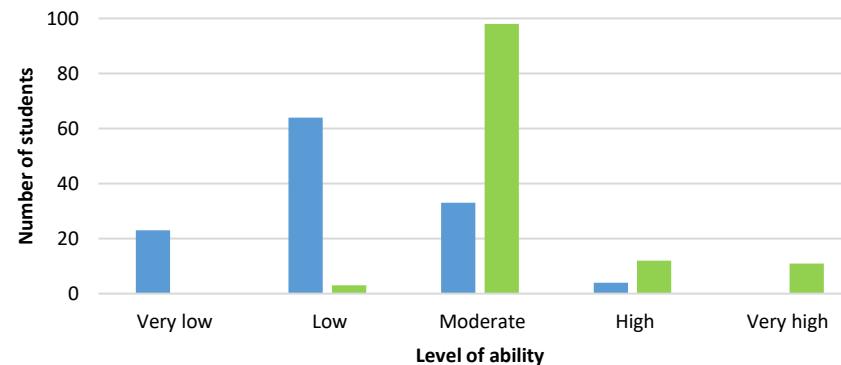
Fig.3: Difference between student and assessor before and after ratings.
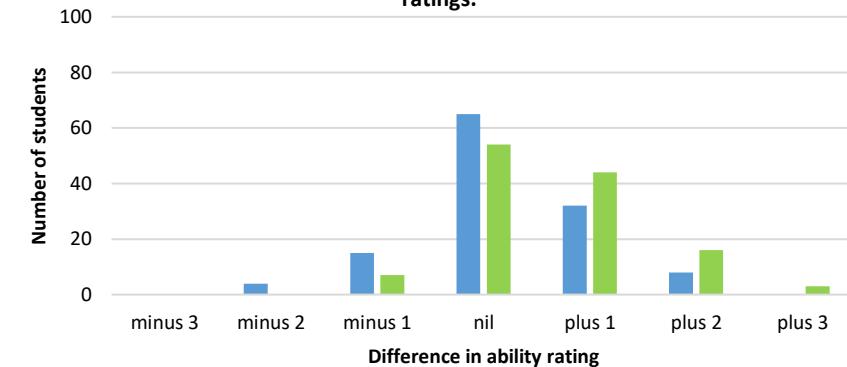
4. Discussion

The results show that students feel they have greater ability after receiving simulator training (Fig.1). This supports the findings of earlier work conducted in the field of medicine [2], [3], [4]. However, if people are inherently poor at objectively evaluating their own competence [1], are the students' ratings accurate?

There is a noticeable difference between the students' ratings of their own ability (before and after training) and the assessor's ratings (Fig.2). When compared, it can be seen that whilst both parties tend to report an improvement in ability after training the degree of improvement reported by students does always match that reported by the assessor. The assessor tended to rate the students competence (before and after training) as lower than each student did. Whereas a majority of students (65 out of 124 individuals) reported their competence as being high or very high after simulator training, the assessor rates the majority of these same students (98 out of 124 individuals) as being of only moderate competence.

Psychologists believe that training should weaken cognitive bias [5], but this is not the case here. Instead, after training, the number of students who rate themselves 'plus 1' or 'plus 2' levels higher than the assessor has increased (Fig.3). Notably, it is only after training that some students consider themselves 'plus 3' levels higher than the assessor rates them. The data collected clearly shows that simulator-based training has compounded students' over confidence rather than reducing it. In this data set, 63 junior officers have a confidence level that is higher than their competence warrants after completing a simulator-based course. That is 51% of all of those whose data was collected. With the size of the current world merchant fleet having been estimated at approximately 53,000 ships [6] as many as 27,000 of these may be out there on the ocean right now with a junior officer onboard who has an unrealistic appreciation of their competence.

5. Conclusion

Does simulator-based learning create overconfidence in the minds of students? Yes, a significant number of students mistakenly assess their competence as being greater than it actually is after having received a course of simulator-based training. The increased sense of confidence that is created in the minds of many students does not equate to a matching increase in their level of competence as identified by an industry practitioner who is serving as their assessor.

Just like the rest of the population, junior officers possess a broad spectrum of mental biases. As a result, more research is needed to evaluate the mechanics of the relationship between the level of confidence possessed by a junior officer and their actual level of competence. Developing a methodology for identifying specific individuals that are experiencing the DK effect (or any other form of cognitive bias) is a challenging task – one that is certainly beyond the ability of a simple questionnaire to directly measure. However, it is also a very difficult task for neuroscientists equipped with state-of-the-art equipment as it is poorly understood how self-bias is generated. Regardless, consideration is already being put into how best to address this shortcoming in the simulator-based training that is provided. Initial thoughts have been in the direction of introducing a 'Kobayashi Maru' style exercise into the existing course content. This would be done with a view to placing participants in to a no-win situation to ensure that their increasing confidence does not go unchecked.

In addition, ongoing training, is critical to maintaining and improving upon initial competence. Rather than focusing on exam results and initial threshold competency assessment, the maritime industry needs to support its most junior members by spending more time measuring the ongoing maintenance of their learning [7], [8]. An integral part of this should be providing them with the ability to develop, a realistic perception of their own ability.