**////Title: What Makes an Effective Grants Peer Reviewer?**

**////Stand-first**:

Peer review is a key component in the determination of funding allocation, especially within the science and technology sectors. However, the literature evaluating this process is sparse, often focusing on outcomes rather than the methodology. Dr Tiffani Conner and her colleagues from Oak Ridge Associated Universities in the USA have researched which specific skills are most desirable in a reviewer and how these can be enhanced, whilst also evaluating the impact of review format.

**////Body text:**

Peer review is the primary method of decision making for most funding bodies, especially in relation to evaluating scientific research. Many academics view this system as fair and rigorous, yet studies have shown it to be a weak predictor of future success.

This discrepancy may be due to the process relying too heavily on the influence of individual personalities. Despite the peer review system being well designed, it can only be as effective as the reviewers recruited. There have also been criticisms suggesting that review panels can be too conservative and reluctant to give opportunities to innovative research. In addition, there have been claims of cronyism, subjectivity, and failure to identify misconduct.

Given these criticisms about peer review, it is surprising that something so widely used remains largely understudied. The research that has been conducted within this area often focuses on funding outcomes and their overall impact in relation to advancing science.

Dr Tiffani Conner and her colleagues from Oak Ridge Associated Universities in the USA noted a particular lack of research around the identification and development of the skills required to be an effective peer reviewer.

This led Dr Conner and colleagues to undertake a piece of multidisciplinary research with three main objectives. The first was to establish which skills are most important for peer review panellists. The second was to investigate which activities can help to develop or improve panel review skills. The final objective was to understand the impact of the peer review format when conducted either face-to-face or virtually.

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Dr Conner and colleagues used two different methodologies. The first was to undertake telephone interviews with seven peer review program officers, all of whom worked for federal agencies in the USA. A further five interviews were conducted with PhD level candidates in science and technology. The themes uncovered in these interviews were used to develop an online survey which was administered as part of the second stage of their research.

The research team also undertook a literature review of the existing research within this area. They discovered that there was a very limited amount of robust literature relating to peer review skills. The most referenced skill identified within this review, was subject matter expertise and having a proven track record of excellence within a specific field. This was measured by the individuals’ publications, awards, and funding grants, as well as the positions they held.

Several professional skills were also identified as being important for the role. These included communication, time management critical thinking, problem solving, objectivity and open-mindedness.

As the literature around peer review skills is so scarce, Dr Conner and her colleagues acknowledged that their findings were difficult to interpret in a wider context. Nonetheless, their interviews did identify that there was a connection between the skills needed as an effective peer reviewer and the professional skills that were required to be a successful scientist. An example of this is the technological skills that are vital to function as a modern scientist but also needed when participating in virtual peer reviews. The research also revealed that neither peer review nor professional skills are typically taught during training.

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Dr Conner and colleagues noted that the pre-existing literature is even more sparse in relation to the training of peer reviewers. Much of the literature focuses on the practices and programs of specific organisations, whose existing training covers aspects such as the history of the research program and review criteria. There is a strong emphasis on informing reviewers about the scoring systems that are used to formulate funding decisions. But little evidence was found of reviewers receiving relevant training in relation to the professional skills identified as desirable for this role.

Two main learning scenarios emerged as being influential in peer review training. The first is witnessing the skills of other reviewers who are more seasoned in the role. The second is having personal experience of undertaking reviews. They also found that being responsible for chairing a discussion was rated by participants as having the strongest impact upon their learning.

Other notable learning activities included listening to other panellists make arguments and having experience of attending and participating in multiple discussions. Interestingly, training programs were considered one of the least effective learning methods. However, the researchers rationalised that this may be because training has only been experienced by a small number of reviewers. Dr Conner and colleagues concluded that further training should be provided for graduate level students, particularly in relation to professional skills.

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Peer review panels can be run in a variety of formats with face-to-face panels being seen as the gold standard. The alternative format is to hold a virtual panel that takes place via webinar or telephone conferencing. This is often employed when panellists cannot be in the same place for logistical or cost efficiency reasons.

There is some evidence to suggest that holding a face-to-face panel leads to better time efficiency and increased participation rates. Previous research has shown that when panels are conducted via teleconference, the reviewers are slightly less engaged than when using more traditional methods. However, holding virtual reviews means that a larger panel can be assembled, providing a greater breadth of knowledge and broader decision making. Also, there is evidence to suggest that offering a greater variety of formats increases the opportunity for more high-level reviewers to become involved, conversely, it allows more junior scientists with budgeting restrictions to take part. Whilst there are some practical advantages of virtual panels, the literature does suggest that there can be a negative impact on engagement, leading to less proactive debates and a lost sense of confidentiality.

Dr Conner’s research further revealed that reviewers find virtual panels more difficult to participate in. Face-to-face panels were also considered to be more helpful in learning the skills required to become an effective reviewer. The results also highlighted that the role of the panel chair became more important when being held virtually, due to a stronger need to keep panellists on task. Dr Conner and colleagues have now begun to evaluate this topic and believe that there should be a greater research focus on peer review, to ensure that a fair and sustainable process is being conducted, which will serve to benefit scientific advancement.

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