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"REASONABLE" YET UNKNOWN: TO WHAT EXTENT PSYCHOLOGY STUDENTS AGREE WITH OPEN SCIENCE NORMS?

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ABSTRACT:

Open science is emerging as a key paradigm for improving the credibility of scientific knowledge. The sustainability of open science, in turn, depends on the attitudes and practices of future researchers. This research aims to examine the awareness and understanding of psychology students about open science practices. The results show that the majority of students are not familiar with the concept of open science and preregistration, and those who are familiar with it most often equate it with open access to publications. Nevertheless, students express relative support for research scenarios that operationalize norms such as critical thinking, transparency and avoidance of questionable research practices, however they have relative reservations towards newer practices such as preregistration, registered reports, preprints and open data. The findings indicate the need for systematic introduction of open science concepts into teaching, through gradual and pedagogically designed integration, in order to develop transparent, responsible and replicable research practices among future psychologists.

Keywords: *open science, replication crisis, repository, preregistration, psychology students*

Introduction

In the past few decades, the global scientific and professional community in psychology has raised the issue of transparency and replicability of psychological research findings. The term '*replication crisis*' describes the widespread difficulty and failure to reproduce the results of published studies in large-scale replication attempts (Pashler and Wagenmakers, 2012). This phenomenon is also called the 'reproducibility crisis', and in a more positive context, the 'credibility revolution' (Munafo et al., 2017; Vazire, 2018)

The attempts to replicate the findings of 100 experiments published in highly ranked psychology journals, according to the Open Science Collaboration report (2015), resulted in the replication of

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less than half of the original findings. Several collaborative initiatives have reached the same or similar conclusions (Nosek et al., 2022). Some authors also pointed out undesirable practices, such as HARKing (hypothesizing after the results are known; Kerr, 1998) and p-hacking (manipulating data to achieve statistically significant results; Nelson et al., 2018; Simmons et al., 2011) that further raise concerns about the integrity of scientific research, undermining the validity of research findings and slowing scientific progress.

In response to this, the *Open Science* paradigm is increasingly being promoted worldwide. In a broader sense, open science is a movement that aims to promote and implement free and open access to scientific knowledge, data and results of scientific research, primarily those financed by public funds. In the 21. Century, one of the most frequently used and influential concepts in science is open science. It represents a new research culture based on the principles of transparency, accessibility and collaboration, in order to overcome the traditional model of closed and elitist knowledge production. Open science is defined as a group of practices aimed at strengthening scientific work by "opening" it to all stakeholders, with researchers sharing publications, data, protocols and analytical procedures (Mellor & Pajic, 2023). This concept encompasses various activities aimed at increasing the efficiency, transparency and reusability of scientific results (Smederevac et al., 2020), and is not a single practice, but a systemic orientation towards more inclusive, cumulative and trustworthy knowledge creation (Pennington, 2023). Its aim is to overcome the traditional model of closed and elitist knowledge production. In this sense, open science not only changes research practices, but also introduces a broader epistemological[1] and institutional transformation of the scientific system.

Open science is an umbrella term for a number of practices, however they can be implemented in the research process in different ways. In an attempt to provide a concise and pedagogically intelligible presentation of the most popular practices of open science, as well as the questionable research practices that need to be addressed through the application of open science, a table adapted from Pennington's (2023) table is provided below.

Table 1. Open science descriptions

Concept/Practices	**Description**
Open science	Knowledge that is openly accessible, transparent, rigorous, can be reproduced and replicated; includes open access, preprinted materials, preregistration, registered reports and open materials, codes and data.
Open science practices	
Preprinting	A scientific paper electronically shared in a repository before formal publication.
Preregistration	Registration of the methodological design of the study, the hypotheses and the analysis plan before collecting data in a public repository.
Registered report	A publishing format with peer review of the methodological design prior to data collection and the manuscript after results.
Open materials	Making materials (questionnaires, stimulus and experimental draft scripts) publicly available to facilitate reproducibility of the findings.

[1] Epistemological transformation refers to changes in how scientific knowledge is created and valued, including changes in the criteria for scientific validity and quality.

Open code	Making codes for analysis/programming publicly available to ensure transparency and reproducibility of findings.
Open data	Making data publicly available, respecting ethical standards such as anonymity.
Questionable scientific practices addressed through open science practices	
HARKing	Hypothesizing after the results are known.
p-hacking	Data manipulation to achieve statistically significant results.

Note. Adapted from *A Student's Guide to Open Science: Using the Replication Crisis to Reform Psychology* (p. 57), by C. R. Pennington, 2023, McGraw-Hill Education.

In the attempt to 'list' the open science concepts it should be mentioned that open science practices should not be treated as an 'all or nothing' request. Quite the contrary, they can be adopted gradually, allowing researchers to selectively apply practices relevant for their work (Kathawalla et al., 2021). This flexible perspective is compared to the model of a 'buffet', where individuals can gradually build competence with practices over time (Bergmann, 2018).

The development of open science practices raises questions about operational practice, i.e. what are the attitudes of researchers towards open science and to what extent open science practices are being applied. One of the more recent, large-scale studies is an international study by Pennington et al. (2024) with a sample of over 3,000 researchers from 45 countries, which points to a discrepancy between declarative support for open science practices (e.g., open access, preprints, open data) and their adoption, indicating a relatively low application of practices such as preregistration, registered reports and replication with significant variations across disciplines, regions and among researchers at different career stages.

The focus of research to date has been more on the attitudes and practices of established researchers, and less on the awareness, attitudes and practices of students, although the sustainability of open science certainly depends on how well future researchers are acquainted with the ethos and principles of open science. Investigating the awareness of open science concepts among undergraduate students, some research (e.g., Clark et al., 2025) focuses on examining their subjective assessments on whether these concepts were covered in their formal education as an indicator of how much students "remember" or have adopted the concepts. The results indicate, among other things, that greater awareness of open science practices is associated with greater self-confidence in their statistical competences and with less support for questionable research practices. Krishna and Peter's (2018) study, on the other hand, found that attitudes toward questionable research practices were predictors of self-reported use of questionable research practices among students who were writing their bachelor's or master's thesis at the time or had such experience in the past two years. Not surprisingly, the students' perceptions of their mentors' attitudes also predicted their attitudes toward and use of questionable research practices.

It should be noted that most research examining students' awareness of open research practices and the extent to which questionable research practices are perceived as 'reasonable' or are implemented, comes from countries where open science is more or less integrated into the curricula of various higher education institutions, such as the United Kingdom (Clark et al., 2025) or Germany (Krishna & Peter, 2018).

On the other hand, there are also studies that do not necessarily assume that students are informed about the concepts of open science as part of their formal education and that examine students' 'naïve' beliefs about how open science practices seem 'reasonable' to them, as opposed

to practices that contradict them. When asked how a researcher should conduct research, first-year psychology students, who had no formal education in open science, in the study by Beaudry et al. (2024), on average, agreed more with scenarios that describe open science norms, compared to practices that contradict them. Greater support was noted for scenarios that operationalize norms of transparency, replicability, and avoidance of questionable research practices, with greater reservations about preprints and open data. The optimism that first-year psychology students 'naively' recognize the value of open science should, however, be contextualized by the fact that they come from countries (Australia, the United Kingdom, and New Zealand) where, according to researchers, the discourse on open science is 'ubiquitous', and literacy about research methodology is developed before 'entering' higher education.

Raising the awareness of future researchers about open science practices should not be considered only from the perspective of the sustainability of science. The adoption of open science practices is not only good for science but has pedagogical value as well. Overviewing available literature, Pownall et al. (2022) indicate that training in open science principles in higher education impacts the students' scientific literacy, increases their motivation to collaborate and engage in the scientific process, and shapes critical attitudes towards science. In the context of scientific literacy, the research by Parsons et al. (2022) shows that learning about the practice of preregistration helps students better understand statistical interpretation, while Blincoe and Buchert (2020) indicate that the same practice contributes to better recognition of questionable research practices. Similarly, Frank and Saxe (2012), who encourage students to replicate renowned research within a regular course on experimental research methodology, suggest that the frustration that arises from attempting to reconstruct "incompletely documented" methodologies can be a strong motivation to increase transparency and improve methodological documentation in one's own research. Additionally, participation in teams practicing open science allows students to develop transferable skills, such as collaborative coding and shared knowledge production (Button et al., 2020), as well as to improve scientific communication, given that open science emphasizes the principle of transparency and democratization of knowledge (Baran & AlZoubi, 2020; Kathawalla et al., 2021).

Development of open science culture in North Macedonia

Open science as a concept is recognized to a certain extent in relevant strategic documents in the country (for a comprehensive overview see Dimitrovska, 2025). For example, the concept is recognized in the strategic goals of the National Programme for Scientific and Research Activity (2024), and the University of Ss. Cyril and Methodius has developed and adopted a document on Open Science Policy (2022). On the other hand, the institutional infrastructure for the application of open science is still in a developmental phase (Cekic, 2025) and mainly focuses on the development of digital repositories and open access to domestic scientific publications. Although initiatives began in the early 2000s, their development has been slower compared to other countries in the region, while more significant institutional support has been provided only after 2020, with the adoption of regional open access policies. Pendse (2021), based on data from OpenDOAR[2], states that there are five digital repositories, most of which are linked to academic institutions, including university repositories such as the one at the University of Ss. Cyril and Methodius in Skopje (repository.ukim.mk), as well as the National Digital Library (DLIB.mk). In terms of scientific journals, the number of open access journals is limited (around 14 indexed in DOAJ), indicating that the open science infrastructure is still being consolidated. Within

[2] OpenDOAR is a global, curated directory of open academic repositories, managed by the Nottingham University, which provides verified information about repositories which enable free access to science papers, theses and data.

social sciences and humanities, including at the Faculty of Philosophy in Skopje, there are individual open access journals, but their international visibility and indexing vary. This indicates that, despite existing initiatives, further efforts are needed for standardization, increasing visibility and alignment with international principles such as FAIR (Findable, Accessible, Interoperable, Reusable; Wilkinson et al., 2016).

The awareness of the scientific and academic community, according to the survey by Bliznakovski and Naumovska (2025), indicates that social science researchers recognize the value of open access, but practice it to a lesser extent in their research, mainly citing obstacles related to infrastructure and insufficient willingness to 'open', for example, datasets, or due to concerns about misuse.

On the other hand, attempts to develop an open science culture from the perspective of future researchers are still in their infancy. This motivated the implementation of the project *RISE-Open: Repository of Instruments and Support for Engagement in Open Science*, funded by UKIM (NIP. UKIM.24-25.16), which aimed to expand the range of opportunities, knowledge, and skills among psychology students and young researchers for gradual transition to Open Science practices. Workshops were held for preregistration of studies on the Open Science Framework platform, and in order to promote the principle of open access, the first Repository of Psychological Instruments in Macedonian language[3], was developed as part of the project and presented through webinars and workshops. Through collaborative processes with the teaching staff and the mobilization of alumni from the Institute of Psychology, the foundations were laid for a sustainable academic network that promotes transparent, accountable, and replicable research.

These efforts were preceded by mapping the awareness and understanding of psychology students about open science practices, and this paper summarizes the survey results. The study is exploratory and examines the awareness about open science from the perspective of how much the descriptions of open science practices seem 'reasonable' to students as opposed to practices that contradict them. Given that the concept of open science is not yet widely accepted in the national academic discourse, we considered this approach of measuring 'their' beliefs justified.

Methodology

Sample

The survey included 238 undergraduate students (93% female) from all four years enrolled in the first cycle of psychology studies at the Faculty of Philosophy in Skopje. Of these, 27.7% are first-year, 26.9% are second-year, 19.7% are third-year, and 25.6% are fourth-year students.

Process

All potential participants were contacted directly before the start of regular classes, and a QR code was shared with them that led to the questionnaire on the Google Forms platform. It took about ten minutes to respond to the questionnaire.

[3] The repository is a publicly accessible base of psychological instruments developed by their authors under open license. It includes instruments that were originally developed in Macedonian or were translated and adapted into Macedonian. It was developed according to the FAIR principles of the Open Science Framework platform.

Instrument

The instrument used was originally developed by Beaudry et al. (2024) to measure beliefs about open science practices among prospective psychology students. It consists of ten statements that describe the so-called norms for open science practices, such as: critical thinking, preregistration, registered reports, avoiding p-hacking, avoiding HARKing, providing information for replication, preprints, open materials, open data, and open access. According to the authors, these practices were chosen as illustrative of the current understanding of open science from the perspective of psychological science. Additionally, naming the practices as normative refers to prescription. At the same time, the instrument also contains ten statements that describe the so-called counternorms, i.e., practices that are contrary to each of the described open science practices. Calling them counternorms can be a bit confusing, given that some counter-normative practices are still "operational practice" in psychological science.

In the original questionnaire, the norms and counternorms are "operationalized" as descriptions of the behaviours of a fictional researcher, who was named Jana in the Macedonian version of the questionnaire. For example, the statement for avoiding p-hacking reads: "Jana should publish the findings of all the analyses she has done," while the counternorm reads: "Jana should do several different analyses and publish only the interesting findings."

For each norm or counternorm statement, respondents were asked to express their level of agreement using a 5-point Likert-type scale, where 1 = "strongly disagree" and 5 = "strongly agree." The instrument does not envisage the calculation of a total score that would indicate the support for the norms for open science practices or counter-normative practices, given that the score for each statement is considered a measure of the 'attitude' towards the specific norm or counternorm. The instrument was translated using a simple, one-way translation method.

Additionally, the questionnaire included two questions on awareness: whether students have previously heard of open science and preregistration. For each affirmative answer, an additional open-ended question was posed, asking participants to briefly describe these concepts. The practice of preregistration was included in order to determine the level of awareness about it, as the survey preceded workshops on open science and preregistration.

Statistical analysis

Since the instrument does not envisage total scores that would indicate the support for open science practice norms or counternorms, descriptive indicators at sample level were calculated for each norm and counternorm item. To determine the relative 'attachment' of students to each norm compared to the corresponding counternorm, the differences between respective arithmetic means for the scale of each norm and the corresponding counternorm were tested using the *t*-test. This essentially replicated the analytical design of the study that informed the development of the instrument. This resulted in the application of ten tests, which can be considered a risk of Type I error. However, as in the original study, no correction for multiple tests was applied, which poses certain limitations on the obtained results.

The statistical analysis was performed using SPSS.

Results

Table 2 presents descriptive indicators and statistics for testing score differences for norms and counternorms. The highest average score is for the critical thinking norm, and the lowest for the preprint norm. At the same time, the highest average score is for the counternorm for registered reports, and the lowest for *p*-hacking.

Out of the ten *t*-tests, eight indicate statistically significant differences, five of which are in 'favour' of the norms for open science practices. The results indicate that students generally support traditional scientific norms, such as critical thinking, predefined hypotheses, and the sharing and transparency of methodology that enable replication. For example, they clearly prefer to critically evaluate research, even when it is published, rather than blindly trusting it. At the same time, they strongly support transparency in analyses and oppose the selective publication of results (so-called *p-hacking*) and hypothesizing after the results are known (*HARKing*).

On the other hand, the results show lack of familiarity with or skepticism towards recent open science practices, such as preregistration, registered reports, preprints, open data, and open materials. Students either do not show clear support for the norm (as with preregistration and open materials) or show greater support for the counter-normative position (as with registered reports, preprints, and open data).

Table 2. *Descriptive indicators and comparison of norm and counternorm scores*

	Norm		**Counternorm**			
	M	*SD*	*M*	*SD*	*t*	*p*
Critical thinking	4.40	.856	2.18	1.137	21.347	< .001
Preregistration	3.64	1.195	3.62	1.435	.167	.868
Registered report	2.76	1.268	3.68	1.181	-7.714	< .001
p-hacking	3.77	1.222	2.08	1.161	14.048	< .001
HARKing	3.80	1.109	2.22	1.414	13.334	< .001
Information for replication	3.90	1.203	2.42	1.285	11.916	< .001
Preprints	2.55	1.208	3.68	1.285	-7.939	< .001
Open materials	3.23	1.374	3.12	1.335	.687	.493
Open data	2.96	1.368	3.55	1.326	-3.879	< .001
Open access	3.75	1.034	2.86	1.214	7.622	< .001

In the questions about general awareness, as many as 87.8% responded that they had never heard of open science. Of the 12.2% who were familiar with the concept, when asked what they understood by 'open science', most answered that it meant free access to scientific research, i.e., reports and publications ("Science available to the wider public, not locked behind a paywall"). Some of the participants mentioned free access to databases ("[…] a database that is free for all users, without the need to pay a fee for access or without the need for membership in an organization."). Only one participant emphasized that open science also encompasses the transparency of the research process for reproducing research ("Better access to knowledge, possibility for critical analysis of the research and participation in data collection, which is especially important in psychology, where reproducibility[4] of results is a great challenge. It implies transparency, accessibility, and collaboration

[4] This is an excerpt from the original respondent's response. It probably refers to the possibility for reproduction of results

in all phases of the scientific process.”). This suggests that very few students are familiar with the concept of open science, and those who are equate it with free access to publications and research reports, and to a lesser extent with open access to research datasets, which aligns with the local infrastructure. Not a single student mentioned open science practices related to preregistration and registration that would allow avoiding the phenomena of *p*-hacking and HARK-ing.

When asked whether they have heard of the practice of ‘preregistration’ of studies in psychology, as many as 91.2% responded that they were not familiar with the concept. On the other hand, of those 8.8% who answered affirmatively, most gave an answer in the sense of understanding the practice: “It is basically prepublishing a scientific research design and posing hypotheses before the research”; in other words, “The hypothesis and the research plan should be preregistered in order not to manipulate or change the hypothesis after obtaining the results.”

Discussion

Although the majority of psychology students are not familiar with the concept of open science, it can be said with some reservation, that they show preference for open science norms over counter-normative practices. Namely, students are, on average, more inclined to critically review published research than to uncritically rely on the authority of scientific journals. The students’ opinions indicate a relatively greater preference for the norms of pre-established hypotheses for confirmatory research, as well as transparency of methodology and analytical procedures, compared to counter-normative positions that would result in retroactive hypothesizing (HARKing), methodological non-transparency that would result in the inability to replicate, and selective reporting only of significant results (*p*-hacking). In addition, the students express a positive attitude towards publishing in open-access journals compared to journals that require readers to pay for access to scientific papers.

These results are consistent with the study by Beaudry et al. (2024) and are encouraging, in the sense that students assess the normative positions of open science for transparency and the democratization of scientific knowledge as ‘more reasonable’ than counter-normative positions. In this sense, future open science curricula should build upon on what students already consider to be (more) correct.

Students, however, show an ambivalent stance towards the norms of preregistration and open materials. In the context of the practice of preregistration, it is somewhat worrying that the counter-normative practice that was described alluded to both the potential risk of HARKing and the risk of p-hacking (“*Jana should decide which analyses are most appropriate for testing her hypotheses only after she has initially reviewed her data*.”). On the other hand, the preregistration norm is a practice that, according to their answers to the question about pre-registration awareness, the majority of students have not heard of; therefore, a certain reservation about this practice can be inferred. The ambivalent position towards open materials can be partly explained by the fact that the counternorm emphasized the need for ‘protection’ of research materials and measurement instruments (“Jana should protect her research materials and measurement instruments, so that they are available only to her and her research team.”). Considering that many psychological instruments, which are used in clinical contexts, explicitly prohibit dissemination which could result in their utilization by non-professionals, it is clear why this claim is attractive to students.

At sample level the students showed relatively greater agreement with the counter-norms for registered reports, preprints, and open data. The practice of registered reports, which involves submitting a study design for peer review in a journal before data collection, can be assumed to be relatively unknown to students, who are probably familiar with the counter-normative position as an

operational practice, i.e., submitting a report for peer review of a conducted study for publication. The same can probably be implied for the practice of preprints, which involves publishing a digital version of the report before it is accepted or published in a journal. Hence, the counternorm that can be said to be an operational practice seems 'more correct' ("Jana should not publish the draft research report online, before it has been officially peer reviewed and accepted for publication in a scientific journal."). In the context of greater acceptance of the counternorm for open data as compared to the norm, it can be assumed that by accepting the counter-normative position, students express caution and concern for data protection ("The research database should be strictly protected, with access limited only to Jana and her research team."). Considering these findings, future open science curricula should address existing dilemmas about methodological rigor and ethics by clearly elaborating how open science practices not only do not conflict with them but also enhance credibility, among other things.

Overall, the results indicate that students are inclined towards open science practices that explicitly emphasize epistemological rigor in the traditional sense, such as critical thinking, transparency of methods, and analytical practices, which is an encouraging finding. On the other hand, the results on beliefs and awareness also indicate they need to become familiar with open science concepts such as preregistration, registered reports, preprints, and openness of research materials and data, which does not compromise their ethical integrity when using them.

Unfortunately, this survey did not compare the attitudes and level of awareness of students from different study years or between students who took and students who did not take courses on research methodology. Therefore, future studies should provide a more differentiated insight into the understanding of open science among students who are already formally familiar with the basic concepts of research methodology in psychology.

The instrument for measuring students' perceptions operationalizes some open science practices through relatively simple statements that describe specific behaviours of a fictional researcher. Each open science practice is operationalized through a single item that reduces the measurement of concepts on a scale for one statement, i.e., to the linguistic idiosyncrasy of that statement. The instrument, as developed, does not envisage a total score for normative open science practices (or for counter-normative practices), so no attempt was made to determine its internal structure or internal consistency. As in the original study from which this instrument was taken, no attempts were made to find appropriate measures for psychometric characteristics. In that sense, it might be more justified to consider this attempt as initial mapping, and not a measurement of attitudes, the validity and reliability of which, among other things, is clearly indicated. Additionally, the translation and adaptation of the instrument relied solely on one-way translation, and no cognitive testing or piloting was conducted, which can be considered a limitation.

Considering that the study was conducted on a convenience sample, the ambition to generalize the findings is certainly unjustified.

Despite its limitations, the finding that most students in the sample had not heard of open science is a clear indication that efforts to introduce open science practices should be intensified. Enthusiasm should certainly be structured through deliberation on pedagogical challenges. In their overview of published experiences, Verheyen and Heyman (2025) identify several challenges and possible solutions for integrating open science into undergraduate psychology studies. Namely, to avoid 'overwhelming' students with all open science practices at once, the authors suggest a gradual introduction through structured activities. For example, students can familiarize themselves with pre-existing preregistration forms or 'practice' replicating selected studies. The discourse of open science can be too 'technical' for students; therefore, it is recommended that instructors

carefully select sources that include a pedagogical approach. It is also desirable to integrate concepts across different courses, so that the introductory material is not necessarily tied solely to statistics courses, which can cause anxiety in some students (the so-called statistics anxiety). This will further distribute the 'burden' of integrating open science among different instructors, and it is additionally recommended that all instructors who would be mentors of bachelor theses to guide students to implement open science practices in the process, not as optional but as necessary to avoid so-called questionable research practices. Some practices may be perceived as 'laborious' by students; for example, preregistration may be seen as 'extra' work, but it can be explained that documenting the methodology in advance can save time when writing the report. Open science may not be 'exciting' for students; for example, replication is 'repeating', but students may be motivated to join international teams that replicate influential studies, and, based on their contributions, such participation may result in authorship. Students may refrain from practices that assume public sharing in the name of transparency, fearing they might make a mistake. Therefore, it is very important for instructors to promote 'epistemological humility' (Verheyen & Heyman, 2025) and discuss together with the students the mistakes of experienced scientists (e.g., errata, corrigenda, and other corrections) as well as to refer them to sources such as the *Journal of Trial & Error*, which publishes research that contextualizes 'failed' results and methodological errors. Perhaps most importantly, instructors need to model and embody the principles of open science, which presupposes inclusivity.

The implementation of such insights certainly requires significant institutional support and preparation, with the perspective that development is incremental.

References

Baran, E., & AlZoubi, D. (2020). Affordances, challenges, and impact of open pedagogy: Examining students' voices. *Distance Education, 41*(2), 230–244. https://doi.org/10.1080/01587919.2020.1757409

Beaudry, J. L., Williams, M. N., Philipp, M. C., & Kothe, E. J. (2024). What do incoming university students believe about open science practices in psychology? *Teaching of Psychology*, *51*(3), 269-276.

Bergmann, C. (2018). *How to integrate open science into language acquisition research.* Student workshop at the 43rd Boston University Conference on Language Development (BUCLD), Boston, USA. https://docs.google.com/presentation/d/1bdICPzPOFs7V5aOZA2OdQgSAvgoB6WQweI21kVpk9Gg/edit#slide=id.p

Blincoe, S., & Buchert, S. (2020). Research preregistration as a teaching and learning tool in undergraduate psychology courses. *Psychology Learning & Teaching, 19*(1), 107–115. https://doi.org/10.1177/1475725719875844

Bliznakovski, J., & Naumovska, B. (2025). Praktikuvanje na otvorenata nauka: Naodi od anketa so istrazhuvachi vo opshtestvenite nauki [Practicing open science: Findings from a survey of social science researchers]. In J. Bliznakovski (Ed.), *Predizvici i moznosti za otvorena opshtestvena nauka vo Republika Severna Makedonija* [Challenges and opportunities for open social science in the Republic of North Macedonia]. Institute for Sociological and Political-Legal Research – Skopje, Ss. Cyril and Methodius University in Skopje.

Button, K. S., Chambers, C. D., Lawrence, N., & Munafò, M. R. (2020). Grassroots training for reproducible science: A consortium-based approach to the empirical dissertation. *Psychology Learning & Teaching, 19*(1), 77–90. https://doi.org/10.1177/1475725719857659

Cekik, A. (2025). Na chekor do evropskite praktiki? Mapiranje i evaluacija na istrazhuvachka infrastruktura za otvorena nauka od oblasta na opshtestvenite nauki vo Republika Severna Makedonija [A step toward European practices? Mapping and evaluation of research infrastructure for open science in the social sciences in the Republic of North Macedonia]. In J. Bliznakovski (Ed.), *Predizvici i moznosti za otvorena opshtestvena nauka vo Republika Severna Makedonija* [Challenges and opportunities for open social science in the Republic of North Macedonia]. Institute for Sociological and Political-Legal Research – Skopje, Ss. Cyril and Methodius University in Skopje

Clark, K., Lindsay, A., Gilligan-Lee, K. A., de-Wit, L., Scott-Samuel, N. E., Azevedo, F., & Pennington, C. R. (2025). Undergraduate psychology students' perceptions of open research: The relationship between statistics understanding, attitudes, and questionable research practices. *Collabra: Psychology,* 11(1): 127671. https://doi.org/10.1525/collabra.127671

Dimitrovska, M. (2025). Pravna analiza na moznostite za otvorena nauka vo Makedonija vo kontekst na univerzalnite i evropskite diskurzivni i normativni zalozhbi [Legal analysis of the possibilities for open science in Macedonia in the context of universal and European discursive and normative commitments]. In J. Bliznakovski (Ed.), *Predizvici i moznosti za otvorena opshtestvena nauka vo Republika Severna Makedonija* [Challenges and opportunities for open social science in the Republic of North Macedonia]. Institute for Sociological and Political-Legal Research – Skopje, Ss. Cyril and Methodius University in Skopje.

Frank, M. C., & Saxe, R. (2012). Teaching replication. *Perspectives on Psychological Science, 7*(6), 600–604. https://doi.org/10.1177/1745691612460686

Kathawalla, U. K., Silverstein, P., & Syed, M. (2021). Easing into open science: A guide for graduate students and their advisors. *Collabra: Psychology*, *7*(1): 18684. https://doi.org/10.1525/collabra.18684

Kerr, N. L. (1998). HARKing: Hypothesizing after the results are known. *Personality and social psychology review,* 2(3), 196-217. https://doi.org/10.1207/s15327957pspr0203_4

Mellor, D., & Pajić, D. (2023). Promoting Open Science Principles and Primenjena psihologija (Applied Psychology). *Primenjena psihologija*, *16*(4). https://doi.org/10.19090/pp.v16i4.2512

Munafò, M.R., Nosek, B.A., Bishop, D.V.M., Button, K. S., Chambers, C. D., Percie du Sert, N., Simonsohn, U., Wagenmakers, E.-J., Ware, J. J., & Ioannidis, J. P. A. (2017). A manifesto for reproducible science, *Nature Human Behaviour,* 1: 1–9. https://doi.org/10.1038/s41562-016-0021.

Nacionalen sovet za visoko obrazovanie i nauchno–istrazhuvachka dejnost. (2024). *Predlog–Nacionalna programa za nauchno-istrazhuvachkata dejnost so predlog merki* [Proposal—National program for scientific research activity with proposed measures]. https://tinyurl.com/ydazrcp3

Nelson, L. D., Simmons, J., & Simonsohn, U. (2018). Psychology's renaissance. *Annual review of psychology*, 69(1), 511-534. https://doi.org/10.1146/annurev-psych-122216-011836

Nosek, B. A., Hardwicke, T. E., Moshontz, H., Allard, A., Corker, K. S., Dreber, A., ... & Vazire, S. (2022). Replicability, robustness, and reproducibility in psychological science. *Annual review of psychology*, 73(1), 719-748. https://doi.org/10.1146/annurev-psych-020821-114157

Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science*, 349(6251). https://doi.org/10.1126/science.aac4716

Pashler, H. & Wagenmakers, E.-J. (2012). Editors' introduction to the special section on replicability in psychological science: A crisis of confidence? *Perspectives on Psychological Science,* 7: 528–30. https://doi.org/10.1177/1745691612465253

Parsons, S., Azevedo, F., Elsherif, M .M., Guay, S., Shahimet, O. N., Govaart, G., Norris, M., O'Mahony, A., Parker, A. J., Todorovic, A., Pennington, C. R., Garcia-Pelegrin, E., Lazić, A., Robertson, O., Middleton, S. L., Valentini, B., McCuaig, J., Baker, B. J., Collins, E., … Aczel, B. (2022). A community-sourced glossary of open scholarship terms. *Nature Human Behaviour,* 6, 312–318. https://doi.org/10.1038/s41562-021- 01269-4

Pendse, L. R. (2021). *Open access in North Macedonia*. ESS Newsletter. https://acrl.ala.org/ess/newsletters/ess-newsletter/ess-newsletter-2021/open-access-in-north-macedonia/

Pennington, C. (2023). *A student's guide to open science: Using the replication crisis to reform psychology*. McGraw-Hill Education (UK).

Pennington, C. R., Norris, E., Skubera, M., Ba, Y., Moffat, R., Amaral, O. B., Adamkovič, M., Adıgüzel, A., Almeida, R. A., Baldwin, J. R., Ballou, N., Behrens, L. M. P., Bertram, M. G., Bjerke, I. E., Blackwell, S. E., Bochynska, A., de Boer, M. R., Buljan, I., … Clark, K. (2024). *Awareness and use of open research practices: An international survey of researchers across disciplines* [Preprint]. PsyArXiv. https://doi.org/10.31234/osf.io/edzxf_v1

Pownall, M., Azevedo, F., König, L. M., Slack, H. R., Evans, T., Flack, Z., Grinschgl, S., Elsherif, M. M., Gilligan-Lee, K. A., de Oliveira, C. M. F., Gjoneska, B., Kalandadze, T., Button, K., Ashcroft-Jones, S., Terry, J., Albayrak-Aydemir, N., Děchtěrenko, F., Alzahawi, S., Baker, B. J., ... FORRT (2022, Apr 8). *Teaching Open and Reproducible Scholarship: A Critical Review of the Evidence Base for Current Pedagogical Methods and their Outcomes* https://doi.org/10.31222/osf.io/9e526

Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). False-positive psychology: Undisclosed flexibility in data collection and analysis allows presenting anything as significant. *Psychological science,* 22(11), 1359-1366. https://doi.org/10.1177/0956797611417632

Smederevac, S., Pajić, D., Radovanović, S., Gilezan, S., Čolović, P., & Milosavljević, B. (2020). *Otvorena nauka: praksa i perspektive.* Univerzitet u Novom Sadu https://open.uns.ac.rs/handle/123456789/16297

Univerzitetot "Sv. Kiril i Metodij". (2022, March 31). *Politika na otvorena nauka na Univerzitetot "Sv. Kiril i Metodij" vo Skopje* [Open science policy of Ss. Cyril and Methodius University in Skopje]. https://www.ukim.edu.mk/dokumenti_m/Open_Science_Policy_UKIM_March_2022-mk.pdf

Vazire, S. (2018). Implications of the credibility revolution for productivity, creativity, and progress. *Perspectives on Psychological Science,* 13: 411–17. https://doi.org/10.1177/1745691617751884

Verheyen, S., & Heyman, T. (2025). *Navigating the pitfalls of teaching open science to undergraduate students.* PsyArXiv. https://osf.io/preprints/psyarxiv/qynpx_v1

Wilkinson, M. D., Dumontier, M., Aalbersberg, I. J., Appleton, G., Axton, M., Baak, A., … Mons, B. (2016). The FAIR Guiding Principles for scientific data management and stewardship. *Scientific Data,* 3, 160018. https://doi.org/10.1038/sdata.2016.18