

Open and Shut: Open Access in Hybrid Educational Technology Journals 2010 – 2017

Eamon Costello, Tom Farrelly et Tony Murphy

Volume 21, numéro 1, janvier 2020

URI : <https://id.erudit.org/iderudit/1067678ar>
DOI : <https://doi.org/10.19173/irrodl.v20i5.4383>

[Aller au sommaire du numéro](#)

Éditeur(s)

Athabasca University Press (AU Press)

ISSN

1492-3831 (numérique)

[Découvrir la revue](#)

Citer cet article

Costello, E., Farrelly, T. & Murphy, T. (2020). Open and Shut: Open Access in Hybrid Educational Technology Journals 2010 – 2017. *International Review of Research in Open and Distributed Learning*, 21(1), 113–134.
<https://doi.org/10.19173/irrodl.v20i5.4383>

Résumé de l'article

Little is known about open access publishing in educational technology journals that employ a hybrid model which charges authors only if they wish to publish via gold open access. In this study we sought to address this gap in the scholarly understanding of open access publishing in hybrid journals that publish research into the intersection of education and technology. We analysed three categories of article access types: gold, green, and limited access, and collected data on their prevalence in the seven-year period from 2010-2017 across 29 journals. Data was gathered from Scopus, Unpaywall, Sherpa RoMEO, and via manual searches of the journal websites, resulting in a dataset comprising the metadata of 8,479 articles. Our findings highlight that most research remains locked behind paywalls, that open access publishing through legal means is a minority activity for the scholars involved, and that the complexity and costs of legal open access publishing in these journals may be inhibiting the accessibility of research to readers.

Copyright (c) Eamon Costello, Tom Farrelly et Tony Murphy, 2020



Ce document est protégé par la loi sur le droit d'auteur. L'utilisation des services d'Érudit (y compris la reproduction) est assujettie à sa politique d'utilisation que vous pouvez consulter en ligne.

<https://apropos.erudit.org/fr/usagers/politique-dutilisation/>

January – 2020

Open and Shut: Open Access in Hybrid Educational Technology Journals 2010 – 2017

Eamon Costello¹, Tom Farrelly², and Tony Murphy³

Dublin City University¹, Institute of Technology Tralee², Dublin Business School³

Abstract

Little is known about open access publishing in educational technology journals that employ a hybrid model which charges authors only if they wish to publish via gold open access. In this study we sought to address this gap in the scholarly understanding of open access publishing in hybrid journals that publish research into the intersection of education and technology. We analysed three categories of article access types: gold, green, and limited access, and collected data on their prevalence in the seven-year period from 2010-2017 across 29 journals. Data was gathered from Scopus, Unpaywall, Sherpa RoMEO, and via manual searches of the journal websites, resulting in a dataset comprising the metadata of 8,479 articles. Our findings highlight that most research remains locked behind paywalls, that open access publishing through legal means is a minority activity for the scholars involved, and that the complexity and costs of legal open access publishing in these journals may be inhibiting the accessibility of research to readers.

Keywords: open access, open scholarship, open education, educational technology research, gold open access, publishing

Introduction

This paper aims to shine a light on publishing patterns of scholars in the area of educational technology research. More specifically it aims to take stock of the practices of open access publishing by scholars in this area. There are some well-known, and well-regarded open access journals in the area (Perkins & Lowenthal, 2016; Zawacki-Richter, Anderson, & Tuncay, 2010), including of course The International Review of Research in Open and Distributed Learning (IRRODL). However, educational technology open access journals are few in number (Costello, Huijser, & Marshall, 2019) relative to the overall journal landscape. There are other forms of open access publishing, outside of fully open access journals. Authors can share early iterations (often known as preprints) of their manuscript in various places as allowed by the publisher. Alternatively, authors can pay to have their work published in journals that are comprised of both open and closed articles.

Open access is a not an uncontested concept, with Chen and Olijhoek (2016) suggesting that it is more appropriate to regard open access as a spectrum that incorporates differential copyright, reuse, and author posting rights. The question arises as to how scholars can grapple with this often complex scholarly publishing landscape. This study sought to explore this topic in the area of educational technology research by examining journals that dominate the area, that are not fully open access, but that in theory provide a range of publishing options to authors. We sought to interrogate how scholars are publishing articles in these journals according to different open access options available to them. Finally, we assess the impact these publishing practices may have for scholars and readers of this literature.

Literature Review

Open access refers to a model of academic publishing where readers have access to published works without cost. While a commitment to the sharing of scholarship predates modern communication technology, the advent of the Internet heralded an era of vast new possibilities (Suber, 2012). There arose the potential for a momentous revolution in scientific and scholarly publishing (Allahar, 2017; Harnard, 1991; Suber, 2012). Researchers now have the ability to promote and share their work in a way that previous generations could have scarcely imagined.

What may have started as a philosophical commitment to openness by individual researchers has increasingly become articulated and translated in institutional and national policy. For example, The European Commission's recommendation on access and the preservation of publicly funded scientific data represents an important milestone in the EU's commitment to ensuring that those who pay for publicly funded scientific research should get to see those outputs without restriction. In May 2016 the 27 members of the European Union committed to making all scientific publications from publicly funded research freely available by 2020; a commitment that was formally articulated in 2018 as "Plan S" (European Commission, 2019). This commitment subsequently formed the basis of "cOAlition S," a coalition of national research funders and charitable organisations across Europe that have agreed to implement the 10 principles enshrined in Plan S (cOAlition S, 2019). In America, the Bill and Melinda Gates Foundation (2015) adopted an open access policy requiring all future research supported by the foundation to adopt open practices with

respect to all. This growth in open access commitment is well illustrated by The Registry of Open Access Repository Mandates and Policies (ROARMAP) tracking of the open access mandates and policies adopted by different funders (including private foundations, research organisations, and universities) which has seen the number of policies and mandates of all types grow from 122 in Quarter 1 of 2015 to 959 in Quarter 4 of 2018 (ROARMAP, n.d.). These are just two examples of a worldwide trend that is attempting to promote open access for research.

An important (and frequently cited) reference point for open access is the Budapest Open Access Initiative (BOAI):

By "open access" to this literature, we mean its free availability on the public Internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the Internet itself (Chan et al., 2002).

The BOAI, in conjunction with the Bethesda Statement on Open Access Publishing (Brown et. al., 2003) plotted two strategies to this open access. First, it promoted archival by scholars of their published works to their own institutional or subject archives. Second, it called for fully open access journals that would enable open access at the point of publishing in the journal itself with no fees or subscription costs to readers.

While there are other definitions of open access, (see Bailey, 2007), the BOAI concepts of gold and green options have continued to persist – but with evolving practices and subtypes that have the potential to confuse (Smith, 2017). Gold open access refers to articles that become open to readers immediately at publication (are born free), on the journal website itself. As the gold model evolved, two scenarios of gold access developed. The first scenario is an open access journal which provides all articles free of charge to the reader, but the authors pay a fee, known as an Article (or Author) Processing Charge (APC). APCs were a response to the loss of revenue incurred by journals for no longer charging subscriptions. They enabled, for instance, a new form of journal known as the mega-journal pioneered by the Public Library of Science One (PLOS One) and were quickly co-opted by the major traditional publishers (Björk, 2018). In some fields, journals supported by APCs are well established (Berger & Cirasella, 2015). However, the issue has also been somewhat clouded by fears of “predatory” journals, largely understood as journals that accept articles regardless of merit for money and hence “prey” on authors (Berger & Cirasella, 2015; Smith, 2016). Predatory journals may be something of a red herring, in terms of actual harm that they cause (Eve & Priego, 2017). Commentators have argued that the real predators may be the dominant big academic publishers (Olijhoek & Tennant, 2018).

The second scenario is journals that take a hybrid form, publishing closed articles alongside open ones paid by APC (Eve, de Vries, & Rooryck, 2017). A third scenario comprises journals which provide gold open access with no APCs, that are financed through other revenue such as membership subscriptions of a scholarly professional association. The terms “platinum” or “diamond” have been proposed for open access journals with no APCs (Fuchs & Sandavol, 2013). These journals have a model of publishing that neither charges the author to publish nor the reader to read.

Another major category is green open access (Guédon, 2004) which dates to at least to 1991 when physicists practiced the self-archival of versions of their articles to the Arxiv archive before their official publication (Harnad et al., 2004). Green access allows scholars to archive a version of their article somewhere other than the publishing journal website. This version may be at the pre-peer review stage, or at some other stage of the publishing lifecycle, such as before typesetting, and up to and including the final version.

A recent study by Piwowar et al (2018) highlighted what they term “bronze” access (Ridgway, 2014) to refer to two types of article. The first appear in journals that share many characteristics of gold open access journals insofar as all articles are freely available. However, they may lack a clear license, such as Creative Commons, and hence legal usage of the articles remain unclear. The second type of bronze article are those that appear in hybrid journals. These articles have been referred to as having “peek-a-boo,” (Harnad, 2006) “fourrée,” (Costello, 2019) and “fauxpen” (Freshwater, 2014) access, to highlight that these articles may not always be available. We use the term “temporary access” for this access type in an attempt to give a concise but technical definition of this very limited and hence problematic form of access. We will return to this issue in the discussion section.

The importance for open access to scholarship is clear. Open access journal articles have been posited as a form of “open educational resource” (OER) particularly for graduate students (Anderson, 2013). It has been shown that some scholars in the area place particular value on open access journals (Perkins & Lowenthal, 2016). However, a study that contrasted open and closed models found editors ascribed no quality judgement based on journal type (Zawacki-Richter et al., 2010). Interestingly, open access publishing helped contribute to the idea of the digital scholar (Weller, 2011) and from this, a dawn of open scholarship was heralded (Veletsianos & Kimmons, 2013). The open access movement found ready friends in the open education movement with its roots in traditional open and distance learning (Costello et al., 2019). Open education, as a movement, has spread and expanded in definition and now encompasses a wide “kaleidoscope” of practices (Conole & Brown, 2018). Nonetheless, the “battle” for open continues (Weller, 2015) as, despite the success of a number of open access journals in the field of educational technology research, the major academic publishers still predominate (Larivière, Haustein, & Mongeon, 2015). The majority of these journals are not fully open access but instead operate a subscription-based hybrid model of publishing, in which open articles are published in the journals alongside closed ones (Prosser, 2018).

As Piwowar et al. (2018) highlight, very little is known about temporary access or bronze articles. To our knowledge, nothing has been published on this topic in the area of blended, online, or educational technology research. Furthermore, very little appears to be known about gold and green publishing patterns in the major journals in the area. Hence, this study aims to address this gap regarding what is known about publishing in hybrid access journals in the area of online, blended, and educational technology research.

This study is guided by the following overarching research question: What is the pattern of open access publishing in prestigious hybrid educational technology research journals? This is further broken down into three sub-questions:

- What is the prevalence of the different access types for articles published in prominent educational technology journals with a hybrid publishing model?

- What article processing charges (APCs) are authors paying to educational technology journals in order to publish gold access?
- How can the rates of open access publishing in hybrid journals be determined?

Methodology

Several data sources were used in this study. The Scimago database was used to determine prominent journals in the field. Scimago Journal and Country Rank rates journals according to the Scimago Journal Rank (SJR) indicator (Colledge et al., 2010). It is used in conjunction with Scopus in many ranking systems of academic scholarship such as the Time Higher Education University Rankings and the 2018 QS World University Rankings (Hanafi & Boucherie, 2018). We selected the top 50 journals by SJR score in the category of “e-learning.” We then removed completely closed journals (i.e., those with no option to publish gold open access as of 2018). We also excluded conference proceedings and fully gold open access journals, of which it should be noted there are 13, including, of course, The International Review of Research in Open and Distributed Learning (IRRODL). It also noteworthy that none of these 13 gold open access journals charge APCs to authors. This left us with a list of 29 prestigious hybrid journals which are detailed in Table 3. It should be noted that we use the term prestige in the technical scientometric sense, which relates to a journal's attraction of citations from other highly ranked journals. We are not ascribing any value beyond this to these journals nor their publications per se. Indeed, some research argues that prestigious journals may actually publish more dubious research (Brembs, Button, & Munafò, 2013).

Initial searches of the Scopus database indicated that no articles were published in the journals as open access prior to 2010. We next performed a search using the Scopus database for all research articles published in these journals between 2010 and 2017 inclusively. This resulted in a dataset comprising the metadata of 8,479 articles. One of these metadata fields showed whether an article is available as gold open access.

To validate this data, one researcher manually verified the access type of each individual article via a systematic hand-search (Armstrong, Jackson, Doyle, Waters, & Howes, 2005). Temporary access articles were also recorded during this search and the results of these manual searches were cross-checked with the Scopus data. Researchers then performed searches of the journal websites to determine APC costs in US dollars. Next a search was made for each journal title in the Sherpa RoMEO database to determine its stated level of archival policy. Sherpa RoMEO (n.d.) is a database that records the self-archiving policies of journals for their authors. It uses the following colour codes to describe the archiving policy allowed by each journal:

- Green: author can archive pre-print and post-print or publisher's version/PDF;
- Blue: author can archive post-print (i.e., final draft post-refereeing) or publisher's version/PDF;
- Yellow: author can archive pre-print (i.e., pre-refereeing); and

- White: archiving not formally supported.

Finally, we conducted a search of the Unpaywall database. Unpaywall is an open database of over 23 million open access scholarly articles and contains the access data on over 90 million articles. Unpaywall uses indexes such as Crossref and the Directory of Open Access Journals (DOAJ); additionally, it draws upon over 50,000 other online sources including gold open access journals, hybrid journals, institutional repositories, and disciplinary repositories (Piwowar et al., 2018). We used the Digital Object Identifier (DOI) of each article in our dataset to query the Unpaywall dataset programmatically. This returned 8,425 results which equates to over 99% coverage. These results provided green access data to supplement the temporary access data of our dataset. We then merged these results into one master dataset and performed descriptive and inferential statistics using Excel and the statistical software R.

Results

Temporary Access

We found 38 temporary access articles through manual search. Unpaywall identified 111 temporary access articles. Unpaywall refers to these articles as “open (via free pdf).” Of the 38 temporary access articles we found manually, 15 were also found by Unpaywall. By combining these two data sources together, we calculated a total of 134 articles in this category. A check of several of the Unpaywall articles revealed that while some were still available to access, others had reverted behind a paywall and were no longer available to access. Hence, we use the term “temporary access,” to describe these articles, as access is unreliable over time. All we can say is that articles in this category were available to access freely at some point in time.

In order to best categorise the corpus as a whole, we chose to use *the best possible type of access of all forms available*. There were only a small number of papers that could be placed in multiple access categories. For example, there were three temporary access articles for which there was a green version (better) also available. Similarly, there were five green articles which had a gold access version (better again) available. The most complicated category however, is temporary access, as separating them from the fully paywalled category could give a misleading impression that they are more accessible than they actually are. In our judgement these are very close to paywalled articles. The results hence show the best available access version, at the point in time during which the data for this study was collected. We report our results in the subsequent charts with colours that equate to the relative level of openness: black for least access; grey for limited access; green for non-final versions, that are not available on the journal website itself; and gold for fully open access versions that are available on the journal website. This may serve to help the reader differentiate access types (with the caveat that the relative merits of access types is contested).

During the period 2010 to 2017, we report 140 gold open access articles, 785 green open access articles, 124 temporary access articles, and 7,429 closed/paywalled articles. Grouping green and gold together, we have 925 articles or 9.26% of the corpus that are available in some open format. Combining temporary access and paywalled articles, that have no green access version, we report 7,553 articles or just over 89% of the corpus. Figure 1 shows the proportion of each best access type in the corpus.

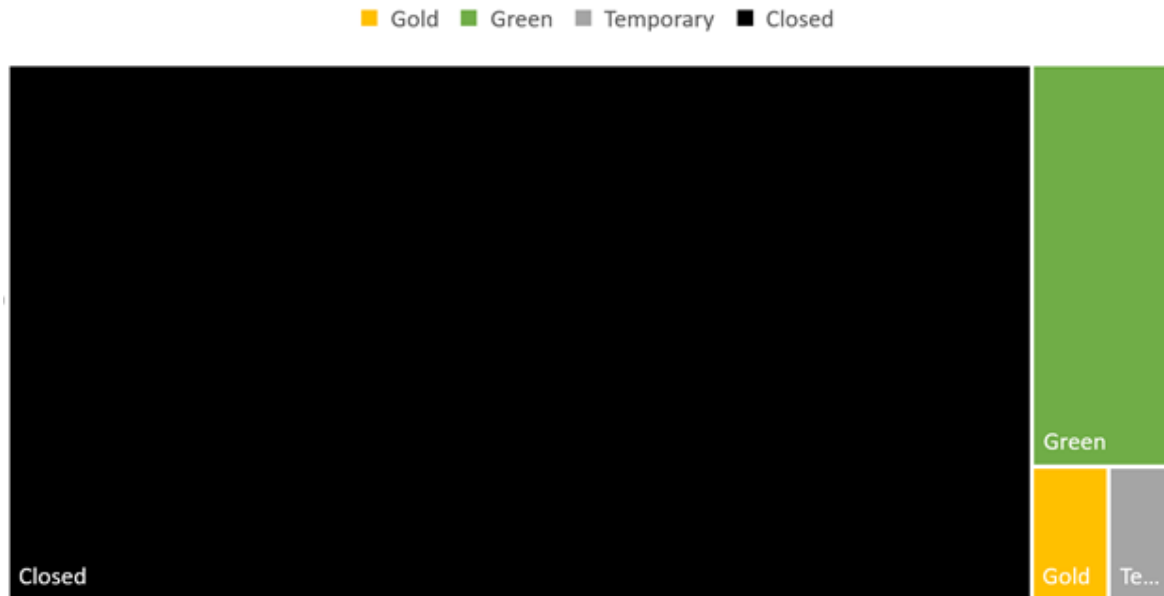


Figure 1. Best access type for 8,478 articles in hybrid e-learning journals 2010 – 2017.

When the data on these four access types is looked at over time, it appears that green access remained at a relatively stable rate with an average of 98 articles per year over the period. Gold open access averaged only five articles a year between 2010 and 2014 but this rose to 27 in 2015 and then to 44 and 49 in 2016 and 2017 respectively. Temporary access articles also increased from 2013 onwards and averaged 27 articles annually for the subsequent four years. Figure 2 below illustrates these trends.

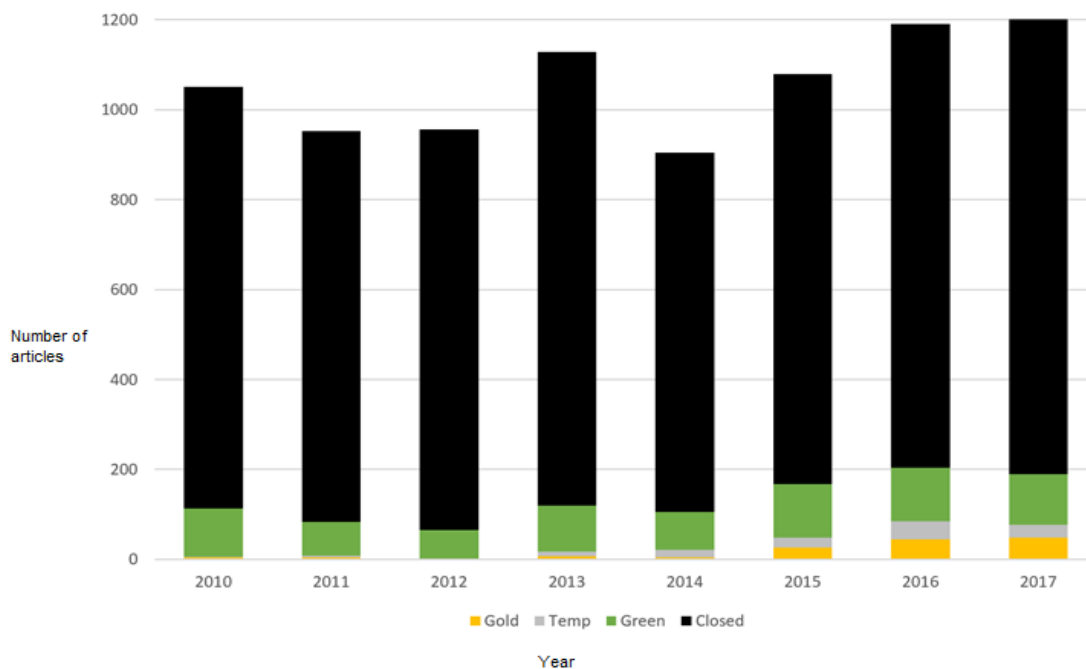


Figure 2. Number of best access type of all articles in hybrid e-learning journals per year.

Funding information, such as acknowledgements to funding agencies, was available for 1,435 articles. Thirty of the 140 gold articles acknowledged funding, and 138 of the 785 green. A chi square test was conducted to determine if there was any correlation between funding information and open access gold or green publishing but none was found ($\chi^2 [1, N = 8,478] = 2.37, p = .30$).

Green Archival

The archival to a repository or website, of various versions of an article manuscript such as the pre-print or post-print version, are allowed for by all but one of the 29 journals, according to the Sherpa RoMEO database. Furthermore, RoMEO catalogues these according to four colours, where green is the most permissive followed by blue, yellow, and white. The archival policies can be further classified according to publisher, of which there are 10. We found that each publisher has one archival policy, as shown in Table 1, which applies to all of its journals in our dataset.

Table 1

Archival Policies per Publisher as per Sherpa RoMEO

Publisher	RoMEO archival
IGI Global	Blue
Elsevier Ltd	Green
Emerald Group Publishing Ltd	Green
Informa/Taylor & Francis	Green
Kluwer Academic Publishers	Green
Inderscience Enterprises	Yellow
Wiley-Blackwell	Yellow
Springer Nature	Green
IEEE Education Society	Green
Ovid Technologies (Wolters Kluwer Health)	Not found

When the RoMEO policies of the publisher are examined for the green access articles there is a correlation between the most permissive policy (green) and slightly higher rates of green access. This is shown in Table 2. There is a negative correlation between green access and the blue archival policy and similarly low rates of green access where archival is not formally supported by the journal (though notably there are 16 articles appearing in a category where archival is not formally supported by publisher policy). This relationship is significant ($\chi^2 [1, N = 8478] = 17.60, p = .00053$).

Table 2

Proportion of Green Access Versions of Articles and Corresponding Sherpa RoMEO Archival Policies of Their Publishing Journals

	Green	Yellow	Blue	No policy	Total
Green access	601	146	22	16	785
Not green	5735	1256	416	286	7693
Total	6336	1402	438	302	8478

Gold Access Costs

Table 3 shows the APC charge per article which authors can pay to make their article available immediately from the publisher website via gold open access. There is a narrow range of APC costs with the lowest being \$1,100 and the highest \$3,200.

Table 3

APC per Journal as of 2018

Journal	Publisher	APC
Journal of Computer Assisted Learning	Wiley-Blackwell	\$3,200
Government Information Quarterly	Elsevier	\$1,100
Internet and Higher Education	Elsevier	\$1,800
Computers and Education	Elsevier	\$1,950
Reference Services Review	Emerald Group Publishing	\$2,650
Transforming Government: People, Process, and Policy	Emerald Group Publishing	\$2,650
IEEE Transactions on Learning Technologies	IEEE Education Society	\$1,950
International Journal of Distance Education Technologies	IGI Global	\$1,500
International Journal of Electronic Government Research	IGI Global	\$1,500

International Journal of Mobile and Blended Learning	IGI Global	\$1,500
Electronic Government	Inderscience Enterprises	\$2,550
International Journal of Mobile Learning and Organisation	Inderscience Enterprises	\$2,550
Learning Environments Research	Kluwer Academic Publishers	\$3,000
The Journal of Continuing Education in the Health Professions	Kluwer Academic Publishers	\$2,650
Open Learning	Informa/Taylor & Francis	\$2,590
American Journal of Distance Education	Informa/Taylor & Francis	\$2,950
College and Undergraduate Libraries	Informa/Taylor & Francis	\$2,950
Distance Education	Informa/ Taylor & Francis	\$2,950
Information Technology for Development	Informa/Taylor & Francis	\$2,950
Interactive Learning Environments	Informa/Taylor & Francis	\$2,950
International Journal of Lifelong Education	Informa/Taylor & Francis	\$2,950
Internet Reference Services Quarterly	Informa/Taylor & Francis	\$2,950
Journal of Library and Information Services in Distance Learning	Informa/Taylor & Francis	\$2,950
New Review of Academic Librarianship	Informa/Taylor & Francis	\$2,950
International Review of Education	Springer Nature	\$3,000
Education and Information Technologies	Springer Nature	\$3,000
International Journal of Artificial Intelligence in Education	Springer Nature	\$3,000
Journal of Continuing Education in the Health Professions	Wiley-Blackwell	\$2,100
British Journal of Educational Technology	Wiley-Blackwell	\$3,000

Most publishers also had one APC charge across all journals, but some had different charges per journal, therefore we used an average of these per publisher to get an overall picture at publisher level as summarized in Table 4 below.

Table 4

APC per Publisher as of 2018

Publisher	Average APC
IGI Global	\$1,500
Elsevier	\$1,617
Emerald Group Publishing	\$2,650
Informa/Taylor & Francis	\$2,950
Kluwer Academic Publishers	\$3,000
Inderscience Enterprises	\$2,550
Wiley-Blackwell	\$3,100
Springer Nature	\$3,000
IEEE Education Society	\$1,950
Ovid Technologies (Wolters Kluwer Health)	\$2,650

Using the above data, we can estimate the approximate total fees paid by authors to publishers to make their articles gold access. Table 5 below shows the estimated APCs paid to journals which totals \$364,850.

Table 5

Estimated Total APCs per Journal

Journal	Gold OA articles	Estimated APCs paid
Education and Information Technologies	27	\$81,000
Learning Environments Research	13	\$39,000
International Review of Education	8	\$24,000

International Journal of Artificial Intelligence in Education	4	\$12,000
Information Technology for Development	12	\$35,400
Open Learning	7	\$20,650
Interactive Learning Environments	6	\$17,700
Distance Education	3	\$8,850
International Journal of Lifelong Education	3	\$8,850
New Review of Academic Librarianship	2	\$5,900
College and Undergraduate Libraries	1	\$2,950
Internet Reference Services Quarterly	1	\$2,950
Computers and Education	28	\$54,600
Government Information Quarterly	11	\$12,100
Internet and Higher Education	3	\$5,850
British Journal of Educational Technology	8	\$24,000
Journal of Computer Assisted Learning	2	\$6,400
Transforming Government: People, Process and Policy	1	\$2,650
Total	140	\$364,850

If we group journal by publisher, we can see how these estimated APC costs were paid to each of five publishers. This is shown in Figure 3 below.

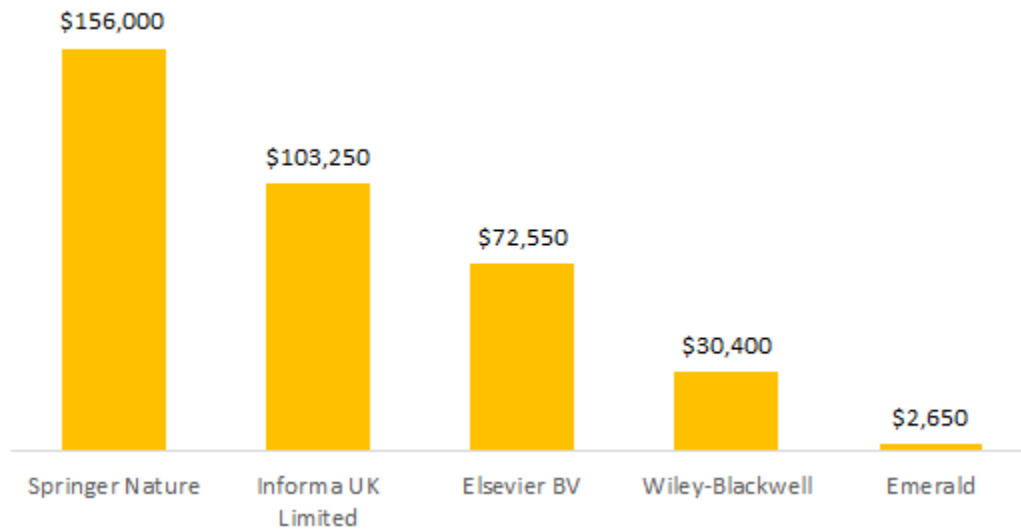


Figure 3. Estimated total APCs paid per publisher 2010 – 2017.

Finally, we multiplied the APC cost that each journal advertises to authors by all of the articles published in that journal in the dataset. This gives us a hypothetical potential total cost if all of the authors had availed of the option to make their articles gold access by paying an APC. There are a number of issues with this calculation as we discuss later, but it has some indicative value. This calculation produces a figure of \$21,099,750. Figure 4 below shows this hypothetical estimated cost by publisher.



Figure 4. Hypothetical potential total APC cost.

Search Evaluation

There was a disparity in outputs between the searches we employed. Although Scopus provides copious and well-structured article metadata it did not find all of the open access articles which we found via manual and Unpaywall searches. The manual and Unpaywall searches indicated 64 more open access articles than Scopus. The journals with the greatest differentials were: Information Technology for Development (-12); Learning Environments Research (-9); Open Learning (-7) and British Journal of Educational Technology (-6).

Discussion

Our manual and Unpaywall searches highlight that gold open access levels are underreported by Scopus. This is worth noting, as some previous reports that have relied solely on Scopus, will likely have understated the true level of open access.

We have used the term temporary access in order to provide a clear technical impression of the nature of articles that appear with the word “free” on journal websites. We noted that several of the temporary access articles we discovered during the manual search, had soon after disappeared back behind paywalls. This was starkly confirmed when we compared those articles classified as temporary access we had found, with those reported by Unpaywall, as our manual search only found 15 of the 111 from Unpaywall. In other words, we surmise that 96 articles were no longer freely available to read and had reverted behind paywalls.

Snapshots from Unpaywall may give a misleading impression as to the true accessibility of these articles. There are few certainties when attempting to quantify the prevalence of this article type. Technically, it is only true to say that such articles have been freely accessible *at some point in time*. Essentially, they are only accessible for as long as the publisher wishes. They may very well be used to opportunistically drive traffic to a journal website. Ultimately, they can be used to gain readers and citations for a journal, but the journal can cut access at any time. The journal publisher hence continues to charge subscriptions to institutions, and users, who need reliable access to all of the journal articles. To return to Anderson's (2013) example of using articles as OER in educational scenarios, it is clear we cannot use these articles as they are not true open access articles. We cannot download and share them, and nor can they even be reliably linked to. They fail to meet most of the 5 Rs of open access (Hilton, Wiley, Stein, & Johnson, 2010; Wiley, 2014) in particular the 5th R which is the right to "retain" a given work. Given the potential issue with the bronze metaphor, we suggest the mineral pyrite, and the term "pyrite access" instead of bronze for this article access type. Pyrite is also known as fool's gold, a base metal that gleams like gold and may beguile casual observers with its false promise. We are currently tracking these articles to see how their availability changes over time as a topic of future research.

APCs can change over time, so our estimates have some potential for error. However, we did find that the APCs are clustered within a tight range of prices. Hence our hypothetical cost to authors are indicative. We report prices in US dollars but many publishers have variable pricing and indeed some have various types of waiver for scholars from developing countries or who cannot pay full prices. Hence, we are reporting the maximum possible cost. Further, there is some limited but growing fight back from academic institutions against so called "double dipping" from publishers, whereby institutions are charged a subscription to a journal but authors are then charged a fee to publish open access in the journal (Earney, 2017; Pinfield, Salter, & Bath, 2017). Hence, waivers have been negotiated in some cases for authors or a reduction, known as offsetting, in the subscription fee for institutions (Earney, 2017; Pinfield et al., 2017). However, this is not widespread and if anything serves to highlight how complex this topic is, and the subsequent difficulty academics and institutions face in attempting to negotiate with what have been termed "oligopolistic publishers" (Larivière et al., 2015).

It is known that green access levels are underreported. The developers of the Unpaywall dataset acknowledge that they are always underreporting the true level of green access (Piwower et al., 2018). They do not have access to every institutional repository (even though have an index of 50,000 resources and growing) and avoid considering academic social networking sites—understandably as have been deemed sites of "black open access," for the amount of content they contain that breaches copyright (Björk, 2017). Nonetheless, it is fair to assume that a vast swathe of articles in the journals we analyzed remain closed but could effectively be freed as green versions. We have highlighted that, according to the policies of all but one journal in the dataset, authors have the option of archiving a green version of their paper for free. Scholars need to be better educated about archiving green versions of their papers, to encourage them to make their articles available in this way. Fears that scholars may have about green access, such as whether their works will be indexed or cited, can be mitigated through better explaining, and indeed busting some of the myths surrounding open scholarly publishing (Tennant et al., 2019). Although the value of making work more openly and freely available may seem self-evident to many, to others there is the incentive of the hypothesised Open Access Citation Advantage (OACA). Piwower et al.'s (2018) study found evidence to

suggest that open access articles are cited more often than closed ones, and although there is much debate about this phenomenon, increasing evidence points in this direction (Lewis, 2018).

More work is needed to try to understand the open access scholarly publishing literacies of scholars in this area. Björk and Holmström (2006) proposed a framework of a “net value of submission” comprised of factors that scholars consider when making choices about where to submit their work. This model comprises 29 factors aggregated into four groups: infrastructure, readership, prestige, and performance. Level of performance is one of the most important of the 29 factors whilst article processing charge cost is one of the few negative factors. Openness of journal has been considered relatively unimportant to authors in where they chose to submit (Björk & Holmström, 2006). The perceived quality/prestige, and the fit for the manuscript are generally considered most important (Björk & Holmström, 2006). Additionally, some recent research indicates that peers may be influential in nudging scholars towards open access (Heaton, Burns, & Thoms, 2019). Most research in this area has concentrated on fully gold open access journals (Solomon & Björk, 2012) and less attention has been paid to hybrid journals which have been the focus of this research. Moreover, there is no research on the practices and beliefs of educational technology researchers regarding green and hybrid gold publishing, though one study examined scholars perceptions of fully open access journals where respondents reported that their perception of journal quality did not directly correlate with traditional rankings (Perkins & Lowenthal, 2016). Hence, further research is required to explore what factors are important for educational technology researchers who publish in hybrid journals and how they pay the associated charges. Finding out more about their beliefs and practices should help scholars in the field better understand open access publishing and increase awareness of the associated issues. This is the focus of a follow up study we are conducting.

Scholars may be under increasing pressure to publish in prestigious closed and hybrid journals. Better education of scholars in how they can publish pre and post prints of their work is important. We have highlighted the low levels of green versions of articles here. On the other hand, we found 16 articles that may have been distributed in contravention of publisher policies. A study of Researchgate and Academia.edu found high levels of scholars (wittingly or otherwise) breaching publisher policies by uploading versions of papers prohibited by the publisher agreements (Jamali, 2017). Authors suffer two problems: breaching publisher policies when attempting to archive their work, and not taking full advantage of what is allowed by publishers in terms of archiving and sharing their work; consequently, they either overshare or undershare their work (Jamali, 2017).

Green access open publishing is complex, being described by Smith (2017) as a “piecemeal approach to openness” (p. 6). So much so that we argue that we need to develop a literacy of open access scholarship. The potential Open Access Citation Advantage might spur scholars in this direction; however, there may be other motivators. We have highlighted the vast sea of educational technology research locked behind paywalls. Hence, we must also appeal to scholars’ intrinsic motivations. Why are we depriving readers of this published research? How can we enable access to those without the privilege afforded by expensive institutional subscriptions to journals that many academics enjoy? The total cost of publishing all of this research via APC as we have highlighted may be prohibitive. Green access publishing is complex but free. Moreover, we have not even touched on the fully open access journals in the field available to scholars, which, although not as numerous as their hybrid counterparts, nonetheless are an uncomplicated gold open

access outlet, many of which do not charge APCs. Research indicates that scholars in this area as a whole publish in multiple journal types (Weller, Jordan, DeVries, & Rolfe, 2018) so a multifaceted strategic approach to addressing the problem may be needed.

The large potential total APC costs we have highlighted may serve to give scholars in the field pause for thought. Is this a sustainable model and how would such APC costs be borne? The main contribution we seek to make with this research is to cause scholars to critically reflect on the role of publishers and scholars, but ultimately readers. Open access benefits readers most, and there is a much larger constituency of readers than authors. Accordingly, we should strive as a community to make the most literature available to the greatest readership possible. There is an imperative for scholars, as a community, not to leave our work in an “intellectual periphery” (Canagarajah, 2002, p. 207) but rather to ensure its accessible place in the domain of human knowledge.

Conclusion

This study has sought to shine a light on the publishing patterns of scholars regarding open access in prestigious hybrid access journals in the area of educational technology research. In doing so it has addressed a gap in the scholarly understanding of author publication patterns in this area regarding gold, green, and limited access. Our research has found low levels of open access publishing. In providing this evidence, and suggesting possible reasons, we hope to stimulate critical debate amongst the scholarly community in this area around how they publish and disseminate their academic work. Ultimately, we hope that this debate will result in more research on the interplay between technology and education being made available to more readers who can thus benefit from it.

References

- Allahar, H. (2017) Academic publishing, Internet technology, and disruptive technology. *Technology Innovation Management Review*, 7(11), 47-56. Retrieved from https://timreview.ca/sites/default/files/article_PDF/Allahar_TIMReview_November2017.pdf
- Anderson, T. (2013). Open access scholarly publications as OER. *The International Review of Research in Open and Distributed Learning*, 14(2), 81–95. <https://doi.org/10.19173/irrodl.v14i2.1531>
- Armstrong, R., Jackson, N., Doyle, J., Waters, E., & Howes, F. (2005). It's in your hands: The value of handsearching in conducting systematic reviews of public health interventions. *Journal of Public Health (Oxford, England)*, 27(4), 388–391. <https://doi.org/10.1093/pubmed/fdi056>
- Bailey, C. W., Jr. (2007). What is open access? (Blog post). Retrieved from <http://digital-scholarship.org/cwb/WhatIsOA.htm>
- Berger, M., & Cirasella, J. (2015). Beyond Beall's list: Better understanding predatory publishers. *College and Research Library News*, 76(3), 132-135. <https://doi.org/10.5860/crln.76.3.9277>
- Bill & Melinda Gates Foundation. (2015, April 8). Bill & Melinda Gates Foundation open access policy. Retrieved from <https://www.gatesfoundation.org/how-we-work/general-information/open-access-policy>
- Björk, B.-C. (2018). Evolution of the scholarly mega-journal, 2006–2017. *PeerJ*, 6. <https://doi.org/10.7717/peerj.4357>
- Björk, B. C. (2017). Gold, green, and black open access. *Learned Publishing*, 30(2), 173-175. <https://doi.org/10.1002/leap.1096>
- Björk, B.-C., & Holmström, J. (2006). Benchmarking scientific journals from the submitting author's viewpoint. *Learned Publishing*, 19(2), 147–155. <https://doi.org/10.1087/095315106776387002>
- Brembs, B., Button, K., & Munafò, M. (2013). Deep impact: Unintended consequences of journal rank. *Frontiers in Human Neuroscience*, 7, 1-12. <https://doi.org/10.3389/fnhum.2013.00291>
- Brown, P. O., Cabell, D., Chakravarti, A., Cohen, B., Delamothe, T., Eisen, M., ... Watson, L. (2003). Bethesda statement on open access publishing. *Scholarly Communications Report*, 7(6), 9-10. Retrieved from <https://dash.harvard.edu/handle/1/4725199>
- Canagarajah, A. Suresh. (2002). *The geopolitics of academic writing*. Pittsburgh, PA: University of Pittsburgh Press.
- Chan, L., Cuplinskis, D., Eisen, M., Friend, F., Genova, Y., Guédon, J. C. ... La Manna, M. (2002). Budapest open access initiative. *ARL Bimonthly*, 48. Retrieved from <https://dergipark.org.tr/en/pub/tid/page/5833>

- Chen, X., & Olijhoek, T. (2016). Measuring the degrees of openness of scholarly journals with the open access spectrum (OAS) evaluation tool. *Serials Review*, 42(2), 108–115.
<https://doi.org/10.1080/00987913.2016.1182672>
- cOalition S (2019) Why plan S? Retrieved from <https://www.coalition-s.org/why-plan-s/>
- Colledge, L., de Moya-Anegón, F., Guerrero-Bote, V., López-Illescas, C., Aisati, M. E., & Moed, H. (2010). SJR and SNIP: Two new journal metrics in Elsevier's Scopus. *Serials*, 23(3), 215–221.
<http://doi.org/10.1629/23215>
- Conole, G., & Brown, M. (2018). Reflecting on the impact of the open education movement. *Journal of Learning for Development*, 5(3), 187-203. Retrieved from
<http://oasis.col.org/handle/11599/3099>
- Costello, E. (2019). Bronze, free, or fourrée: An open access commentary. *Science Editing*, 6(1), 69-72.
<https://doi.org/10.6087/kcse.157>
- Costello, E., Huijser, H., & Marshall, S. (2019). Education's many "opens". *Australasian Journal of Educational Technology*, 35(3), 1-6. <https://doi.org/10.14742/ajet.5510>
- Earney, L. (2017). Offsetting and its discontents: Challenges and opportunities of open access offsetting agreements. *Insights*, 30(1), 11–24. <https://doi.org/10.1629/uksg.345>
- Eve, M. P., de Vries, S., & Rooryck, J. (2017). The state of the market, offsetting deals, and a demonstrated model for fair open access with the open library of humanities. In L. Chan & F. Loizides (Eds.), *Expanding perspectives on open science: Cultures and diversity in concepts and practice*. Retrieved from <http://eprints.bbk.ac.uk/18914/1/STAL9781614997696-0118.pdf>
- Eve, M., & Priego, E. (2017). Who is actually harmed by predatory publishers? *TripleC: Communication, Capitalism, & Critique: Open Access Journal for a Global Sustainable Information Society*, 15(2), 755–770. Retrieved from <http://www.triple-c.at/index.php/tripleC/article/view/867/1041>
- European Commission. (2019, January) Future of scholarly publishing and scholarly communication - Report of the expert group to the European Commission. Retrieved from https://www.eosc-portal.eu/sites/default/files/KI0518070ENN.en_.pdf
- Freshwater, M. F. (2014). Open access, fauxpen access: Problems in transparency and proposed solutions. *Journal of Plastic, Reconstructive, & Aesthetic Surgery*, 67(4), 589-590.
<https://doi.org/10.1016/j.bjps.2013.09.035>
- Guédon, J. C. (2004). The “green” and “gold” roads to open access: The case for mixing and matching. *Serials Review*, 30(4), 315–328. <https://doi.org/10.1016/j.serrev.2004.09.005>
- Hanafi S., & Boucherie S. (2018, January 18) Discover the data behind the Times Higher Education World university rankings (Blog post). Retrieved from <https://www.elsevier.com/connect/discover-the->

[data-behind-the-times-higher-education-world-university-rankings](#)

- Harnad, S. (1991). Post-Gutenberg galaxy: The fourth revolution in the means of production of knowledge. *Public-Access Computer Systems Review*, 2(1), 39-53. Retrieved from <https://eprints.soton.ac.uk/253376/1/harnad91.postgutenberg.html>
- Harnad, S. (2006, December 4). Re: When is a journal open access? [Online forum comment]. Retrieved from <https://www.southampton.ac.uk/~harnad/Hypermail/Amsci/5881.html>
- Harnad, S., Brody, T., Vallières, F., Carr, L., Hitchcock, S., Gingras, Y. ... Hilf, E. R. (2004). The access/impact problem and the green and gold roads to open access. *Serials Review*, 30(4), 310–314. doi: [10.1080/00987913.2004.10764930](https://doi.org/10.1080/00987913.2004.10764930)
- Heaton, R., Burns, D., & Thoms, B. (2019). Altruism or Self-Interest? Exploring the Motivations of Open Access Authors. *College & Research Libraries*, 80(4), 485-507. <https://doi.org/10.5860/crl.80.4.485>
- Hilton, J., III., Wiley, D., Stein, J., & Johnson, A. (2010). The four 'R's of openness and ALMS analysis: Frameworks for open educational resources. *Open Learning: The Journal of Open, Distance and E-Learning*, 25(1), 37–44. <https://doi.org/10.1080/02680510903482132>
- Jamali, H. R. (2017) Copyright compliance and infringement in ResearchGate full-text journal articles. *Scientometrics*, 112(1), 241-254. <https://doi.org/10.1007/s11192-017-2291-4>
- Larivière, V., Haustein, S., & Mongeon, P. (2015). The oligopoly of academic publishers in the digital era. *PLOS ONE*, 10(6), 1-15. <https://doi.org/10.1371/journal.pone.0127502>
- Lewis, C. L. (2018). The open access citation advantage: Does it exist and what does it mean for libraries? *Information Technology and Libraries*, 37(3), 50–65. <https://doi.org/10.6017/ital.v37i3.10604>
- MacCallum, C. J. (2007) When is open access not open access? *PLOS Biology*, 5(10), 2095-2097. <https://doi.org/10.1371/journal.pbio.0050285>
- Olijhoek, T., & Tennant, J. (2018, September 25). The “problem” of predatory publishing remains a relatively small one and should not be allowed to defame open access [Web log post]. Retrieved from <https://blogs.lse.ac.uk/impactofsocialsciences/2018/09/25/the-problem-of-predatory-publishing-remains-a-relatively-small-one-and-should-not-be-allowed-to-defame-open-access/>
- Perkins, R. A., & Lowenthal, P. R. (2016). Open access journals in educational technology: Results of a survey of experienced users. *Australasian Journal of Educational Technology*, 32(3), 18-37. <https://doi.org/10.14742/ajet.2578>
- Pinfield, S., Salter, J., & Bath, P. A. (2017). A “Gold-centric” implementation of open access: Hybrid journals, the “total cost of publication,” and policy development in the UK and beyond. *Journal of the Association for Information Science and Technology*, 68(9), 2248–2263.

<https://doi.org/10.1002/asi.23742>

- Piwowar, H., Priem, J., Lariviere, V., Alperin, J. P., Matthias, L., Noorlander, B. ... Haustein, S. (2018). The state of OA: A large-scale analysis of the prevalence and impact of open access articles. *PeerJ* 6. <https://doi.org/10.7717/peerj.4375>
- Prosser, D. (2018, September 5). RLUK – Plan S – A major shift for open access in Europe [Web log post]. Retrieved from <https://www.rluk.ac.uk/plan-s-a-major-shift-for-open-access-in-europe/>
- Ridgway, G. (2014, August 22). Could we redefine Gold #OpenAccess: Gold = CC-BY or CC-BY-SA; Silver = NC, ND, or new STM nonsense; Bronze = only open on publisher website [Tweet]. Retrieved from <https://twitter.com/RidgwayGR/status/502774185610211328>
- Registry of Open Access Repository Mandates and Policies. (n.d.). Policies adopted by quarter. Retrieved January 10, 2019, from <http://roarmap.eprints.org/>
- Sherpa RoMEO. (n.d.) Publisher copyright policies & self-archiving. Retrieved from <http://sherpa.ac.uk/romeo/index.php>
- Smith, K. L. (2017). Examining publishing practices: Moving beyond the idea of predatory open access. *Insights* 30(3). 4–10. <http://doi.org/10.1629/uksg.388>
- Solomon, D. J., & Björk, B.-C. (2012). Publication fees in open access publishing: Sources of funding and factors influencing choice of journal. *Journal of the American Society for Information Science and Technology*, 63(1), 98–107. <https://doi.org/10.1002/asi.21660>
- Suber, P. (2012). *Open access*. Cambridge, MA: MIT Press.
- Tennant, J. P., Crane, H., Crick, T., Davila, J., Enkhbayar, A., Havemann, J. ... Vanholsbeeck, M. (2019). Ten myths around open scholarly publishing. *PeerJ Preprints*. <https://doi.org/10.7287/peerj.preprints.27580v1>
- Veletsianos, G., & Kimmons, R. (2013). Scholars and faculty members' lived experiences in online social networks. *The Internet and Higher Education*, 16, 43–50. <https://doi.org/10.1016/j.iheduc.2012.01.004>
- Weller, M. (2011). *The digital scholar: How technology is transforming scholarly practice*. Basingstoke: Bloomsbury Academic.
- Weller, M. (2015). *Battle for open: How openness won and why it doesn't feel like victory*. London: Ubiquity Press.
- Weller, M., Jordan, K., DeVries, I., & Rolfe, V. (2018). Mapping the open education landscape: Citation network analysis of historical open and distance education research. *Open Praxis*, 10(2), 109–126. <https://doi.org/10.5944/openpraxis.10.2.822>

Wiley, D. (2014, March 5). The access compromise and the 5th R [Web log post]. Retrieved from <https://opencontent.org/blog/archives/3221>

Willinsky, J. (2006). *The access principle: The case for open access to research and scholarship*. Cambridge, MA: MIT Press.

Zawacki-Richter, O., Anderson, T., & Tuncay, N. (2010). The growing impact of open access distance education journals: A bibliometric analysis. *International Journal of E-Learning & Distance Education*, 24(3). Retrieved from <http://www.ijede.ca/index.php/jde/article/view/661/1210>

