Zhu, Yimei (2014) Seeking and sharing research information on social media: A 2013 survey of scholarly communication. In Rospigliosi, Asher & Greener, Sue (ed.) *Proceedings of European Conference on Social Media ECSM 2014*, 10-11 July 2014, University of Brighton. Brighton: Academic conferences & publishing international, p. 705-712.

Seeking and sharing research information on social media: A 2013 survey of scholarly communication

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Abstract

Introduction: For academics, the methods of seeking information and sharing research work have been broadened dramatically since the development of internet and Web 2.0. Apart from online journals, academics may gather research information from various online services, such as wikis and Twitter. Social media tools have also provided novel distribution channels for research outputs. Rather than waiting for the long process of publishing in peer-reviewed journals, academics may share ongoing research on research blogs and other social media platforms.

Methods: An internet survey was conducted with 1829 researchers from 12 Russell Group universities. Comparing to the data sourced from the HESA, our sample of UK academics was broadly representative of the UK academic population as defined by our primary demographic variables of gender, discipline area and age.

Findings: The vast majority of respondents never used Twitter (84%), blogs (84%) or social networking sites (81%) to publish ongoing research updates or contributed to public wikis (84%). In total 30% of respondents had experience in sharing ongoing research updates on social media to some extent. Only 16% of respondents reported having used Twitter and 20% reported having used social networking sites to gather research information. However, 60% of respondents reported having read research blogs and 77% reported having read public wikis. Compared to the findings of a similar study, the percentage of academics who reported using Twitter in their research work increased from 10% in 2009 to 21% in 2013.

- Respondents in Social Sciences and Humanities were more likely to gather research information as well as post ongoing research updates online than those in Sciences disciplines. However, respondents in Natural Sciences were more likely to read a public wiki as well as contribute to a public wiki in their research work than those in Medical Sciences, Social Sciences and Humanities.
- Older respondents were more likely to be non-adopters of social media services for both seeking and sharing research information.
- Women seemed to be slightly more likely to adopt Twitter to post ongoing research updates and the gender difference was only significant for junior researchers and respondents in Natural Sciences disciplines.
- Men appeared to be more likely to contribute to a public wiki in their research work and this gender difference was only significant for early to mid career researchers and respondents in Medical Sciences, Natural Sciences and Social Sciences.

Keywords: open science, Twitter, blog, Social Networking Sites, wiki

Introduction

For academics, the methods of seeking information and sharing research work have been broadened dramatically since the development of internet and Web 2.0. The physical spatial restriction of looking for information in books and print journals in the library has now been liberated. Nicholas et al. (2009) studied Oxford Journals database and found that many UK researchers searched research information online out of office hours and probably at home. Apart from online journals, academics may gather research information from various online services, such as blogs, micro-blogs and wikis. Some early academic adopters of Twitter suggested that Twitter was useful for helping them keep up to date on new literature in their fields (Bonetta 2009). Wikis and blogs were found to be frequently used by academics 'keeping up to date' with the latest progress in the research field and 'searching' for knowledge (Gu and Widén-Wulff 2011).

Social media tools have also provided novel distribution channels for research outputs. Rather than waiting for the long process of publishing in peer-reviewed journals, academics may share ongoing research on research blogs, such as the Open Notebook Science project. Open Notebook Science in Chemistry and Chemical Biology was a project whose participants used a web blog to record day-to-day laboratory work within which data could be linked and open to the public (RIN 2010). This involves real-time scholarly communication at all stages of the scientists' work. Other studies also found that social media services such as blogs, Twitter and social networking sites, were effective in disseminating scholarly materials such as publications, information of research projects and conference promotion (Kjellberg 2010;Letierce et al. 2010;Nicholas and Rowlands 2011).

However, the proportion of the UK academics adopting social media tools to seek and share research information are not clear except a survey study conducted in 2009 by Procter et al. (2010b). This current study is trying to construct an overall picture of UK academics seeking and sharing research information on social media and examine adoption disparities for different groups in terms of gender, discipline area and age. The data collection of this current study was completed in the summer 2013.

Background

Social media can be referred to a group of online applications 'that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content' (Kaplan and Haenlein 2010:60). Web 2.0 is seen to offer a technical platform for its users to interact and collaborate with each other in a social media dialogue as creators of user-generated content in a virtual community, in contrast to websites where users are limited to the passive viewing of the content that was created for them (Thanuskodi 2011). Examples of Web 2.0 applications include social networking sites, blogs, micro-blogs, wikis, photo and video sharing sites. These new applications have become more and more popular among academic users and were found to be effective information resources as well as dissemination channels (Gu and Widén-Wulff 2011) in addition to traditional peer-review journals and academic books.

Previous studies of Web 2.0 conducted by Procter *et al. (2010a; 2010b)* and Stewart et al. (2012) used an internet survey with a large sample of UK scholars and interviews with survey respondents and publishers. Procter et al. investigated the use of blogs, wikis and other social media sites in 2009. The survey results indicated that only 4% of respondents wrote a research blog and 1% contributed to a public wiki as frequent users, while 39% of UK academics were non-users of social media. Their findings also suggest that current forms of scholarly communication among UK scholars were strongly influenced by disciplinary and institutional norms. While users of web 2.0 came from all age groups and levels of seniority, the age group 35-44 had the highest percentage of frequent users. Twitter has only started to gain popularity with scholars in the last couple of years and the uses of Twitter to disseminate research

information were not asked in the 2009 survey. Their survey asked whether respondents used Twitter in the course of their research in general. Approximately 4% of respondents reported 'frequently' (at least once a week) and 6% reported 'occasionally' which made it 10% in total for Twitter use in academic work. Over the past three years, Twitter has been adopted for scholarly activities, such as sharing information and resources, asking for advice, promoting work, and networking with peers (Veletsianos 2011). Twitter has often been used in various academic conferences first as a communication tool by using specific hashtags (Ebner et al. 2010). By using official hashtags of those specific conferences, conference organisers are able to disseminate information about the conference and facilitate communication between participants and peers (Letierce *et al*., 2010). Weller et al. (2011) studied two academic conferences' information flows and citations on Twitter and found that a considerable percentage of users (40% and 27% respectively for the two conferences) used URLs in their tweets, in which some of them are directed to publications. Therefore, in this study, it is worth investigating Twitter adoption for scholarly communication. There is a lack of studies in the literature as how social networking sites such as Facebook and ResearchGate were used to seek and share research information.

The Research Councils UK (RCUK 2013), the major academic research funder announced their policy on Open Access (OA) to the outputs of RCUK-funded research which came into effect on 1 April 2013. There are two main routes to open access: the 'gold' OA, which is based on the model of online open access journals; and the 'green' OA, which refers to depositing published or working papers at open online repositories or personal websites (Björk 2004). To promote Gold and Green OA publications, publishers, librarians, research communities and individuals may announce the publications on Twitter and blogs by including direct links to these online papers. Social networking sites such as Academia.edu and LinkedIn were also found to have enhanced access to online publications and content hosted in repositories (Kelly and Delasalle 2012).

The non-open subscription-based journals by those major academic publishers are online too and each article would usually have a URL link to the page with article title and abstract. Academic Twitter users often cited research articles by either providing link to a page on a social bookmarking service like CiteULike or to a blog post or news article describing and linking to the resource (Priem and Costello 2010). A study of blog aggregator ResearchBlogging.org (RB) found that academic bloggers wrote blog posts citing papers from high-impact journals and most blogs in their sample (72%) had at least one active public Twitter account (Shema et al. 2012). Other social media tools such as social bookmarking sites were found to be popular for bookmarking published journal articles, records in databases and digital repositories (Borrego and Fry 2012). Thus social media services can be good sources for gathering research information, networking with colleagues and keeping up to date with new findings.

Wikis have also gained popularity over the years in higher education and academia. Public Wikis such as Wikipedia were found to have helped university students check facts and find background information for academic purposes (Lim 2009). These functions also apply to academics. A study found that *Wikipedia's* citation rates in scholarly publications had been consistently increasing as Wikipedia was cited 3,679 times in the *WoS* and *Scopus* databases during the previous nine years of that study (Park 2011). Therefore, wikis have become sources for providing research information and references to academics. A study found that the majority of participants (70%) reported reading Wikipedia at least several times a week, although only 16% said they had ever contributed to Wikipedia (Antin and Cheshire 2010).

Hopkins et al. (2013) surveyed academics from two Sciences disciplines and two Social Sciences disciplines which found that women had lower h-index than men in all four disciplines and women were under-represented in academic positions and published less than men. H-index has been adopted to measure individual's research performance which quantifies the impact of an individual's research outputs (Bornmann and Daniel 2007). To fight against gender inequality in academia, women may use new forms of scholarly communication to promote their work and help them find collaboration opportunities through the adoption of social media. However, Shema et al. (2012) found that there were gender disparities in science blogging that men were more likely to write research blogs than women in their sample. A 2010 survey found age and discipline disparities for social media use in research workflow that respondents in Humanities and Social Sciences and those younger than 35 were more likely to be social media users (Nicholas and Rowlands 2011). Thus, it is also worth investigating whether there is any gender, discipline or age disparities in seeking and sharing research information on social media for UK academics in general. Thus this study sets out to answer these questions:

a. To what extent do UK academics seek and share research information on social media?
b. Are there disciplinary disparities when seeking and sharing research information on social media?
c. Are there age disparities for these practices?
d. Are there gender disparities for these practices?

Methods

In order to capture these new practices among UK academic community, we conducted a series of scoping studies using qualitative methods followed up by an internet survey of academics from twelve UK universities. The scoping studies informed the development of the survey and the specific questions which were included. The scoping studies included a review of social media tools and their use, exploratory interviews and a case study of Twitter live chat which were described in Zhu and Procter (2012). The survey questionnaire was piloted with a number of colleagues and the questions were edited before final distribution.

In this study, in order to investigate the proportion of academics who adopt social media for scholarly communication, we decided to target all academics in Russell Group universities as the population for the survey. The Russell group universities were chosen to be drawn a sample from as they all have a strong research focus. Russell Group, which claimed to 'represents 24 leading UK universities which are committed to maintaining the very best research'[1], are well-acknowledged in the world as elite universities for their impact of research. As the nature of this study is a PhD project with limited fund, we used clustering to lower the cost of distribution of the survey. Each university became a primary sampling unit (PSU) and half of PSUs were chosen in the sample. A random sample of ten out of twenty original Russell group universities (before August 2012) and two out of four new group members were selected. In theory, all of the twelve units' email addresses would be harvested from those universities' websites although there would be bias. The exclusion bias resulted from exclusion of particular groups from the sample, such as those having no email addresses listed on their university websites. It is also possible that our techniques failed to harvest certain email addresses from sampled universities' websites.

The email addresses from these twelve universities' official websites were captured using a script written in the Perl programming language and the final numbers of email addresses in the sample was 42,008 after cleaning up irrelevant addresses. An invitation letter with the author's information, the introduction of the research and a link to the web survey was sent to each email address in the sample and this process was completed by 2 July 2013. The survey was live for around a month and was closed at Tuesday 6 August 2013. We received 1841 responses with response rate at 4.4%. This survey is the biggest of its kind. The response rate is similar as the 2009 scholarly communication survey conducted by Procter et al (2010), which indicates that this kind of response rate may be a common characteristic for this type of internet survey. As we only sampled half of the Russell Group universities, the survey is limited in its representativeness for other UK higher education institutions. However, comparing to the data sourced from the Higher Education Statistics Agency (HESA 2013), our sample of UK academics was broadly representative of the UK academic population as defined by our primary demographic variables of gender, discipline area and age.

The final valid cases were 1829 for this study after excluding problematic cases (two indicated deliberate sabotage and ten only filled in one or two questions). Among the 1829 survey respondents, 46% were female (836) and 54% were male (977). The majority of respondents fell into the age group of 25-34 (31%) or 35-44 (26%). Less than 10% of the respondents were under 25 or over 65. There were 36 disciplines with an 'other (please specify)' option in the original question. These disciplines were listed in the same order as the official 2014 REF categories and were grouped into four discipline areas—medical, biological & human sciences (35%), natural science & engineering (23%), business, law & social sciences

[1] See http://www.russellgroup.ac.uk/ accessed 2 November 2013

(27%) and humanities & cultural studies (15%). This means that 58% of respondents were from Sciences subjects and 42% were from Humanities subjects.

One section of the survey questionnaire asked questions about online services that the respondents used, how frequent they used them, why they started using them and some questions gave options for comments. In order to explore the relationships between reported behaviour on social media and various demographic variables, we ran cross-tabulation of the two observed variables along with Pearson Chi-square test. Chi-square test examines whether there is a real association between two categorical variables. If the significance value p is small enough (usually < 0.05), we can reject the null hypothesis that the relationship between the two variables are actually unrelated to each other (Field 2009). This method of analysis will be used to explore whether there were any disparities by discipline area, age and gender.

Findings

a. To what extent do UK academics seek and share research information on social media?

Table 1: Frequency of gathering & sharing research information on blogs, Twitter, SNS & Wiki

	always		often		sometimes		never		
	N	%	N	%	N	%	N	%	Total
read research blog	22	1%	133	8%	860	51%	662	39%	1677
comment on research blog	3	0%	17	1%	341	20%	1313	78%	1674
post research updates on blog	17	1%	40	2%	204	12%	1407	84%	1668
gather research info on Twitter	25	1%	54	3%	176	11%	1415	85%	1670
post research updates on Twitter	25	1%	65	4%	182	11%	1401	84%	1673
gather research info on SNS	5	0%	59	4%	271	16%	1341	80%	1676
post research updates on SNS	10	1%	46	3%	255	15%	1360	81%	1671
posting ongoing research updates on any of blog/Twitter/SNs	32	2%	107	6%	371	22%	1167	70%	1677
read a public wiki	83	5%	461	28%	739	44%	383	23%	1666
contribute to a public wiki	2	0%	15	1%	250	15%	1383	84%	1650

As shown in Table 1, the vast majority of respondents never used Twitter (84%), blogs (84%) or social networking sites (81%) to publish ongoing research updates or contributed to public wikis (84%). Compared to the low rate of contribution/sharing rate, a much higher percentage of respondents reported using blogs and wikis to gather research information. The majority of respondents (60%) reported having read research blogs and 77% reported having read public wikis in their research work. Only 20% of respondents reported having gathered research information on Social Networking Sites (SNS) such as Facebook and ResearchGate and 15% said to have gathered information on Twitter in research work.

The pattern for the experiences with posting research updates on Twitter (16%) and SNS (19%) is similar to gathering research information on Twitter (15%) and SNS (20%). However, the vast majority of respondents reported having 'never' commented on (78%) or posted research updates (84%) on blogs while the majority of them reported having read research blogs. Similarly, the vast majority reported having 'never' contributed to a public wiki (84%) while the majority read public wikis in their research work. Among the four social media tools reported here, Twitter owned more 'super contributors' who 'always' shared research updates. Wikis had more 'super and frequent readers' who read public wikis as 'always' (5%) or 'often' (28%). However, Wikis had less 'super and frequent contributors' (1% in total) compared to the other three social media tools (all over 3%).

While combining blogs, twitter and SNS together, in total 30% of respondents had experience in sharing ongoing research updates on at least one of these three social media tools. Among these users, 2% were super users, 6% were frequent users and 22% were occasional users in sharing their research information in a novel form.

b. Are there disciplinary disparities when seeking and sharing research information on social media?

In general, respondents in Humanities & Cultural Studies and Business, Law & Social Sciences were more likely to gather research information and post ongoing research updates on blogs, Twitter and Social Networking Sites, while those in Medical, Biological & Human sciences and Natural Sciences & Engineering were more likely to be non-users for these tools. For example, 22% of respondents in Humanities & Cultural Studies and 21% in Business, Law & Social Sciences had 'always', 'often' or 'sometimes' posted research updates on Twitter compared to 14% in Natural Sciences & Engineering and 12% in Medical, Biological & Human sciences (overall $p<0.001$). The patterns were similar for gathering research updates on Twitter as well as the use of blogs and social networking sites for gathering and sharing research information.

However, for Wiki use, the pattern was slightly different. Respondents in Natural Sciences & Engineering seemed to be most experienced in reading and contributing to public wikis. Natural Sciences & Engineering had higher percentage of 'super and frequent readers' who 'always' (9%) and 'often' (40%) read public wikis while in the other three discipline areas, super readers were all at around 4% and frequent readers were at between 23-25% ($p<0.001$). For contributing to wikis, 24% of those in Natural Sciences & Engineering reported having contributed to public wikis compared to 18% in Humanities & Cultural Studies, 13% in Business, Law & Social Sciences and 13% in Medical, Biological & Human sciences. The contribution gap between various discipline areas were mainly among occasional users who reported 'sometimes' contributing to wikis. Taking in account of all four social media tools reported here, respondents in Medical, Biological & Human sciences were most likely to be non-users of all of them.

c. Are there age disparities for these practices?

In general, respondents' reported experiences with gathering and sharing research information decreased with age. In all cases, those aged 55 and over were most likely to be non-users. Respondents who posted ongoing research updates online were more likely to be under 45 years old, having less than 20 years research experiences and having lower job grades. Since research experiences and job grades heavily correlate with age, we focus on age disparities in this paper.

Respondents aged under 35 were most likely to have used Twitter to post ongoing research updates (22%), followed by those aged 35-44 (21%) compared to those aged 45-54 (11%) and 55 and over (4%) ($p<0.001$). The gap between the youngest group (under 35) and oldest group (55 and over) in terms of sharing research updates on Twitter was 18%. The patterns were similar for gathering research updates on Twitter as well as the use of blogs and social networking sites for gathering and sharing research information. The gap between the youngest group and oldest group in terms of reading wikis and contributing to wikis were smaller than the gap for using other social media tools reported here. Around 80% of those under 35 reported having read public wikis compared to 73% of those 55 and over with a gap of 7% ($p<0.001$). The association between contributing to public wikis and age groups was not significant ($p=0.493$).

d. Are there gender disparities for these practices?

Women appeared to be more likely to gather research information (18% vs 13%) and sharing ongoing research updates (19% vs 14%) on Twitter ($p<0.05$). Women were more likely to be 'super users' or 'frequent users' for gathering research information (7% vs 3%) or posting research updates (7% vs 4%) on Twitter. Women were also more likely to gather research information (23% vs 17%) on Social Networking Sites ($p<0.05$). On the other hand, men seemed to be more likely to contribute to public wikis and frequently read wikis. Around 21% of men reported having contributed to public wikis compared to 10% of women ($p<0.001$). Men were more likely to report having 'always' (6% vs 3%) or 'often' (32% vs 23%) read public wikis ($p<0.001$). Survey results indicated no difference between male and female respondents in terms of posting ongoing research on SNS or reading/commenting on/posting ongoing research on blogs.

When comparing gender differences in each discipline area by running a three-way cross-tabulation, it turned out that the gender disparities for adopting Twitter were only significant for those in Natural Sciences & Engineering with a 10% gap between women and men for both gathering and sharing research information ($p<0.05$). Only those in Humanities & Cultural Studies had gender disparities of 13% for gathering research information on SNS. On the other hand, men appeared to be more likely to contribute to a public wiki in all discipline areas except Humanities & Cultural Studies. Gender disparities for reading public wikis were only significant for the frequent readers in Social Sciences ($p<0.05$).

When comparing gender differences in different job grades, only female researchers in training were more likely to adopt Twitter to post ongoing research updates and only female professors/readers were more likely to adopt Twitter to gather research information with significant gaps ($p<0.05$). There was no gender disparity for professors/readers in terms of contributing to a public wiki, but the gap (over 9%) existed for early to mid career researchers.

Conclusion and Discussion

This study found that the vast majority of respondents have not yet adopted social media tools to share their research work. This is largely because contribution of scholarly work on social media has not been recognised by academic reward system. The predominant indicator of professional performance for researchers and the institutions that employed them has always been related with the publication of articles in journals and the relative prestige of the journals in which they are published (Merton 1957;Schauder 1993;Correia and Teixeira 2005). Under the academic reward system, individual researcher's career advancement and promotion are often based on their professional performance in terms of the quality and quantity of publications (Kim 2011). Thus the majority of academics still view the traditional distribution channels as most important and have yet to adopt social media for sharing research work, which is in line with findings from Procter et al. (2010a).

However, the new digital technology has changed the way people seek information. As we found that the majority of respondents have had experiences gathering research information through public wikis and research blogs. There was also an increase in the use of Twitter in research work in the past three years. The percentage of academics who reported using Twitter in their research work increased from 10% to 21% compared to Procter et al's survey findings in 2009. Since the benefits of using social media are supported by a number of studies (e.g., Kjellberg 2010;Eysenbach 2011;Zhu 2012), academics who have not yet adopted social media could face a possibility of missing out these benefits. However, there are also risks related to sharing ongoing research, such as leaking results to competitors or having good ideas being stolen, which were asked in the survey and got over 30% agreement from respondents.

Disciplinary disparities were confirmed in this study as respondents in Social Sciences and Humanities were more likely to seek and share research information on social media than those in Sciences disciplines. However, respondents in Natural Sciences were more likely to read and contribute to public wikis in their research work than those in Medical Sciences, Social Sciences and Humanities. This is in line with survey findings from Nicholas and Rowlands (2011) of a range of international scholars. Age disparities were confirmed in this study as respondents' reported experiences with gathering and sharing research information decreased with age. This finding is in line with previous studies which found age being inversely associated to internet and other new media use (Dutton et al. 2005;Helsper and Eynon 2010). Confounding expectations that use of new technology is more easily accepted by men as confirmed by

Shema et al. (2012) and Procter et al. (2010b), this study found that women appeared to be more likely to adopt Twitter and Social Networking Sites to gather research information as well as share research updates on Twitter. On the other hand, men seemed to be more likely to contribute to public wikis in their research work. However, these gender disparity patterns were not the same for those in different discipline areas or job grades. For example, gender disparities for adopting Twitter were only significant for those in Natural Sciences disciplines. For wiki contributors, the gender disparities were only significant for early to mid career researchers and respondents in Medical Sciences, Natural Sciences and Social Sciences.

This study found that academics who adopted Twitter and Social Networking Sites to gather research information were also likely to share research work on those platforms. Those super users and frequent users of Twitter who gathered research information also shared their research work frequently. However, the majority of those who gathered information on blogs and wikis rarely contributed on these platforms and were merely observers of blogs and wikis. As one respondent commented, 'Oh dear, I benefit but don't contribute. Oops.' The patterns of wikis adoption are similar to the findings by Antin and Cheshire (2010) who argued that readers of public wikis such as Wikipedia were not free-riders because readers provided a valuable service to Wikipedia by acting as an audience to help strengthen the rewards that motivate others to participate in more active ways. The reported gaps between seeking and sharing on various social media forms may also because that Twitter and Social Networking sites such as Facebook and Academia.edu are more interactive and require users to register, create a profile, and to connect with others. It requires the users to invest time and effort to maintain relationships such as searching for colleagues and gaining followers on those sites. Many academics may find this distracting and wasting time. While blogs and wikis are more straightforward without having to register or creating profiles in order to find useful resources. As institutional blogs have become more and more popular in academia, individuals can easily be directed to these sites by university News Channels, online newspaper or colleagues' recommendation. Further research would be carried out to explore what other factors are associated with the extent of social media adoption in research work.

Acknowledgements

The author thanks Kingsley Purdam, Martin Everett, Rob Procter, Andy Macheta and colleagues in Sociology and Social Statistics of University of Manchester. Special thanks to the participants of this study.

References

Antin, J. & Cheshire, C. (2010). Readers are not free-riders: reading as a form of participation on wikipedia. *Proceedings of the 2010 ACM conference on Computer supported cooperative work.* ACM.

Björk, B. C. (2004). Open access to scientific publications–an analysis of the barriers to change? *Information research,* 9(2)**,** 170.

Bonetta, L. (2009). Should you be tweeting? *Cell,* 139(3)**,** 452-453.

Bornmann, L. & Daniel, H. D. (2007). What do we know about the h index? *Journal of the American Society for Information Science and Technology,* 58(9)**,** 1381-1385.

Borrego, Á. & Fry, J. (2012). Measuring researchers' use of scholarly information through social bookmarking data: A case study of BibSonomy. *Journal of Information Science*, 38(3)**,** 297-308.

Correia, A. M. R. & Teixeira, J. C. (2005). Reforming scholarly publishing and knowledge communication: From the advent of the scholarly journal to the challenges of open access. *Online information review,* 29(4)**,** 349-364.

Dutton, W., Di Gennaro, C. & Millwood Hargrave, A. (2005). Oxford Internet Survey 2005 report: the internet in Britain. *Available at SSRN 1327035*.

Ebner, M., Mühlburger, H., Schaffert, S., Schiefner, M., Reinhardt, W. & Wheeler, S. (2010). Getting Granular on Twitter: Tweets from a Conference and Their Limited Usefulness for Non-Participants. *Key Competencies in the Knowledge Society***,** 102-113.

Zhu, Yimei (2014) Seeking and sharing research information on social media: A 2013 survey of scholarly communication. In Rospigliosi, Asher & Greener, Sue (ed.) *Proceedings of European Conference on Social Media ECSM 2014*, 10-11 July 2014, University of Brighton. Brighton: Academic conferences & publishing international, p. 705-712.

Eysenbach, G. (2011). Can tweets predict citations? Metrics of social impact based on twitter and correlation with traditional metrics of scientific impact. *Journal of medical Internet research,* 13(4).

Field, A. (2009). *Discovering statistics using SPSS, third edition*. London: Sage

Gu, F. & Widén-Wulff, G. (2011). Scholarly communication and possible changes in the context of social media: A Finnish case study. *Electronic Library, The,* 29(6)**,** 762-776.

Helsper, E. J. & Eynon, R. (2010). Digital natives: where is the evidence? *British educational research journal,* 36(3)**,** 503-520.

HESA. (2013). *Higher Education Statistics for the United Kingdom 2011/12* [Online]. Available: http://www.hesa.ac.uk/ [Accessed 21 September 2013].

Hopkins, A. L., Jawitz, J. W., McCarty, C., Goldman, A. & Basu, N. B. (2013). Disparities in publication patterns by gender, race and ethnicity based on a survey of a random sample of authors. *Scientometrics,* 96(2)**,** 515-534.

Kaplan, A. M. & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of Social Media. *Business horizons,* 53(1)**,** 59-68.

Kelly, B. & Delasalle, J. (2012). Can LinkedIn and Academia.edu enhance access to open repositories? *OR2012: the 7th International Conference on Open Repositories, 9-13 July 2012.* Edinburgh, Scotland.

Kim, J. (2011). Motivations of Faculty Self-archiving in Institutional Repositories. *Journal of Academic Librarianship,* 37(3)**,** 246-254.

Kjellberg, S. (2010). I am a blogging researcher: Motivations for blogging in a scholarly context. *First Monday,* 15(8).

Letierce, J., Passant, A., Breslin, J. & Decker, S. (2010). Understanding how Twitter is used to spread scientific messages. *Web Science Conference.* Raleigh, NC, USA.

Lim, S. (2009). How and why do college students use Wikipedia? *Journal of the American Society for Information Science and Technology,* 60(11)**,** 2189-2202.

Merton, R. K. (1957). Priorities in scientific discovery: a chapter in the sociology of science. *American Sociological Review,* 22(6)**,** 635-659.

Nicholas, D., Clark, D., Rowlands, I. & Jamali, H. R. (2009). Online use and information seeking behaviour: institutional and subject comparisons of UK researchers. *Journal of Information Science,* 35(6)**,** 660-676.

Nicholas, D. & Rowlands, I. (2011). Social media use in the research workflow. *Information Services and Use,* 31(1)**,** 61-83.

Park, T. K. (2011). The visibility of Wikipedia in scholarly publications. *First Monday,* 16(8).

Priem, J. & Costello, K. L. (2010). How and why scholars cite on Twitter. *Proceedings of the American Society for Information Science and Technology,* 47(1)**,** 1-4.

Procter, R., Williams, R. & Stewart, J. (2010a). If You Build It, Will They Come? How Researchers Perceive and Use Web 2.0. *Research Information Network. Available at www. rin. ac. uk/system/files/attachments/web_2. 0_screen. pdf [accessed 21 Dec 2011]*.

Procter, R., Williams, R., Stewart, J., Poschen, M., Snee, H., Voss, A. & Asgari-Targhi, M. (2010b). Adoption and use of Web 2.0 in scholarly communications. *Philosophical Transactions of the Royal Society A,* 368(1926).

RCUK. (2013). *RCUK Policy on Open Access* [Online]. Research Councils UK. Available: http://www.rcuk.ac.uk/research/Pages/outputs.aspx [Accessed 25 September 2013].

RIN. (2010). *Open to All: Case Studies of Openness in Research* [Online]. Research Information Network Available: http://www.rin.ac.uk/our-work/data-management-and-curation/open-science-case-studies [Accessed 25 June 2011].

Schauder, D. (1993). Electronic publishing of professional articles: attitudes of academics and implications for the scholarly communication industry. *Proceedings of the IATUL Conferences.*

Shema, H., Bar-Ilan, J. & Thelwall, M. (2012). Research Blogs and the Discussion of Scholarly Information. *Plos One,* 7(5)**,** e35869.

Stewart, J., Procter, R., Williams, R. and Poschen, M. (2012). The Role of Academic publishers in shaping the development of Web 2.0 services for scholarly communication *New Media & Society,* DOI: 10.1177/1461444812465141.

Thanuskodi, S. (2011). WEB 2.0 Awareness among Library and Information Science Professionals of the Engineering Colleges in Chennai City: A Survey. *J Communication,* 1(2)**,** 69-75.

Veletsianos, G. (2011). Higher education scholars' participation and practices on Twitter. *Journal of Computer Assisted Learning* [Online]. Available: http://dx.doi.org/10.1111/j.1365-2729.2011.00449.x [Accessed 23 Feb 2012].

Weller, K., Dröge, E. & Puschmann, C. (2011). Citation Analysis in Twitter. Approaches for Defining and Measuring Information Flows within Tweets during Scientific Conferences. *Proceedings of Making Sense of Microposts.*

Zhu, Y. (2012). Shall we use social media for our research. *The Co-Production of Knowledge Symposium, University of York, 18-20 July 2012.*

Zhu, Y. & Procter, R. (2012). *Use of blogs, Twitter and Facebook by PhD Students for Scholarly Communication: A UK study. China New Media Communication Association Annual Conference, Macau International Conference, 6-8 December 2012* [Online]. Available: https://www.escholar.manchester.ac.uk/item/?pid=uk-ac-man-scw:187789 [Accessed 24/04/2014].