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Abstract

The research reported on in this paper explores the use of social media for work-related or professional purposes. In particular, it focuses on the perceptions and use of social media by academics in the UK. The purpose of the research was to explore the potential social media has to facilitate the changing landscape of higher education and support the individual academic in their role. Of particular interest is how specific social media tools are being used to enhance networking opportunities and contribute to career progression. The use of social media was explored in detail through interviews and a survey. Typical activities that are currently being undertaken were identified and user group profiles developed that articulate different levels of engagement with these tools and the motivations that each group of users have for using social media. The study found that, with increasing levels of activity, the number of motivations for using social media increase, as does the perceived number of successful outcomes, including contributions towards career progression. The main barriers to using social media were identified as a lack of time and skills to undertake these activities, as well as a negative perception towards social media. Recommendations for increasing participation are: to provide practical training, including the sharing of good practice; and to initiate dialogues within institutions regarding the potential career progression opportunities that social media may afford.

Keywords: Social media, Twitter, blogs, social network sites, networking, STEM.

Introduction

The increasing popularity and availability of social media over the past decade has attracted much attention. New research initiatives have investigated how social media are being used, from an individual's viewpoint but also how organisations might make use of a technology that has now permeated the lives of so many people. From the individual's perspective, research has explored how people are using social media to interact and engage with different communities. Of particular interest is the impact on the size and shape of an individual's social capital (Benson, Filippaiso & Morgan, 2010; Finkbeiner, 2013; Ellison, Steinfield & Lampe, 2007) and the implications for in-person or face-to-face socialising (Brandzaeg, 2012; Pollet, Roberts & Dunbar, 2011). On an organisational level, research has explored how social media may be used to engage with various stakeholders and communities (Lovejoy & Saxton, 2012; Rybalko & Seltzer, 2010; Waters, Burnett, Lamm & Lucas, 2009). Some organisations are developing and implementing social media marketing strategies. Work has also been published that develops profiles to describe different types of user, to attempt to predict user behaviour and develop appropriate marketing strategies (Foster, West & Francescucci, 2011; Ip & Wagner, 2008; Lorenzo-Romero, Alarcon-del-Amo & Constantinides, 2012).

The purpose of the research presented here is to investigate the experiences of individuals using social media within a specific work environment. The aim is to identify professional motivations for using social media and investigate whether these tools are being used to promote engagement with existing professional networks and extend the boundaries of these networks to reach broader communities. The research also explores the perceived impact of

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these activities and whether they are creating positive career progression opportunities. The specific work context that is the focus of this research is the use of social media by UK academics in science, technology, engineering and mathematics (STEM) related disciplines. This includes professors, lecturers and researchers working within higher education institutions (HEIs). Academics working within these fields are almost certain to have had previous experience working with technology, and exposure to some form of computer-mediated communication in their roles. It is therefore logical to expect that the use of social media will have already filtered into some working practices.

The research begins with a small scale exploratory study focussing on the use of social media at the UK Open University (UK OU). The UK OU is the largest provider of distance education in the UK and computer-mediated communication is central to teaching and research activities. A range of electronic communication tools, including various forms of social media, are used to support learning and teaching activities and collaborative research projects. As such, some academics within the UK OU have been using social media tools for quite some time. The research then moves on to conduct a larger scale exploration of emerging themes and patterns of activity with a more substantial sample set at other HEIs.

Background

The changing academic environment

This paper explores how social media tools are being used to support some of aspects of the academic role. The changing nature of the academic role has attracted attention in recent years. Increasing commercial interests within higher education and the effects this is having on the individual academic are leading to complex professional identities with a shift towards alignment with corporate culture (Billot, 2010; Winter, 2009). The new university fee structures introduced in the UK have sparked debates about students taking on the role of customer (Garner, 2012) and HEIs having to adapt their marketing strategies and compete for student registrations. As a part of an academic's research activities, increasing public engagement seems central to the changing nature of the individual academic role. Academic researchers are expected to engage with wider user communities and, where possible, connect with the public (Lispett, 2010). Implications are that the academic role is something that can no longer only be nurtured within specialist academic groups and subscription based journals (Freedman & Anyangwe, 2012). Research activities that have an impact on a HEI's wider strategies and that attract attention, and therefore funding, from new spheres are encouraged.

Social media in academia

Information and communication technologies (ICTs) have transformed professional and work-place activity. They have affected how people communicate, collaborate, and find and share information. Over the past decade, the social influences of Web 2.0 and the huge increase in social media tools that are freely available have transformed these activities yet again. In this research, the term 'social media tool' includes blogs, Twitter, social networking sites (such as Facebook and professional based sites such as LinkedIn), media sharing sites (such as YouTube, Flickr and SlideShare) and social bookmarking sites (such as Delicious).

From a higher education perspective, exploiting the fact that many of these tools have already permeated students' lives outside of their studies, some of these tools have been incorporated into both formal and informal learning activities (Donlan, 2014; Kear, Donelan & Williams, 2014; Selwyn, 2009; Tess, 2013). From a career development view-point, and still making use of graduates' fluency with these tools, an abundance of resources are available that offer

advice on activities such as: finding jobs through social networking; managing an online reputation; and self-marketing techniques. Social media offers a low-cost platform for building and communicating a professional identity or '*personal brand, communicating who you are both within and outside your company*' (Dutta, 2010).

The research presented in this paper focuses on the perceptions of today's academics of how these tools fit in with the academic role. With the number of academic authored blogs that are now available, and an increasing presence on Twitter, the evidence suggests that some academics are embracing the use of these tools as avenues for increasing public engagement and for creating an online professional presence. Recent discussions on digital scholarship (Pearce, 2010; Weller, 2010) and open access publishing (Freedman & Anyangwe, 2012) also imply that social media may be becoming an important mechanism in the dissemination of research (Osterrieder, 2012; Roscorla, 2012). Blogs are being used to circulate early research findings and invite comment on early drafts of books (Weller, 2010). Twitter offers a space that can be used to publicise links to blogs or 'follow' peers in order to keep up with what others in similar fields are doing. 'Professional' social networking sites such as LinkedIn and Academia.edu offer opportunities to build professional networks and create an online professional profile.

So the tools are available and initial evidence has shown that academics are interested in using social media for enhancing their professional reputation and interacting with wider communities to generate increased interested in their work (Knight & Kaye, 2014). The research presented here sought evidence of these activities and investigated the perceived impact they are having on networking, wider engagement and ultimately career progression opportunities. It asks whether academics are adapting their ways of working, publishing, networking and engaging to make use of these new methods and tools, and if so whether there are measurable outcomes with respect to professional development.

Social media research
Published work that examines the use of social media spans many disciplines including computer science, in particular computer-mediated communication (e.g. Brandtzaeg, 2012; Lovejoy & Saxton, 2012), social behaviour and psychology (e.g. Pollet et al., 2011; Lorenzo-Romero et al., 2012) and business, management and marketing (e.g. Finkeiner, 2012; Foster et al., 2011). One way of dealing with data that describes how people use technology is using segmentation – a marketing strategy that aims to divide users into groups based on common needs, in order to develop targeted marketing strategies. This 'Social technographics' is a market research tool that classifies social media users according to their level of participation and is used by companies to set their social media agendas (Li, 2007; Zhang, 2010). Foster et al. (2011) provide a useful summary of the published work on social media segmentation which provides various frameworks and spans various disciplines including Brand Management (Marketing), Computer Science and Sociology. Of particular note to this research is the work carried out by Ip & Wagner (2008) that studied weblogging (or blogging) activity. Through a series of 33 interviews with bloggers the researchers developed four categories of user, based on their usage intensity. In increasing order of usage, from rarely to several times a day, these four categories were: Lurkers, Personal, Active and Habitual. Similarly, more recent work situated within the Social Behaviour literature (Lorenzo-Romero et al., 2012) developed different social networking site user groups by looking at the frequency of different activities, sociodemographic variables, social networking experience and patterns of interaction. They defined three user groups: Introvert,

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Versatile, and Expert communicator. Table 1 provides a brief summary of the activities of these three user groups.

Table 1: A summary of social networking site user groups (Lorenzo-Romero et al., 2012)

The above profiles were developed based on data describing participants' use of the internet and social networking sites in general. Activities that have a professional purpose were not the focus. The findings of the research presented in this paper extend on the user groups developed by Lorenzo-Romero et al. (2012) and add to the original profiles by considering how the different levels of participation in work-related activities may be classified. Activities are associated with the original definitions to enable different levels of professional or work-related usage to be identified. The research also includes other forms of social media, such as Twitter and blogs, as well as use of social networking sites.

Whilst the different groups are easily identified by their activities and patterns of interaction, an interesting aspect that also identifies them are different motivations for using social networking sites. For example, in the original research (Lorenzo-Romero et al., 2012) the only motivation identified for Introvert users was that they had been invited by others, whereas users in the other two groups tended to exhibit other, more self-driven motivations. For example, Versatile users cited maintaining contact with friends or entertainment as additional motivations. Expert communicators gave a wide range of possible motivations including: to make new friends, for the novelty, professional interests, establishing relationships, to keep informed about events and to develop existing relationships.

The research presented here focuses not only on the activities being undertaken but the motivations that academics have for engaging with these tools. It then goes onto examine the perceived outcomes. This is an important dimension to the research, particularly as the motivations and outcomes are professionally orientated and should align with the academic role and demands regarding networking and engagement.

Research objectives

This research provides a timely exploration into how STEM academics are using social media. It extends recent work on social media user group profiles to include use of these tools from a work-orientated viewpoint. The main research questions addressed are:

- How are STEM academics currently using social media in their working practices?
- What are the motivations for, and perceived outcomes of, using social media within a professional context?
- What are the barriers that are preventing STEM academics from using social media in their working practices, and what recommendations can be made to support them?

Method

The research takes a mixed-methods approach, using interviews and an online survey. A mixed-methods approach is described by Creswell (2003) as combining the use of qualitative and quantitative methods. One mixed-method approach is to start with a general exploration to elicit the key variables involved and then go on to explore these variables with a large sample (Creswell, 2003, p. 22). For example, a study might use a small number of exploratory interviews to identify the key issues, followed by a larger scale survey to assess the significance of these issues. This method suits the current study well so the research was

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carried out in two phases. The first phase took a qualitative approach, and was a small scale exploratory study. This was used to identify the key themes and to begin to identify a range of activities of STEM academics already using social media. The second phase of the study aimed to explore these emerging themes and patterns with a more substantial sample set, and used an online survey to encourage a wide range and large number of responses.

Table 2 provides a summary of: the time periods for data collection; sample sizes; methods; and approaches used in the two phases of the research. Each phase is then described in more detail, in terms of approaches and objectives, in the rest of this section. The results of both phases are then discussed in the next section.

Table 2: Phases of the project

Phase 1: Interviews
A small number of semi-structured, face-to-face interviews were used in the first phase. These enabled predetermined topics to be discussed and yet allowed unexpected responses to be explored in more detail as they arose (Anderson & Kanuka, 2003). The main aims of the interviews were:
- to gain an insight into the perceptions and experiences of academics that are currently using social media in some form;
- to start to develop user group profiles based on work-related activities.

The interview participants needed to have a work-related social media presence. Therefore, potential participants for this phase of the project were either blogging on a regular basis (about work related subjects) and/or posting work related updates and connecting to (amongst others) work related connections via Twitter or social networking sites.

Potential participants who were employed as academic or academic-related members of staff within STEM departments at the UK Open University (UK OU) were identified. The UK OU was where the research project was being carried out and therefore direct access for face-to-face interviews was available. In order to identify potential participants, personal website profiles of UK OU academic staff within STEM disciplines were studied to find links to blogs or Twitter usernames. Additionally, the search functionality was used to find UK OU STEM academics with a presence on Twitter. From the results of these investigations a pool of potential participants was identified. Invitations to participate in the study were sent to 6 people via e-mail. This number was chosen as it allowed a range of disciplines across STEM, and a variety of different social media related activities, to be included. Keeping the number small ensured that in-depth discussions could be held with each participant and the subsequent analysis of the interview data was thorough and detailed but could be carried out within the time constraints of the project. From these initial invitations 5 people agreed to be interviewed. It was felt that this number was sufficient to cover the different areas identified above.

Although the sample set for Phase 1 was potentially biased, as all participants were from the same HEI, Phase 2 extended the research beyond the UK OU to STEM academics at other UK HEIs.

The 5 interviews were conducted over a period of a month (May/June 2012). All interviews were recorded, with the permission of the participants, and then transcribed to assist in the

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analysis. Each interview lasted between 15 and 30 minutes and used open ended questions that guided discussions around four general areas of interest:

- Activities – what were they doing;
- Motivations – why were they doing it;
- Outcomes – what benefits, or otherwise, did they feel they were getting out of it.

Phase 2: Online survey

The second phase of the study aimed to collect both qualitative and quantitative data from a substantial sample set through a survey. The research was extended to other UK HEIs to examine patterns of engagement amongst UK academics more generally. In addition, those who did not use social media for work-related purposes were also invited to participate in the research. The main aims of the survey were:

- To further investigate and validate patterns and themes emerging from Phase 1
- To investigate differences between the different social media tools
- To investigate the barriers for those not using social media

An online survey was used, as this offers a range of advantages over paper or telephone surveys, including reduced cost and time and higher response rates (Anderson & Kanuka, 2003). The survey was tested at several stages in order to avoid the various errors that can occur in online surveys (Anderson & Kanuka, 2003). There are numerous online survey tools available, offering similar services, and www.surveymonkey.com was used in this instance.

Invitations to participate in the survey were distributed via the following email distribution lists: news@mail.heacadamy.ac.uk, the Higher Education Academy's (HEA) newsletter; nccpe-pen@jiscmail.ac.uk, a mailing list for those interested in public engagement in HEIs ; psci-com@jiscmail.ac.uk, a mailing list for those interested in the public communication of science and public engagement with science. Some of these generated more interest and therefore responses, than others. In addition, some academics that received the initial invite from one of these lists forwarded the invite via email to colleagues at their HEI. The invitation was also 'tweeted' and then 'retweeted' four times via Twitter.

Responses were received from academics at a wide range of UK based universities, including: Bath, Bournemouth, Brunel, Cardiff, Dundee, Durham, Huddersfield, Manchester Metropolitan, Edinburgh Napier, Newcastle, Plymouth, Salford, Sheffield and Southampton.

Results

Phase 1: Interviews

Comments received from interview participants that described their social media activities were studied in detail and it was found that these mapped relatively easily onto the original activities identified by Lorenzo-Romero et al (2012). For example, interview participants described activities in terms of whether they were communicating with specific groups of people (existing contacts or new contacts) and whether they were using private (one to one) messaging facilities, public (one to many) messaging facilities or a combination of both. These activities are applicable to both personal and work-related use of social media.

Comments relating to activities were used to extend the original user group profiles to include work-related activities and these activities are summarised in Table 3. The activities described in Table 3 and the original descriptions summarised in Table 1 were used to

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position each of the interview participants in one of the user groups. For example, a participant that described daily use of more than one social media tool, large numbers of followers, and that was regularly posting and commenting online, would be considered an Expert communicator. Of the 5 interview participants, 2 were considered Versatile users and 3 were considered Expert communicators.

Table 3: Activities of Versatile users and Expert communicators identified through interviews

The Versatile users displayed a combination of passive and proactive approaches to their use of social media. They regularly used social media tools but tended to read/observe/view more frequently than they would write/comment/post.

All 5 participants had some contact with work-related social networking sites (SNS) – the most commonly mentioned being LinkedIn and Academia.edu. The level of activity on these varied but, for most participants was limited to viewing approximately once a week and updating profiles less frequently.

All interview participants except one Versatile user were blogging. The Versatile user who was blogging, regularly updated a project blog with the specific aim to keep various communities up to date with the project progress. The Expert communicators contributed to multiple blogs. These included work-related blogs where they were the sole contributor as well as project blogs that typically had multiple contributors.

All interview participants except one Versatile user were using Twitter. The other Versatile user was using Twitter, but had a casual attitude towards it.

> *I am not, you know, doing it as a big deal I suppose or making a huge effort - certainly not doing anything everyday [...] I think that's quite good to have that out there as a, you know, [a] visible face.*

Where the Versatile users described periods of either regular blog posting or tweeting, this was usually initiated due to project updates or attendance at an event – i.e. these periods of activity were inspired by an external event rather than it being something that was maintained long term.

> *So for instance if I'm at a conference I'll tweet. I don't use it very often but it tends to go in bursts.*

The Expert communicators were more consistent in their use of Twitter, with phrases such as '*constantly on in the background*' or '*daily conversational space*' used to describe their attitudes towards it.

> *[...] certainly have my Twitter feed going on in the background and I might look at it several times a day just to see if there is anything interesting going on.*

As well as having multiple blogs, the Expert communicators maintained a wide portfolio of tools, especially in the form of online environments that were focused around resource sharing. They often proactively searched for new tools that enabled them to share different kinds of content (presentations, videos etc.) and mentioned: social bookmarking services such

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as Delicious; slide sharing sites such as SlideShare; CloudWorks (a UK OU social networking site for sharing learning and teaching ideas); and RefWorks – an '*online research management writing and collaboration tool*' (Refworks, n.d.).

Motivations for using social media were also discussed in interviews. Four key themes emerged concerning motivations:

- Externally driven: invited by colleagues or a project or institutional demand.
- Self-development: such as information acquiring or keeping up to date.
- Maintaining networks: maintaining or strengthening existing connections.
- Widening networks: making new contacts or increasing engagement opportunities.

Table 4 provides a summary of the motivations that emerged from the interviews.

Table 4: Motivations of Versatile users and Expert communicators identified through interviews

Of the four themes surrounding motivations that were identified, Expert communicators did not talk about any externally driven motivators. That is, they were not invited by others or having to use something due to the demands of a project or institution. When it came to 'networking' motivations, comments from the Expert communicators suggested they were more likely to take a strategic approach. They tended to give more examples of how they used social media to widen networks and were particularly interested in contacts that they considered useful. One said he would '*only follow people ranked above me*' another talked about the people he followed as a community of people whose main communication method was via Twitter. The Versatile user who used Twitter talked primarily about self-development motivations and how Twitter provided access to regular updates and information in his field. He mentioned several international or major organisations and agencies that he followed. Although he also talked about individuals that he followed and knew personally, Twitter was not his main channel for communication with these people.

Expert communicators placed high priority on the online content they generated such as blog posts or the comments they made on online public documents and felt this was integral to their academic work.

> *…occasionally things come back through the press or people talk to people […]. They are aware of what I am doing through my public presence.*

'Ego' was also mentioned by two Expert communicators as part of what motivated them.

> *I am kind of conscious of that in some respects, you know, what you are writing, I suppose, is for an audience as well and its also partly, you know, arrogance or ego at the same time - there is no doubt about that.*

Despite being avid Twitter users, they also tended to exhibit either a dislike of, or indifference towards Facebook.

> *I do have a Facebook account, absolutely detest Facebook… but I am also conscious of the fact that, you know, it's still an extremely […] dispersed medium and, you know, I need to find a way of me engaging with it better, if that makes sense, because the audience, you know, is actually very large.*

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> *Facebook is a bit different because Facebook is largely these days just another repository for my Twitter feed.*

Phase 2: Online survey

Although other tools were mentioned, blogs, Twitter and SNS, such as LinkedIn and Academia.edu, were the main focus of discussions in Phase 1and therefore Phase 2 also focused on these tools. The activities, motivations and outcomes that were discussed in the Phase 1 interviews were used to formulate the survey questions and options provided. Blank text boxes were also provided, to encourage elaboration on answers. Space was provided that enabled those not using social media to give their reasons why.

127 survey responses were received. Of these, 12 were incomplete and are not used in the analysis presented. The responses of the remaining 115 participants were studied in detail to obtain an overall picture of each individual's use of social media. The responses were examined for the survey questions that asked about the tools used how they were used, for example: frequency of use; how often they read and/or posted; and the number of contacts they maintained for each social media tool. These responses, and the information from Tables 1 and 3 illustrated earlier, enabled survey participants to be placed within the different user groups. It also enabled the identification of activities and motivations that paralleled those that described the Introvert users originally defined by Lorenzo-Romero et al. (2012). The activities and motivations identified for Introvert users from the survey responses are summarised in Tables 5 and 6 respectively.

Table 5: Activities of Introvert users identified through the survey

Table 6: Motivations of Introvert users identified through the survey

Early in the process of examining survey participants responses it became apparent that a fourth user group 'Non-adopters' was also needed. This group represented those individuals who indicated they did not use any of the social media types identified in the survey questions.

The percentage of survey participants within each of the 4 user groups are given in Table 7.

Table 7: Percentage of survey participants in each user group

Table 8 gives the percentages of survey participants using each of the social media tools that were explored through the survey. In the cases of Twitter and SNS an additional number of participants said they used these tools but only for social (non-work related) purposes.

Table 8: Percentage of survey participants using each social media tool

Outcomes of using social media

Several of the survey questions explored the outcomes that survey participants had experienced through using social media. These questions provided a list of options, and participants were able to select as many of these as they felt applicable, for each social media tool they used. The options provided are illustrated in Table 9. Each of the options is associated with one of the themes relating to motivations identified earlier and the results are discussed below within the context of these themes.

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Table 9: Options describing outcomes of using social media

Self-development
The use of Twitter by Introvert users was low however most of the Versatile users and Expert communicators were using it.

70% of those using Twitter felt they had learnt something new that had contributed to their work (compared to 51% of those that were blogging and 33% of SNS users). Only 50% of Versatile users that said that they were aiming to use Twitter to keep up to date indicated that this had actually happened compared to 80% of Expert communicators.

The option '*Contributed to my career progression'* received the lowest number of selections for each of the 3 social media tools (11% of SNS users, 16% of Twitter users and 30% of bloggers). However, looking at the responses by user group there is an interesting difference. None of the Introvert users, and only a small number of Versatile users, felt that using any form of social media had had any impact on their career progression. This was compared to half of the Expert communicators, who chose this option for at least one of the tools they were using. For those who did feel it had made some impact, open comments were invited to encourage examples to illustrate how. The most frequent comments (most noticeably with respect to Twitter, but comments were also received with respect to the others) was that being able to use social media successfully was now seen as a skill that employers want.

> *I have managed Twitter accounts for the department where I work, and special interest groups that I'm involved in. These are skills that people have expressed an interest in.*

> *The ability to use twitter is a skill which many employers are looking for now.*

Another theme that emerged with respect to career progression was that of increased visibility and public profile.

> *Senior people know who I am because of Twitter. That has to help.*

> *Prizes for public outreach, higher public profile, journalist contacts, name recognition.*

This provides an interesting insight into how users of these tools perceive their usefulness from a career progression point of view.

Maintaining networks
Most participants who were using SNS indicated that they were using these with the aim to keep in contact with existing networks. 71% of SNS users felt that SNS had actually helped them maintain existing networks (47% Twitter; 38% blogs). However, only 53% said that SNS had helped them *strengthen* existing networks, with Twitter being slightly more successful at this (60% Twitter; 41% blogs).

Widening networks
With respect to widening networks, two of the options provided were significant –
'*Developed new networks/contacts'* and '*Extended the audience of my work*'. Less than half

of those using SNS felt that these had enabled them to make new contacts or reach new audiences. Blogs were, unsurprisingly, the most successful tool for extending the audience of participants' work, with 76% of those who were blogging selecting this option (66% Twitter; 47% SNS). However, only 51% of bloggers felt that these activities had helped them develop new contacts, compared to 66% of Twitter users (43% SNS).

Participants who selected at least one of the options that related to widening networks were given the opportunity to expand on this through an open comments box. This asked them to elaborate on who they felt the new contacts/audiences were. There was a wide variation in the groups, communities and individuals mentioned. This is illustrated in the word cloud in Figure 1.

Figure 1: New contacts through social media

Academic networks were mentioned most frequently, both within and outside individuals' discipline areas. Journalists, the 'interested' public and teachers were also mentioned frequently. The only specific discipline areas mentioned were Environment and Health.

Barriers
The survey included questions to investigate what was preventing some participants from engaging in activities via social media. Participants who indicated they did not use each type of social media tool were asked to give their reasons via open text boxes. A total of 111 comments were received, 33 referring to Twitter, 31 to SNS and 47 to blogs.

A wide variety of responses were received to this question and comments were categorised under 6 main themes.
- Negative perceptions of social media.
- Not having the time to use social media or not seeing it as an efficient use of time.
- A lack of knowledge or skills about how to use the tools.
- A lack of confidence in generating the content to be communicated via social media
- No interest in using social media tools for work-related purposes.
- Concerns around safety and privacy.

The proportion of comments that fell within each of these themes is illustrated in Figure 2.

Figure 2: Barriers to using social media

As Figure 2 illustrates, the largest number of comments overall related to lack of time to use social media for work related purposes. Most of these comments, however, referred to blogs. 55% of comments that related to blogs were about a lack of time to blog, compared to 26% of the comments relating to SNS and 15% of the comments relating to Twitter.

The second largest barrier was simply not having an interest in using social media for work-related purposes. Here, the biggest contributor was SNS with 41% of SNS comments related to lack of interest, compared to 27% for Twitter and 6% for blogs.

The third largest barrier was negative perceptions of social media, with around 19% of comments. Here, Twitter had the highest proportion of comments with 27%, compared to

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SNS with 19% and blogs with 13%. Comments included terms such as 'superficial', 'inane', 'unproductive' and 'celebrity led'.

The fourth main barrier was participants not knowing *how* to use social media, or a particular form of social media, for work-related purposes. The number of comments was higher for Twitter (21%) and blogs (19%) than for SNS (3%). More people were confident about how SNS could be used, but they had simply chosen not to use them for work-related purposes.

A few comments were also received that expressed a lack of confidence with generating the content to be published online and in public view, and also concerns around safety and privacy.

Bearing the above breakdown of results in mind, the most significant barriers for each of the individual tools are quite different, as illustrated in Figure 3.

Figure 3: Barriers to using Twitter, SNS and Blogs

Discussion

The following discussion is structured around the research questions outlined earlier.

How are STEM academics currently using social media in their working practices?

This research enabled a substantial development of ideas around the user group profiles originally identified by Lorenzo-Romero et al. (2012): Introvert users; Versatile users; and Expert communicators. An additional group, Non-adopters, was also identified. Different levels of engagement with social media mapped onto these user group profiles and illustrated the range of current practices of STEM academics.

Some academics have fully integrated social media into all aspects of work routines, sometimes using it as a main communication medium rather than email. Ip & Wagner (2008), in their research into blogging activities, used the words 'less addicted' to differentiate between the two groups of user they called Active and Habitual - who were the most enthusiastic users. A degree of 'addiction' was seen in some examples in the research presented here. One interview participant said that he had been 'weaning' himself off Twitter as he felt he used it too much. Another described how he was continually looking for new tools and methods to share content. For these academics, Twitter was central to everyday communications – particularly within niche academic networks – and was '*constantly on in the background*'. One major differentiating factor of these participants was that they did not describe their use of social media as an additional task, rather it had replaced other more traditional communication channels. Examples were identified where social media was embedded within working practices and was being used on a daily basis to find information, record thoughts and outputs, and strategically network.

The majority of academics that took part in this research were using some form social media within their work practices but to a lesser extent than described above. Social media was not integrated into all daily routines and was not generally a primary channel of communication, more an additional one. In this way, using social media appeared to be an extra task. These 'Versatile users' generally used more than one social media tool and it was often observed that social media was used more intensely around certain events. The term 'Versatile' implies that these are adaptable users, which in some respects is accurate, but what this does not impart is the intermittent use that was observed in this research. This behaviour was not

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characterised by any of the user groups defined by Lorenzo-Romero et al. (2012) or Ip & Wagner (2007) and may be a product of the work-related context within which this research took place.

What are the motivations for, and perceived outcomes of, using social media within a professional context?

Four main themes that describe different motivations for using social media emerged from the data: Externally driven; self-development; maintaining networks; and widening networks.

Substantial differences were observed not only in the activities but also the motivations and outcomes described by participants. Moving from Introvert, to Versatile, to Expert, it is obvious that the number of activities observed will increase. It was also observed that the number of motivations increased as well as the number of perceived outcomes – i.e. how successfully these motivations were being realised. The implication from the results is that undertaking the additional activities that have been described for Expert communicators is likely to result in a greater number of positive outcomes, including career progression.

Different approaches were observed with respect to widening networks. Examples of widening networks through the use of Twitter were varied. Some participants were interested in following either individuals or organisations that would provide useful updates or information, whereas others talked about strategic networking practices, using social media to associate themselves with contemporaries that were perceived as useful or ranked more highly. A small number of examples were found where the use of social media was focused on engaging with the public. These were in fields where there was already a public interest, such as the environment and health.

What are the barriers that are preventing STEM academics from using social media in their working practices, and what recommendations can be made to support them?

Approximately one third of participants in this research were not using social media much, if at all. Past research has identified two main categories of barrier to the adoption of new technology: functional and psychological (Ram & Sheth, 1989; Tu & Poston, 2012). Functional barriers include situations when the technology is not compatible with users' existing routines or where users are daunted by, amongst other things, the uncertain benefits of using the new technology (Tu & Poston, 2012). Some of the barriers identified in the research presented here, such as a perceived lack of skills or time, or not having an interest in using social media for work-related purposes, are functional barriers. Increasing the perceived usability, that is how easy a technology is to use, and its perceived usefulness, are ways to overcome functional barriers (Davis, 1989; Tu & Posten, 2012). These barriers could most readily be addressed through training or workshops providing, for example: practical guidance on using social media within an academic environment; examples of successful practice; and guidance on writing for specific online environments.

Psychological barriers include a technology being viewed negatively. This was one of the main barriers identified in the present research and may not be as easily solved through training. Other measures may be needed to convince sceptics of the potential benefits of social media in the work-place, and more specifically the academic workplace. Initiating dialogues, both with academics who feel they are using social media to successfully support their academic role, but also with management to clarify any institutional policies, may begin to address these barriers. An important aspect of these dialogues is to identify measurable outcomes from an individual's career progression point of view.

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Interestingly, very few responses received in this research indicated a lack of confidence in generating online content. This may be because the majority of data collected here was describing barriers faced by Non-adopters and Introvert users. Issues surrounding negative perceptions and a lack of skills may be the first barriers encountered by someone contemplating using social media for work-related purposes. Lack of confidence in generating the actual content may be something experienced at a later stage once the initial hurdles have been overcome. An interesting follow up to this research would be to explore whether lack of confidence is a bigger barrier to Versatile users who are trying, but struggling, to increase their level of participation. It is possible that Versatile users may have overcome any negative perceptions, and to some extent the skills gap, of Introvert users, and therefore will be confronted by a different set of barriers.

In summary, this research has highlighted how social media tools are currently being used to support some aspects of the STEM academic role. Examples have been highlighted that show how social media are extending networks and fulfilling the needs of some academics. However, only 50% of those surveyed that currently have high levels of engagement with social media felt that these activities had some positive influence on their own career progression. Social media are not currently viewed by all STEM academics as an essential, or in fact necessary, tool for carrying out their daily tasks.

Limitations of the research
The findings were limited by the sample set used. In the first phase of the study, interviews were limited to academics at the UK OU where the culture of a distance learning environment will have some effect on the use of ICTs and therefore social media.

In the second phase of the study, the survey participants were self-selected. Survey responses were invited from STEM academics whether they were or were not using social media, although due to the nature of the mailing lists and networks utilised there is likely to be bias towards those that have had some exposure to social media. In addition, one of the mailing lists used was science based, and although it is unknown exactly what percentage of responses this mailing list generated, there were a proportionally higher number of respondents working in science related disciplines, which may be attributed this.

These limitations mean that the results are not completely transferable. The patterns of activity and motivations identified, and the user groups developed, may be useful for future studies interested in the use of social media, particularly in an academic environment. Some of the more context specific results may not transfer as readily. In particular, the proportions of people observed within each user group, in both phases of the project, are heavily influenced by the sample sets used.

CONCLUSION
This paper identifies: approaches to social media that STEM academics are adopting; the different motivations for using social media; and the outcomes that they are experiencing in their professional lives. Motivations are varied and differ across the different types of social media investigated (Twitter, social networking sites and blogs). Social media user group profiles that have previously been developed have been extended by this research to include work-related activities and motivations. The differences between these groups were examined.

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The data suggests that academics who engage more frequently, with a higher number of social media tools, tend also to have a wider range of motivations for using them, and experience a greater number of successful outcomes. Half of those surveyed, who had integrated social media activities into their daily work routines, felt that they had experienced some positive contribution to their career progression as a result. These users were driven mostly by motivations related to self-development and widening networks. They employed tools that facilitate and promote the sharing of content and felt that this was important to their academic role.

Barriers to participation were also identified. The biggest barriers to those currently not engaging with any great significance are negative perceptions of social media and lack of time, interest or skills.

If the use of social media is to be encouraged in academia, practical training is needed, as are dialogues with institutional management to understand the potential benefits and career progression opportunities these activities bring.

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User group	Activities
Introvert users	Send private messages, contact friends. Less frequently they update their profiles. Typically use less than once a week for less than an hour.
Versatile users	Update their profile, share photos, send private messages and search for friends. Less frequently they might look for information and send public messages. Typically use several times a week for over an hour per week.
Expert communicators	They do all the above activities but more frequently. They may also share ideas/reflections, make comments on other users' profiles/photos, send public messages, examine other users' profiles and inform others about products etc. Typically use more than once a day for over an hour per week.

Table 1: A summary of social networking site user groups (Lorenzo-Romero et al., 2012)

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	Phase 1	**Phase 2**
Date undertaken	May/June 2012	March/April 2013
Sample size/responses	5	127
Method of data collection	Face-to-face interviews	Online survey
Approach	Qualitative	Qualitative and quantitative

Table 2: Phases of the project

User group	Work-related /professional activities
Versatile users	• Engage regularly with one or more social media tools. • May be blogging fairly regularly. • May be using Twitter; tend to log on fairly regularly (several times a week); read more than post although may post more frequently around specific events (e.g. conferences); typically 'follow' more than are 'followed'. • Typically a member of at least one professional based SNS (e.g. LinkedIn, Academia.edu) and log on at least weekly. Activities may include: viewing others' profiles; message or search for existing contacts; update profile; read relevant discussions.
Expert communicators	• Use a minimum of 2 different social media tools and typically engage with at least one tool several times a day. • May have several blogs, although the frequency of posts may vary. • Tend to use Twitter very frequently; have a large contact base; are typically followed by more people than they follow. • May use different tools to support different networks. • Typically share ideas/reflections online and make content publicly available through some form of social media, and welcome comments and feedback. • May use profession based SNSs but tend to use them less frequently than the tools facilitating content sharing/commenting.

Table 3: Activities of Versatile users and Expert communicators identified through interviews

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User group	Motivations
Versatile users	- *Externally driven*: either invited by colleagues or know of others that are using a particular social media tool; there may also be a project or institutional requirement. - *Self-development*: Keeping up to date and using social media as a reliable information source. - *Maintaining networks*: Using social media to keep in touch with and strengthen (mostly academic) existing networks; to disseminate research work to specific communities - *Widening networks*: using social media to bring the work of an institution to a wider audience;
Expert communicators	- *Self-development*: Keeping up to date and using social media as a reliable information source; using blogs to maintain an online notebook (for personal reference and feedback); as an ego boost - *Maintaining networks*: Using social media to keep in touch with and strengthen existing networks; to disseminate research work to specific communities; to maintain wider, sometimes non-academic, professional networks - *Widening networks*: using social media to bring the work of an institution to a wider audience; strategic networking; to encourage public content and comments; using blogs to maintain an online notebook (for informing others)

Table 4: Motivations of Versatile users and Expert communicators identified through interviews

User group	Work-related /professional activities
Introvert users	• May use one or two social media tools, infrequently. • May blog very infrequently or log on to Twitter, but to read rather than post. Typically 'follow' more than are 'followed'. • May be a member of a profession based SNS (e.g. LinkedIn, Academia.edu) but typically log on less than once a week and mainly to view others' profiles.

Table 5: Activities of Introvert users identified through the survey

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User group	Motivations
Introvert users	• *Externally driven*: either invited by colleagues or know of others who are using a tool. There may also be a project or institutional requirement.

Table 6: Motivations of Introvert users identified through the survey

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User group	Percentage of survey participants
Non-adopters	15%
Introvert users	19%
Versatile users	41%
Expert communicators	25%

Table 7: Percentage of survey participants in each user group

Social media tool	Percentage of survey participants using for work related purposes	Percentage of survey participants using in total (work or social purposes)
Twitter	68%	82%
SNS	57%	72%
Blogs	39%	39%

Table 8: Percentage of survey participants using each social media tool

Outcome	Motivation
Learnt something new that has contributed to my work	Self-development
Received useful feedback	
Contributed to my career progression	
Strengthened existing networks	Maintaining networks
Maintained existing networks that I wouldn't have otherwise	
Developed new networks/contacts	Widening networks
Extended the audience of my work	

Table 9: Options describing outcomes of using social media

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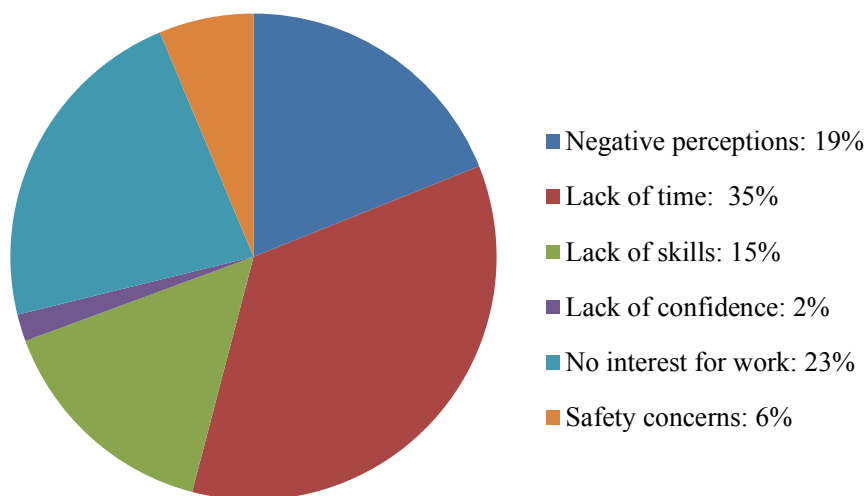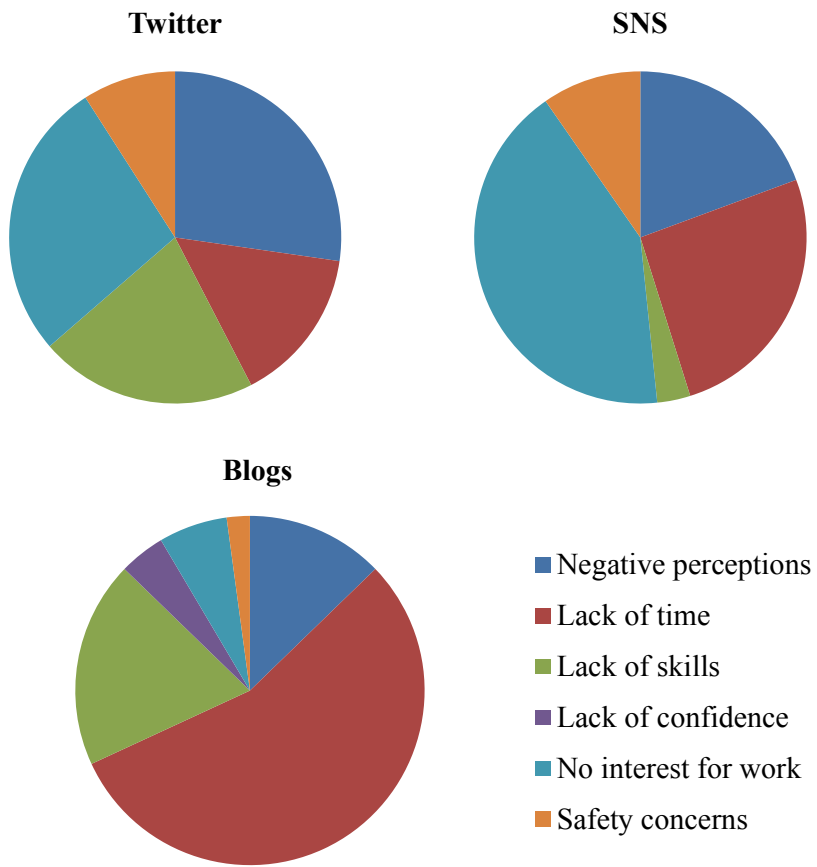45
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Figure 1: New contacts through social media

Figure 2: Barriers to using social media

Figure 3: Barriers to using Twitter, SNS and Blogs