



## **UWL REPOSITORY**

**repository.uwl.ac.uk**

Building a community of practice for engaging pharmacy students to learn in a collaborative research environment

ElShaer, Amr, Calabrese, Gianpiero, Casanova, Diogo ORCID: <https://orcid.org/0000-0002-8586-0370> and Huet, Isabel ORCID: <https://orcid.org/0000-0002-6215-0448> (2016) Building a community of practice for engaging pharmacy students to learn in a collaborative research environment. *Currents in Pharmacy Teaching and Learning*, 8 (5). pp. 698-707. ISSN 18771297

<http://dx.doi.org/10.1016/j.cptl.2016.05.001>

This is the Accepted Version of the final output.

UWL repository link: <https://repository.uwl.ac.uk/id/eprint/4593/>

**Alternative formats:** If you require this document in an alternative format, please contact: [open.research@uwl.ac.uk](mailto:open.research@uwl.ac.uk)

**Copyright:** Creative Commons: Attribution-Noncommercial-No Derivative Works 4.0

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

**Take down policy:** If you believe that this document breaches copyright, please contact us at [open.research@uwl.ac.uk](mailto:open.research@uwl.ac.uk) providing details, and we will remove access to the work immediately and investigate your claim.



## **Building a community of practice for engaging pharmacy students to learn in a collaborative research environment.**

### **Abstract**

*Background:* Conventional research project supervision is not always compatible with current challenges facing Higher Education, such as students' diverse backgrounds, increasing demands and multidisciplinary research interests. Additionally, research students may experience isolation at different stages of research. To help students coping with these challenges, approaches such as progress reports, departmental presentations and co-supervision have been introduced. Community of practices (CoP) are alternative approaches that if successfully adopted may improve the students' learning experience. These communities were developed as knowledge-based social structures between groups of people sharing goals and interests. Considering the importance of CoPs as a strategy to engage students and researchers to work collaboratively; this study aims to investigate the impact of a formal CoP on the students' learning experience at different levels of study.

*Methods:* Six months qualitative evaluation study. Participants included 2 PhD, 5 Master and 2 undergraduate students (level 6) from the School of Pharmacy at a British University. Participants were asked to interact face-to-face and online using Diigo as a virtual learning environment to share and discuss problems and questions related to their on-going work, including the finding of research articles. Qualitative data was gathered from two focus groups and an in-depth thematic analysis of the online interactions was carried out.

*Results:* All participants at undergraduate and Master level felt that their learning experience was boosted by the sharing of knowledge and resources. Closer look at the data reveals that most of the production and interactions were made by the largest group (i.e. Master students). This group believed that Diigo helped them in building up their research knowledge by sharing information online which also enriched their face-to-face (f2f) discussions. In contrast PhD students felt that the CoP did not significantly help them to develop their knowledge.

*Conclusions:* The development of a small CoP helps students to gain knowledge and improves their research productivity by sharing experience and skills. The CoP was effectively supported by Diigo, which provided a good platform for data sharing and a culture of collaboration. The CoP had an overall positive impact on the students' learning experience and research.

*Keywords:* Research supervision, Community of Practice, Pharmacy teaching and learning, Online bookmarking, Diigo.

*Abbreviations list*

Communities of Practice	CoP
face-to-face	f2f
Higher Education	HE
High Performance Liquid Chromatography	HPLC
MPharm	Master of Pharmacy
Virtual Learning Environment	VLE
Student Academic Development Research Associate Scheme	SADRAS
Undergraduate	UG

## Introduction

Holbrook<sup>1</sup> defines conventional research supervision as a one-to-one supervision process between a single supervisor and a student. However, conventional supervision is no longer compatible with the current and ever changing Higher Education (HE) sector. Diverse background and interests of research, the need of having multidisciplinary research supervisory teams to respond to more complex research questions, and the pressure for high completion rates within tight timelines are amongst the challenges research supervision is facing nowadays.<sup>2,3</sup> These, together with the lack of supervisory time to guide and follow individual projects, can result in a sense of isolation for research students, even if they have the research lab and a supervisor in common. As a result, students might not fully use their potential, thus underperforming. All of these might result in a breakdown of the supervisor-student relationship as suggested by Wisker<sup>4</sup>. This relationship is of paramount importance to ensure success and progression; Lee<sup>5</sup> believes that the relationship between the student and the supervisor should be personalised. A report presented by Metcalfe<sup>6</sup> showed that the quality of supervision is directly correlated with boosting the postgraduate students' experience and achieving high success rate. Nonetheless, this relationship is under challenge because of the various changes taking place at the HE sector, which are associated with governmental agenda, the emerging of new degrees and universities, and the increased diversity of students.<sup>7</sup>

In order to maintain good research supervision quality under these challenges, many approaches have been proposed by researchers and universities, such as the introduction of progresses reports, symposia on research studies and departmental presentations. Although submitting interim reports can be useful at PhD level, this approach is seldom feasible and/or effective at undergraduate or Master levels as projects may run for few weeks or months and students may not have enough data and/or time to generate an interim report. Co-supervision is another approach that could be adapted to enhance students' experience during their degrees.<sup>8</sup> Co-supervision provides the opportunity of having an extra academic input offering different expertise and perspectives to the student. Although co-supervision is recognised and used in universities' guide or codes of practice, there are no established guidelines or procedures that guarantee the process works in practice.<sup>9</sup> Moreover, co-supervision enriches discussions around the research topic, but it also adds complexity to the process and to the student-supervisors relationships as discussed by McMorland.<sup>9</sup> Similarly, Olmos-López<sup>10</sup> revealed that conflicts might take place between supervisors because of varying research interest, personality and professional competition. Besides, research students believe that co-supervision is associated with lack of continuity as each supervisor pays attention to their own field of expertise and as a result the student may feel a push towards two contrasting magnetic poles. This becomes even more challenging if supervisors' perspectives or interests are different.<sup>10</sup>

## Community of practice (CoP)

As referred in previous studies, research supervision models are changing.<sup>11</sup> The supervision process is no longer focused on the individual, centred on private top-down student-supervisor relationships, but on formal or informal CoP where supervisors and students develop collaborative work, support and inquire each other. CoP has been researched as a tool to mitigate isolation by facilitating informal interaction with peers and other networks of support. The term CoP was coined in 1991 by Lave<sup>12</sup> and defined as a group of people sharing a passion about certain topics and deepening their expertise and knowledge through continuous interaction. A CoP flourishes by joint commitment, shared innovativeness and repertoire of actions from their participants. A CoP also enables embedding expertise and knowledge within the larger population, which facilitates access to expert opinion, in turn ensuring quality, retaining knowledge and increasing potential for innovation.

Over the years, CoP have been used in many disciplines such as business, the social sector, education, government and professional associations. A study by Orr<sup>13</sup> revealed that Xerox photocopy repairmen co-built their knowledge by sharing stories and troubleshooting problems within a community, rather than reading standard operating procedures and manuals, or relying on what they had been previously taught.<sup>13</sup> This approach enabled repairmen to develop more skills on repairing copiers. Similarly, by using a CoP research students can share their experiences on using certain techniques, practice in conducting an experiment and even troubleshooting some of the issue that arise during project work. Similar approaches have been adapted to the education sector to improve teachers training. Dunne<sup>14</sup> compared the practices of teachers who participated in a CoP to those who did not. The study revealed that the CoP members adapted new techniques during their teaching, for instance changing the pace of instructions and the arrangements of classrooms. Similar findings were suggested by Englert<sup>15</sup> as teachers within the CoP implemented new group story method and choral reading strategies rather than literacy instructional practices. CoP also demonstrated success in sharing knowledge between nurses<sup>16</sup>, radiotherapy physicists<sup>17</sup> and amongst professors in academia<sup>18</sup>.

The CoP approach was first introduced to support research students at the University of Anglia Ruskin<sup>4</sup> with the aim of enhancing learning between research students. This strategy showed great success. The community was composed by research students, supervisors and distance supervisors. Regular meetings between members of the CoP helped in establishing the relationships within the CoP and also helped to identify students' skills and weaknesses. Communication was established through series of dialogues, initially with supervisors then with peers, in order to clarify processes and show logical links. Alongside this community, another online community was established to support supervisors. Interaction between the two communities made considerable contribution to success of all members. After developing this framework at Anglia Ruskin University, Shacham *et al.*<sup>19</sup> evaluated how research students perceived their learning characteristics within the CoP. Upon interviewing, students praised CoP as a mean for knowledge diffusion by inputting members' ideas and different point of views.<sup>19</sup>

Duncan-Hewitt and Austin<sup>20</sup> reported that the role of CoP in pharmacy education was more pronounced in the past when pharmacy education was achieved via apprenticeships. The study proposed restructuring the Pharmacy education by implementing CoP to optimise learning. It is believed that students will benefit from each other by sharing their implicit knowledge via conversation, coaching and demonstration. All are facilitated by the close proximity within the community. The study argued that implementing CoP in Pharmacy education would provide an authentic environment for learning pharmacy students and subsequently add a meaningful role to the graduate professional practice and better provision of patient care<sup>21</sup>. Austin and Duncan-Hewitt proposed a potential curricular model around the notion of CoP. The designed curriculum was not definitive and was open for discussion with other pharmacy education experts<sup>21</sup>. The model has not reported the logistics to support and sustain communication within the community. Hence, the aim of the current study is to focus on evaluating the role of the CoP in enhancing project supervision and students' experience in Pharmacy course using face-to-face and VLE to initiate and sustain communication and knowledge exchange between students.

### **Communication within a CoP**

It is of paramount importance for members within a CoP to communicate, share information and provide feedback with a certain *lexis* and to be able to learn from one another.<sup>13</sup> Hoadley *et al.*<sup>22</sup> discussed a new framework on how learning takes place in online communities. The framework is called content, conversation, connections and context for purpose (C4P). The five elements are non-linearly connected within the CoP, in another word; an increase in any of these elements reinforces the remaining elements.

CoP members can communicate face-to-face (f2f), through chat rooms, teleconferences and web-based meetings. Wesely<sup>23</sup> investigated the role of social media on professional development by using Twitter to support a community of world language educators. The study argued that an online CoP dedicated to the professional development of teachers can support their learning in various ways, for instance developing debate and discussion, which enable deep learning amongst the members of the community. Nonetheless, the study did not evaluate the engagement of teachers in the online community, as some members might be passive or reluctant to join online communities because of social-psychological factors as suggested by Brass<sup>24</sup>. Moreover, social media is commonly associated with safety and privacy concerns and an uncritical use might be associated with abolishing the professional boundaries between the teacher and students<sup>25</sup>, cyberbullying, online grooming and even self-destructive behaviours<sup>26</sup>. Some constraints associated with using social media in learning could be avoided by using social bookmarking tools such as Delicious or Diigo<sup>26</sup>. These tools offer numerous benefits such as generating and managing contents and enabling social engagement with other learners. They were also employed in the past as a tool to create communities of shared interest and expertise. Diigo was used in a study by Im<sup>27</sup> as a bookmarking tool to enable students to create a collaborative knowledge platform by sharing relevant links around course topics.<sup>27</sup>

### **Rational/objectives**

Undergraduate students have to undertake a research project in their final year. Projects run throughout the academic year which makes it challenging for both supervisors and students. Additionally Master students must undertake a research project at the end of their course of studies.

Teaching and administrative commitments of academic members of staff during term time make one-to-one meetings more difficult. Disengagement and isolation may be observed in some students as a consequence of poor interaction with their supervisor. Forming a CoP with a shared passion between students of different levels can be a strategy to enhance students' learning experience. Communication within this community can nourish either f2f or online<sup>11</sup>. In this perspective, the online CoP serves the purpose of (i) facilitating an online research supervision, where the academic promotes and facilitates some of the group discussions and shares relevant resources, and of (ii) creating a formal environment where students feel free to communicate with each other, exchanging relevant information and sharing common problems. An online CoP can serve the purpose of facilitating students' learning by promoting the collaboration between students from different levels of study. By students learning we refer to the capacity of students in conceptualising a research project, developing it, interpreting the results and writing-up the research findings.

The aim of this research is to investigate the impact of a formal CoP for students from different levels of study on supporting and enhancing each other's learning experience during a research module. The research was underpinned by the following research questions

1. How can a CoP help students from different level of study to support each other?
2. How can a social bookmarking tool help in establishing and sustaining communications within the CoP?

## **Research methods**

A qualitative evaluation study was conducted with the purpose to evaluate the impact of the CoP on the students' learning experience. The data was generated from two focus-groups and an in-depth analysis of online interactions of the VLE to support the CoP activity, a social bookmarking tool – called Diigo (<https://www.diigo.com/>). Diigo was used to support students to share and communicate online.

The study ran over five months between April and September 2014. Ten participants undertaking three different degrees at various levels were recruited for the current study. Two students undertaking a PhD in Pharmaceutical Sciences (i.e. SM, UB), 5 students conducting a Master of science in Pharmaceutical Sciences and Pharmaceutical Analysis (i.e. AW, RA, BB, MK and AD), 2 undergraduate students enrolled at M Pharmacy program (i.e. FR, ZA) at level 6 and the main supervisor (i.e. AE), all from the School of Pharmacy and Chemistry at a University in the UK. All participants worked under supervision of AE and worked on pharmaceuticals or pharmaceutical analysis related research project. The supervisor was involved in the CoP to embed expertise within the community, identify gaps in students' learning and guide students throughout the project.

An induction session was delivered before students started working on their projects aiming to introduce the CoP and to help initiating the communication. During the induction, students introduced themselves and talked about their research. Furthermore, they were introduced to Diigo and received guidance on how to use it. An approach similar to Wisker *et al.*<sup>4</sup> was adopted. After the induction session, two focus groups took place: one prior to the start, and a second one at the end of the project. The emphasis of the first focus group was to assess students' previous experience in

working within a group or a community, and to understand their perception of a CoP. This was also designed to gauge students' use of technology and social media as communication tools as their ability and confidence in using computer technology and interaction with social media may differ. The second focus group was organised after submission of students' dissertations. This focus group scrutinized two aspects: firstly, students were asked questions to assess their experience of working within a CoP in regards to the impact on the quality of the learning experience and research. The second dimension explored the impact Diigo had on learning and the degree of satisfaction for using this tool.

Focus groups were used for data collection, as they can provide useful information such as feelings, attitudes and experiences of participants of the CoP. These experiences and attitudes might be difficult to be explored by questionnaires or one-to-one interviews. Focus groups enable social engagement amongst participants, which in turn elicit multiplicity of views.<sup>28</sup> Focus groups also allow the observation of salient issues that might arise prior to or after setting up a CoP, therefore the CoP can be better set and managed. A pre-prepared list of questions was used to collect data from the focus groups. Both focus groups were set to run for 90 minutes. The data collected from the two focus groups were analysed qualitatively using Nvivo10 software using a thematic approach. After data collection from the focus groups, data was transcribed by the research team, added to Nvivo10 and themed under various nodes according to similarity in patterns and meanings. Creating nodes will help in simplifying the data in a more intelligible fashion. Thereupon, themes are reviewed and refined prior to generating the final report. No names were used that could identify the participants.

As the study involved human participants, ethical approval was sought and obtained by an independent ethics committee prior to commencing the study. Both focus groups were attended by a second researcher to moderate the sessions. All collected data was treated under high degree of confidentiality and anonymity.

## **Results and discussion**

### **Students' previous experience and expectations of a CoP and the use of social media**

Domain, community and project are the three elements imparting shape to a CoP<sup>16</sup>; these elements need to be developed simultaneously in order to nurture such a community. The domain defines the identity of the community. Research students not only share interests but also practice as some of them use the same or similar techniques and equipment during their project. In this study, the domain is represented by the role of polymers in drug delivery and the effect of particulate systems' properties in developing pharmaceutical preparations. Sharing interest and practice encourages discussion which helps students to learn from each other. Hence, learning takes place by immersion into practice as suggested by Burkitt *et al.*<sup>29</sup>

During the first focus group, participants were asked whether they had any previous experience of collaborative work with colleagues or other students from different levels of study. Most of the participants collaborated by one way or another with their colleagues in the past. Some worked closely with PhD students during their undergraduate projects, another student collaborated with colleagues while working as a community pharmacist. One student worked on a research project funded by the Student Academic Development Research Associate Scheme (SADRAS) at the same Institution for two years and worked with students from different educational backgrounds.

Participants believed that working in a group would boost their learning experience, as everyone is in the position to share their own knowledge and experience within the group. During the first focus group, MK-Master said “Two brains are better than one”. BB-Master said that he had never done any collaborative work before but he assumed that if they were to work in a group or a community it would have been a good experience. It seems that all students but one had done some collaborative work in the past and they believed the outcomes were positive and would like to repeat this experience again. Students below PhD level expected a CoP to help them exchange information and expertise as well as build-up friendship. PhD level participants also believed it was a good opportunity for them to learn. As an example, SM-PhD said: *“Definitely. I am an expert in my field so if you ask me about my polymers or my drugs, I can help you with that, but I know you can contribute with experience of projects and labs... so I don’t think I am an expert in everything”*. This statement suggested that PhD students were open to learn with students in lower levels and, in doing so, able to truly take advantage of the CoP. The willingness to learn and deepen their expertise from working in a group is considered a critical factor for a CoP to be effective as suggested by Lave<sup>12</sup>.

In terms of technology and social media usage, all participants were active on social media and used mobile phone applications to keep in touch with their families and friends. Some of the students used Facebook for educational purposes; ZB-UG commented *“I used to use Facebook a lot when it was new but now it is boring so I don’t have time for Facebook. The only reason I use it is because of our university group, during the exam time a lot of questions are asked and a lot are answered, and so you develop a level of understanding of things you don’t know”*. This was a relevant statement specially having in mind the relevance given to social networks and how they are used according to their purpose. Students seem to be able to choose different social media according to the purpose of use and so they would be able to adapt to a new social bookmarking with a different purpose. This idea was shared by other students. MK-Master said *“I don’t use Facebook for social reasons ... more WhatsApp”*. RA-Master said *“I do use Facebook when I get back to University so I can see what everyone is up to. I don’t chat on it. Just if someone doesn’t have my number in WhatsApp or Viber, we can exchange messages via Facebook”*. A mature level of using technology for learning was seen as an important factor for taking advantage of the CoP as students are able to act naturally in an online environment. This is widely explored by the literature<sup>11</sup>.

Although Facebook was used extensively as a communication tool between students and their family/friends, they refused to use it as a communication tool with their colleagues. *“I think it would be confusing to use Facebook”* another participant said *“You would be distracted by social aspects”*.

### **In-depth analysis of online interactions**

In-depth analysis of the interactions on Diigo showed that 95 posts had been shared on the website over a five month period (i.e. mid-April to mid-September) (Figure 1).

Looking at Figure (1), three peaks are observed during the course of the CoP: weeks commencing 19<sup>th</sup> of April, 28<sup>th</sup> of June and 19<sup>th</sup> of July. The graph showed that students were enthusiastic about the concept of learning together and this can be reflected by the high number of posts during April. Besides, during this period students were preparing their research proposal and were sharing review and research articles with their peers on Diigo. In June- where the second peak is seen- students shared a lot of literature articles to support their research. By that time students spent one month in the laboratory and had a better understanding of what they were doing and this is reflected by the



relevance of the posted articles and their ability to identify peers who were working in a similar research area, despite the early findings suggested by Im<sup>27</sup>. Posting was sustained after that period and extended between July and August and this is possibly because they started to put their results together and interpret their data, hence a lot of engagement on VLE was observed at the week commencing the 9<sup>th</sup> of August. From August, most of the shared links were dominated by structuring dissertation, anatomy of scientific posters and articles to support data generated by students. During the course of the study, students have shared links, commented on them and asked questions on Diigo (Figure 2). Most of the shared links were research articles (32%), literature review articles (12%) and websites (9%) to help students to develop their research knowledge and writing skills. Only 2% of the shared links were videos that focused mainly of the structure and format of the literature review. Data analysis of the communications on Diigo, demonstrated that students have communicated effectively to develop different aspects of their research including: (i) literature survey to build up their background and knowledge on the research area; (ii) setting up the laboratory experiments by sharing links to cover different methods they will adopt; and (iii) articles that could help to interpret their results and explain some of the trends observed in the generated data (Figure 3). Members of the community also learned about the format of dissertation and how to design a poster via sharing relevant links with their peers on Diigo (Figure 3). Because of the nature of the domain, the majority of keywords retrieved from within the posts shared on Diigo by students were related to pharmaceutical formulations and analysis as depicted in Figures (4).

Most of these posts were shared by students at Master's level with minimum contribution by undergraduate and PhD students as indicated in Figure 5. When students at PhD level were asked about their contribution on Diigo, SM-PhD replied *"In terms of using the website, honestly I didn't get the chance to use it as much. I did get a chance later to go over all the articles. I was in lab and I really knew what I was doing"*. Looking at the demographics of the members of the community of practice, 88.8% of the participants were younger than 35 years old. The average age of undergraduate, Master and PhD student was  $23 \pm 0$ ,  $29.6 \pm 7.4$  and  $28.5 \pm 2.1$ . The data demonstrated that age of participants did not play any role in their engagement on Diigo as PhD students were younger compared to Master participants but their contribution was lower.

Although PhD students did not take part in posting and sharing information on Diigo (Figure 5), they found it useful later on when they were researching analytical techniques such as high performance liquid chromatography (HPLC). Students at Master level had a different view as they believed that Diigo helped them to build-up their research knowledge by sharing information online. Furthermore, Diigo helped students to improve their writing skills. RA-Master said *"If I am stuck with the write-up, I find many things useful through Diigo"*. BB-Master has also confirmed that he could find useful information on Diigo regarding data interpretation and the writing-up of discussions, as students have shared a considerable amount on literature review, research proposal and thesis writing-up, and posters preparation. Hence, although the CoP was driven by the domain related with the role of polymers in drug delivery and the effect of particulate systems' properties in developing pharmaceutical preparations there was scope for sharing resources about academic writing and how to do research.

Students also used the CoP to share problems they encountered during their projects; an example is shown in table (2) where two students were working on the same drug and one of them had some issues with the dissolution study. Their colleague, AW-Master, tried to help to find a solution to this

problem by sharing an article and giving some constructive comments. In another occasion (Table 3), a student had an issue with his microbiological test, his colleague found a relevant article highlighting the concentration range that should have been used in the experiment.

Students also found Diigo easier for sharing information when compared to phones and emails. Four participants preferred Diigo over face-to-face as this gave the flexibility to seek advice and support from more than one person; MK-Master says *"I think Diigo is better than face-to-face because face-to-face is one-to-one, while on Diigo you have more than one opinion that you can adopt"*. Also students supported their face-to-face meetings by referring to papers shared on Diigo.

### **Students' perception of the CoP and using Diigo**

After finishing the lab work and submission of dissertations, a second focus group was organised in order to evaluate students' perception of working within a CoP. Students were asked whether the CoP had helped them in their learning and in developing their research expertise. All students agreed that working within a group deeply helped them in their learning by sharing knowledge and laboratory skills. MK-Master said *"At first I thought it was not going to be useful as every student is working on a different topic, but when we find something relevant to our colleagues or encountering the same problem we share it"*. PhD students shared a similar perception of the relevance of the CoP. However, these students rather prefer to highlight the relevance of being able to help students at lower level than learning from being in the CoP.

In order to evaluate the role of Diigo for establishing communication within the CoP, when compared with the lab interactions, participants were asked whether Diigo helped them improving their interactions with their colleagues during the research project. PhD students were of the opinion that face-to-face interaction was the best way to communicate and share knowledge with their peers in the community and they did not get the chance to share any research articles on Diigo. SM-PhD argued that *"For me, I like face-to-face, for example when I need help with calculation it is easier to do it f2f. However, writing papers, literature reviews or methodology [...] I can get it from articles (referring to the articles found in Diigo)"*. This was also reflected on Diigo as analysis of the data on Diigo showed the absence of participation from PhD students who were added to Diigo as experts. Despite not sharing articles, PhD students found some of the shared papers relevant to their work. On the other hand, most students at undergraduate and master level believed that Diigo was very helpful. MK-Master argued that *"Diigo is much better than face-to-face interaction"*. And AW-Master supported this by saying that *"Even if we have face-to-face interaction, we just say I found an article that supports that, and I will share on Diigo"*. Moreover, all the students found it easy and felt comfortable to share information on Diigo and this was attributed to knowing each other through the community. Students were also confident in using Diigo's various tools such as "like", "tag" and "comment". Nonetheless, some of the participants found Diigo rigid and felt it was difficult to initiate discussions. Receiving notification was another issue; some students never received notification via email while others did not receive notifications when downloaded the mobile application. Some of the participants found it difficult to search the shared articles and comments and it took them sometime to find the relevant information they were after. Furthermore, some of the students suggested that Diigo should have a "favourite" function, which will help them to build their own library of articles according to the relevance to their work. Diigo limitations are also widely explored by Estellés et. al.<sup>30</sup>

## **Limitations**

Due to the nature of this study, the sample was not large enough to provide a data set suitable for a quantitative study. By introducing a larger sample of students, the integration in the CoP of students from other supervisors would be necessary, which could bring competitive domains and disperse the focus of the CoP. However, it is understood this study would require more participants and thus more editions of the CoP. Another possible limitation relates with the heterogeneity of the CoP, which was seen by the researchers has one of study's biggest virtue. By having students coming from different cycles of study students with a semester of research were blended in the same community with students with three years of research. Also a door was open for students that belong to a consolidated community (Master or undergraduate cohorts) and to students that live in individuality (PhD). Perhaps the reason why PhD students were not so active in the CoP was that they did not have time to consolidate themselves in the community as they act knowing that they have more time to consolidate their evidences and findings. Perhaps Master and undergraduate students have a level of engagement with research that is less deep therefore they were able to read and share more documents without reflecting on the real value each of these would have for their own research. In future studies, the researchers agree that more time is needed to create this sense of CoP and perhaps use the PhD students as the glue between the different Master and Undergraduates cohorts.

## **Conclusion**

Students' learning experience can be boosted by working with their peers within a research community and Diigo can be used to facilitate communications besides face-to-face interactions. Students can share and discuss issues they encounter during or at the end of their research, and help each other to solve some of these issues. Although some students may not be actively partaking to the exchange of information via Diigo, the same students can find this resource helpful to consult in the future. Students might face some issues especially using Diigo. This is a new tool and it requires setting up a username and password before use. Participants who prefer to receive instant notification from Diigo need to download a mobile phone application and some of the participants might not have smartphones to facilitate this, which could result in disengagement. Although the CoP has been studied as a tool for learning at undergraduate, postgraduate and even professional level, most of these studies recruited participants of at same level. The current study recruited participants of diverse levels and thoroughly evaluated their interaction within the community. The current study demonstrates that small group of researchers can communicate effectively but it is not evident how the community will interact at a broader scale. Although adapting CoP as a research supervision tool will help academics a lot, researchers should be careful with what they are sharing and discussing online especially if the data generated are distinctive and patentable. Our future investigations will look at bigger samples and also evaluate whether running an induction session will have an impact on students' interactions.

## **Conflict of Interest**

Authors declare that there is no conflict of interest.

# References

1. Holbrook A, Johnston S. The many facets of research supervision in education. In Holbrook & Johnston (Eds.). *Supervision of Postgraduate Research in Education*. Victoria: AARE; 1999.
2. McCallin A, Nayar S. Postgraduate research supervision: A critical review of current practice. *Teaching in Higher Education*. 2012; 17(1): 63–74.
3. Baptista AV, Huet I, Jenkins A. Quality of Doctoral Supervision: Supervisors' conceptions of learning, supervision and students' profiles. In N. Jackson, L. Frick, C. Nygaard & N. Courtney (eds.), *Postgraduate Education: Form and Function*. Libri Publishing; 2011: 43-58
4. Wisker G, Robinson G, Shacham M. Postgraduate research success: communities of practice involving cohorts, guardian supervisors and online communities, *Innovations in Education and Teaching International*. 2007; 44(3): 301-320.
5. Lee A, Green B. Introduction postgraduate studies/postgraduate pedagogy. In A. Lee & B. Green (Eds.). *Postgraduate studies postgraduate pedagogy*. Sydney: Centre for Language and Literacy, University of Technology, Sydney; 1998.
6. Metcalfe J, Thompson Q, Green H. Improving standards in postgraduate research degree programmes. Bristol, HEFCE; 2002.
7. Pearson M. The changing environment for doctoral education in Australia: Implications for quality management, improvement and innovation. *Higher Education Research and Development*. 1999; 18(3): 269–287.
8. Shannon T, Duffield C. Co-supervision of Research Degree, UTS Graduate School Discussion. 1996; Paper no. 9, September.
9. McMorland J, Carroll B, Copas S, Pringle J. Enhancing the Practice of PhD Supervisory Relationships Through First- And Second-Person Action Research/Peer Partnership Inquiry FQS. 2003; 4(2), Art. 37.
10. Olmos-López B, Sunderland J. The how and why of co-supervision of PhD students: reported understandings of supervisors and supervisees. *Opening New Lines of Communication in Applied Linguistics: Proceedings of the 46th BAAL Annual Meeting*, Heriot-Watt University: Edinburgh; 2013.
11. Loureiro MJ, Huet I, Costa N, Baptista A, Casanova D. Using ICT to enhance the on-line research supervision process. *Acta Academica*. 2010; (1): 151-174.
12. Lave J, Wenger E. *Situated learning: Legitimate Peripheral Participation*. Cambridge University Press: New York; 1991.
13. Orr JE. Sharing knowledge, celebrating identity: Community memory in a service culture. In D. Middleton & D. Edwards (Eds.). *Collective remembering*. Newbury Park, CA: Sage Publications; 1990: 169–189.
14. Dunne F, Nave B, Lewis A. Critical friends groups: Teachers helping teachers to improve student learning. [electronic version]. *Phi Delta Kappan*; 2000:28.

15. Englert CS, Tarrant KL. Creating collaborative cultures for educational change. *Remedial and Special Education*. 1995; 16(6): 325–336, 353.
16. Andrew N, Tolson D, Ferguson D. Building on Wenger: Communities of practice in nursing. *Nurse Education Today*. 2008; 28: 246-252.
17. Armoogum K, Buchgeister M. Factors affecting knowledge sharing in the radiotherapy department: the radiation physics team as a community of practice. *Journal of Radiotherapy in Practice*. 2010; 9: 17.
18. Ismail I, Silong A, Asmiran S, Hassan Z. Development of educational leadership in research university through community of practices among professors. *Procedia - Social and Behavioral Sciences*. 2011; (15): 828-83.
19. Shacham M, Od-Cohen Y. Rethinking PhD learning incorporating communities of practice, *Innovations in Education and Teaching International*. 2009; 46(3): 279-292.
20. Duncan-Hewitt W, Austin Z. Pharmacy Schools ad Expert Communities of Practice? A Proposal to Radically Restructure Pharmacy Education to Optimize Learning', *American Journal of Pharmaceutical Education*, 2005; 69 (3): 370-380.
21. Austin Z, Duncan-Hewitt W. Faculty, student, and practitioner development within a community of practice. *Am J Pharm Educ*. 2005; 69: 381-389.
22. Hoadley C, Kilner PG. Using technology to transform communities of practice into knowledge-building communities. *SIGGROUP Bulletin*. 2005; 25(1): 31–40.
23. Wesely PM. Investigating the Community of Practice of World Language Educators on Twitter. *Journal of Teacher Education*. 2013; (64): 305.
24. Brass J, Mecoli S. The (failed) case of the Winston Society wikispace: The challenges and opportunities of web 2.0 and teacher education. *Contemporary Issues in Technology & Teacher Education*. 2011; 11(2): 149-166.
25. Cain J, Scott DR, Tiemeier AM, Akers P, Metzger AH. Social media use by pharmacy faculty: Student friending, e-professionalism, and professional use. *Currents in Pharmacy Teaching and Learning*. 2013; (5): 2–8.
26. Cain J, Romanelli F. E-professionalism: a new paradigm for a digital age. *Currents in Pharmacy Teaching and Learning*. 2009; (1): 66–70.
27. Im T, Dennen V. Building a Collaborative Knowledge Base in Diigo: How Links, Tags, and Comments Support Learning. In T. Bastiaens & G. Marks (Eds.). *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education*; 2013: 794-797.
28. Kitzinger J. Introducing focus groups. *British Medical Journal*. 1995; 311: 299-302.
29. Burkitt I, Husband C, McKenzie J, Torn A, Crew S. *Nurse education and communities of practice* London: ENB; 2001.

30. Estellés, E., Del Moral, E., & González, F. (2010). Social bookmarking tools as facilitators of learning and research collaborative processes: The Diigo case. *Interdisciplinary Journal of E-Learning and Learning Objects*, 6(1), 175-191.