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Open-access writing: An investigation into the online drafting and revision of a research article in pure mathematics

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ABSTRACT

ESP research has provided an account of research articles (RAs) across disciplines using both text-analytical methods and ethnographically-oriented approaches. This study explores what additional insights are gained into the genre from the study of a collaboratively produced RA in pure mathematics, negotiated via an open-access research blog. The data consists of 659 thread comments posted by blog participants as they engage with the research and writing up process. Facets of research-based writing that preoccupy the blog participants are revealed, as well as how decisions pertaining to genre and dissemination outlets are made. In addition, blog posts point to how the RA is adjusted to cater for the more diverse readership that open-access knowledge dissemination may entail. The findings provide support for results of existing genre analyses of RAs in pure mathematics, and offer new insights into writing for publication practices in the discipline. Potential pedagogical applications of the findings are proposed.

1. Introduction

Academia has now entered the blogosphere (Mauranen, 2013); although still in its infancy, the academic blog is used for knowledge dissemination, particularly within the hard sciences, enabling scholars to engage with academic communities, present work in progress, and receive feedback (Luzón, 2012). Thus, blogging can be seen as a new medium for performing tasks which academics already do; however, unlike traditional mediums of academic communication facilitated via established genres, academic blogs are not necessarily accessed by a clearly defined discourse community, and therefore constitute a potentially powerful means of reaching both scholarly and lay audiences simultaneously (Luzón, 2013a).

Research into the discourse, visual characteristics, operational facets and pedagogical applications of blog communication has started to accumulate (e.g. Gurak, Antonijevic, Johnson, Ratliff, & Reyman, 2004). Nonetheless, Myers' (2013) has pointed out the need for more qualitative studies into academic communication using digital media. Most ESP research on blogs to date has analysed the discourse features of posts and comment threads. For example, Luzón (2011, 2012, 2013a, 2013b) investigates the interactional dimension of blog discourse, and how scientific knowledge can be repackaged to address a diversified blog audience. Theoretical questions have also been raised, such as whether generic status can be accorded to texts transmitted via this medium (e.g. Giltrow & Stein, 2009; Mauranen, 2013; Myers, 2010; 2013), the applicability of "discourse community" (Swales, 1990, p. 23) to describe a blogging community (e.g. Barton & Lee, 2013; Luzón, 2011; Mauranen, 2013; Schmidt, 2007), and what blogs reveal about genre change and recurrence (Miller & Shepherd, 2009).

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Collaborative research blogs, although rarer than personal blogs maintained by individual researchers, offer additional scope for investigation; online research cooperation between scholars via blogs renders research and writing practices more visible, revealing how knowledge is constructed as well as reported as a final product. In other words, the affordances of digital media have the potential to make writing for publication practices more transparent (Myers, 2010). This offers an intriguing shift in perspective; some ethnographically-oriented investigations into writing for publication include Knorr-Cetina's (1981) investigation into the production of an RA, Lillis and Curry's (2010) research into the multilingual scholars' writing practices, Myers' (1990) account of the textual construction of scientific knowledge, and Bazerman's (1988) exploration of the development of the experimental report. Nonetheless, while research on L1 and L2 writing (e.g. Zamel, 1982) shows that writing academic genres is a complex and "recursive" process (Swales, 1990, p. 220), ESP genre research (e.g. Lin & Evans, 2012; Stoller & Robinson, 2013) has typically focused on the end product (i.e. the published RA) providing limited insight into the journey of the article in its construction and the rhetorical decisions made by authors en route. This is no doubt in part due to the significant complication that "research activities occur in relative privacy" (Bazerman, 1988, p. 200).

This study addresses the issue of visibility by investigating the online co-authorship and revision of an RA in pure mathematics, facilitated via the *Polymath* 8(a) open-access research blog. *Polymath* is a collaborative research project which unites mathematicians in solving open problems and reporting results using a blog and wiki as the main channels of communication. The blog is particularly interesting in that experts elicit the views of non-specialist participants in an attempt to make the RA in production as accessible as possible to a wider academic audience. Through an investigation of the "internally-moderated changes" (Swales, 1990, p. 117) negotiated online, I explore what can be learnt about disciplinary discourse and writing for publication practices in pure mathematics from the study of this collaborative research blog.

The main contribution of the study lies in the method; my findings reveal how an analysis of discussions conducted via research blogs can provide insights into a discourse community's engagement with article construction and the RA genre. This particular blog not only provides support for descriptions of the pure mathematics RA obtained from studies using text-analytical and interview methods, but also reveals effects of the digital medium on writing practices, and how the genre of the RA could be adapted to a more heterogeneous audience.

The article is organized as follows: Section 2 summarizes our current knowledge of the discourse of mathematics. Next, some background to the *Polymath* blog is given, and analytical procedures are described. The results of the blog analysis are set out in Section 4, and illustrative extracts from the threads are discussed. In Section 5, I consider what can be ascertained about the discourse and writing practices of scholars through the investigation of a collaborative research blog.

2. Previous research into the discourse of mathematics

It has been established that the RA differs along disciplinary lines (e.g. Hyland, 2005, 2006; Hyland & Tse, 2004). Numerous studies drawing on ESP genre theory demonstrate specificity across a number of disciplines (e.g. Bruce, 2009; Lim, 2010; Lin & Evans, 2012; Yang & Allison, 2004), with epistemological and social factors (e.g. Becher & Trowler, 2001; Bernstein, 1999) providing a rationale for the variation observed.

In terms of mathematics, O'Halloran's research (e.g. 2000, 2005, 2010) takes a functional, multi-modal perspective, while education scholars have investigated discoursal identity construction (Burton & Morgan, 2000), and genres used in mathematics teaching (Artemeva & Fox, 2011). However, from an ESP perspective, mathematics is a somewhat neglected discipline; Swales (1998) examined imperatives in research level mathematics, and Shaw (2006) described the integration of mathematical code in pure mathematics, engineering, and physics texts. Four recent papers based on textual analysis and interviews (Graves, Moghaddasi, & Hashim, 2013; 2014; Kuteeva & McGrath, 2015; McGrath & Kuteeva, 2012) have provided a more detailed description of RAs. An investigation into the overall RA structure (Graves et al., 2013) found that the IMRD structure is not adopted, but rather an "Introduction-Results" organization. Kuteeva and McGrath (2015) draw attention to the two argument structures that run through RAs: the mathematical argument, which consists of definitions, theorems and proofs, and the meta-mathematical argument, which comprises inter alia motivations and examples. This argument structure entails an overall article shape which differs significantly from Hill, Soppelsa and West's (1982) hour-glass representation of empirical articles.

The organization of sections in pure mathematics RAs appears to be relatively non-standardized. While theoretical RAs contain at least an opening section and a proof, a prototypical structure for the remainder of the article is difficult to establish (Kuteeva & McGrath, 2015). Graves et al. (2013) identify "complementary introduction" sections, containing some prototypical introduction moves (Swales, 1990) while Kuteeva and McGrath (2015) use the term "contextual background section" to describe sections distributed throughout the article. In particular, the ending of RAs is the least standardized; some terminate at the conclusion of the proof (indicated by the QED square notation), while others pose questions for future research. Prototypical conclusion sections (e.g. Swales, 1990) are rare in pure mathematics (Graves et al., 2013; Kuteeva & McGrath, 2015). Thus, the rhetorical structure of the RA is fluid, enabling the author to adapt the RA to the content and reader.

A corpus study based on Hyland's (2005) stance and engagement framework found a low number of hedges and attitude markers compared with both hard and soft disciplines, but higher than expected shared knowledge and reader references (McGrath & Kuteeva, 2012). Interview data suggested an urge to uncover the aesthetic quality of mathematics in the drive to achieve an elegant and natural simplicity to the results (McGrath & Kuteeva, 2012).