

Gabrielė Gušcytė

Vilnius University, Lithuania
gabrielegust@gmail.com

Jolanta Šinkūnienė*

Vilnius University, Lithuania
jolanta.sinkuniene@flf.vu.lt

RESEARCH ARTICLE ACKNOWLEDGEMENTS ACROSS DISCIPLINES: PATTERNS OF SCHOLARLY COMMUNICATION AND TRADITION

Abstract

In this paper we analyse the generic structure of acknowledgements in four disciplines: Biology, Robotics, Education, and Art history. The study is based on a self-compiled corpus of acknowledgements and employs the rhetorical move/step structure analysis to investigate disciplinary trends of expressing gratitude in research articles. The results show that in hard sciences acknowledgements are more frequent than in soft fields. In addition, scholars in Robotics, Biology and Education frequently express gratitude for various types of resources provided, whereas researchers in Art history rely on academic assistance in the form of feedback on manuscripts and discussions. The most vivid and least formulaic expressions of gratitude are observed in research articles written by scholars in Art history. Overall, the study reveals certain distinct disciplinary practices in expressing gratitude and confirms the importance of acknowledgements in EAP/ESP fields. It also points towards the need to reconsider the communicative purpose(s) of acknowledgement texts.

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Key words

genre analysis, acknowledgements, research articles, cross-disciplinary, English.

* Corresponding address: Jolanta Šinkūnienė, Department of English Philology, Faculty of Philology, Vilnius University, Universiteto str. 5, LT-01131, Vilnius, Lithuania.

1. INTRODUCTION

Over the past decades there has been steady scholarly interest in research writing: numerous studies have revealed the ways in which different disciplines and cultures generate arguments, negotiate claims, structure discourse, and thus create distinct patterns of academic rhetoric (see Berkenkotter & Huckin, 1995; Charles, Pecorari, & Hunston, 2009; Fløttum, Dahl, & Kinn, 2006; Hyland & Bondi, 2006; Suomela-Salmi & Dervin, 2009; Swales, 1990, *inter alia*). The disciplinary perspective or study of small (disciplinary) cultures (cf. Atkinson, 2004) attested in research writing has become the focus of considerable research in the fields of English for Academic Purposes (EAP) and English for Specific Purposes (ESP). Language variation across the disciplines has increasingly been considered to be “one of the more fruitful lines of research” (Hyland, 2011: 178).

Many cross-disciplinary studies have drawn on Becher’s (1989) hard/soft disciplinary division¹ and revealed distinct rhetorical trends between these two broad fields of research inquiry, namely the sciences, and the humanities and social sciences. For example, Hyland’s (2005a, 2005b, 2008) research on metadiscourse, stance and engagement, and interaction and persuasion patterns has shown that “writers in different disciplines represent themselves, their work and their readers in different ways, with those in the humanities and social sciences taking far more explicitly involved and personal positions than those in the science and engineering fields” (Hyland, 2008: 12-13).

It is interesting to note that studies of rhetorical, pragmatic or structural features of scientific texts in different disciplines representing the same science field could also show variation in disciplinary patterns of text construction. For instance, Sanderson (2008) investigated the use of personal pronouns in five disciplines (Philosophy, History, Folklore, English/German Literary studies and English/German linguistics) within the same field of humanities and obtained interesting findings characteristic of individual disciplines. Bondi (2006) explored the signals of narrative development in Business and Economics research articles and concluded that “cross-disciplinary variation can be seen at work even when focusing on neighbouring discourses” (Bondi, 2006: 69).

The results of various cross-disciplinary studies thus point to a tendency for individual disciplines to display their own identity traits, and their “disciplinary culture” (Mauranen, 1993), which should be mastered by members of different disciplinary communities in order for them to be considered insiders of those communities (Hyland, 2006). Becher (1989: 24) convincingly argues that “to be admitted to membership of a particular sector of the academic profession involves not only a sufficient level of technical proficiency in one’s intellectual trade but also

¹ Becher (1989) generally understands disciplines of the sciences as the hard field, while the humanities and social sciences are considered soft fields. For a more fine-grained discussion see Becher (1989: 150-159).

a proper measure of loyalty to one's collegial group and of adherence to its norms". These aspects become increasingly important from EAP/ESP perspectives, as many novice writers or researchers who are non-native speakers of English need not only to learn the ropes of their discipline, but also to be aware of rhetorical differences in different languages if they intend to write in English.

Many studies of research writing have dealt with genre analysis, which has been widely applied in EAP/ESP fields (Bhatia, 1993; Paltridge, 2002; Swales, 1990). Genre and discourse analysis theories have been applied in research on written and spoken genres, such as research articles (RAs) (Salager-Meyer, 1990; Swales, 1990), internet blogs (Crețiu, 2013), lectures (Thompson, 1994), to mention but a few. As a result, many individual genres have been thoroughly analysed, revealing the conventions and rules that govern them (Bhatia, 1993). Specific sections of individual genres, or the so-called "part-genres" (Ayers, 1993 as cited in Dudley-Evans, 2000), have also come to be regarded as separate genres with their own norms and patterns of construction. A case in point could be the RA abstract, frequently considered an independent genre (cf. Martín-Martín, 2003). Another interesting section of a research text, the section of acknowledgements, has been labelled "Cinderella genre" (Hyland, 2003), with its textual status still described as "unstable" (Giannoni, 2002) despite its potential to reveal the patterns of scholarly communication and disciplinary traditions.

Acknowledgements have been analysed within several science fields, such as Applied linguistics (e.g. Giannoni, 2002; Hyland, 2003), Bibliometrics (Costas & van Leeuwen, 2012; Tang, Hu, & Liu, 2017), or Social psychology (Billany, 2014). Traditionally considered as a way to express gratitude to institutions and individuals for their contribution to the research conducted and/or for the assistance in text construction, the act of acknowledging can be a significantly more complex and multi-layered gesture (Hyland, 2003). Ben-Ari (1987), who analysed social, cultural and interpersonal aspects of acknowledgements in ethnographic texts, refers to acknowledgements as "special textual constructs that relate both inwards toward the main parts of ethnographic texts and outwards toward the social contexts within which these ethnographies are produced" (Ben-Ari, 1987: 63), thus highlighting the social value of acknowledgements. This view is echoed in the potential of acknowledgements to show "webs of interaction and connectedness" (Cronin, McKenzie, & Rubio, 1993: 121) as well as "the dialogic processes of academic research" (Hyland, 2003: 245).

Acknowledgements also reflect complex and multiple stages of the research process and academic text construction. Expressions of gratitude for providing funding, samples, pre-prints, copyright permissions, for assisting with field work, for discussions and readings of the drafts attested in acknowledgements are all indicative of various stages of the research and writing process, which would be much more difficult or even impossible without the help of others (Díaz-Faes & Bordons, 2014; Hyland, 2004; Šinkūnienė & Dudzinskaitė, 2018). Some studies (cf. Díaz-Faes & Bordons, 2014), however, show that sections of acknowledgements do

not necessarily express gratitude, but can be used to report conflicts of interest or compliance with ethical issues, thus emphasising the need to reconsider the communicative purpose of this dynamic genre (cf. Askehave & Swales, 2001; Swales, 1990) and the ways it reflects changes and progress in how scientific research is conducted.

Current studies into acknowledgements show how this genre has developed over different periods of time (Cronin, 2001; Cronin et al., 1993) as well as explore bibliometric patterns (Costas & van Leeuwen, 2012; Tang et al., 2017) and socio-cultural features of acknowledgements (Alcaraz, 2014; Salager-Meyer, Ariza, & Berbesí, 2010). A substantial body of research focuses on the move and step structure of acknowledgements. The *rhetorical move* concept was proposed by Swales (1981) to refer “to a section of a text that performs a specific communicative function. Each move not only has its own purpose but also contributes to the overall communicative purposes of the genre” (Kanoksilapatham, 2007: 23). A move can consist of smaller discourse units called *steps*. Research on the rhetorical move/step structure of acknowledgements confirms disciplinary differences in structural patterns, with both experienced and novice scholars from more discursive disciplines of the social sciences and humanities composing more complex and more elaborate acknowledgements (Giannoni, 2002; Hyland, 2004). Alongside the structural analysis, another area of linguistic inquiry into acknowledgements is patterns of expressing gratitude. A number of studies demonstrate that different disciplines display different ways of acknowledging others. Hyland and Tse (2004), for example, show that particularly in hard sciences writers may express their gratitude quite implicitly, while in the soft fields they tend to write more overt thanks, thus also strengthening the personal dimension of the acknowledgement.

A substantial amount of studies investigate acknowledgements in MA and PhD theses (Al-Ali, 2010; Cheng, 2012; Hyland & Tse, 2004; Yang, 2012). Acknowledgements have also been explored in academic books (Šinkūnienė & Dudzinskaitė, 2018) and in RAs, typically in one discipline (Alcaraz, 2014; Salager-Meyer et al., 2010) or in several related science fields (Cronin et al., 1993). However, comparative studies focusing on RA acknowledgements across different research fields are still quite scarce. Given the significance of the RA as the pre-eminent genre of the academy (cf. Hyland, 2009) and the importance of understanding disciplinary norms and traditions in research writing, especially from EAP/ESP perspectives, more cross-disciplinary contrastive work on individual less researched disciplines seems to be needed.

This paper sets out to investigate the rhetorical move/step structure of acknowledgements in Biology, Robotics, Education and Art history RAs by exploring similarities and differences in the expression of acknowledgements across hard and soft fields represented by these four disciplines. The paper also aims to examine how the acknowledgements under study could be linked to disciplinary patterns of scholarly communication.

2. DATA AND METHODS

The study is based on a self-compiled comparable corpus of RA acknowledgements (100 RAs from each discipline, i.e. 400 RAs in total). The size of the corpus is 27,959 words (Table 1).

DISCIPLINE	JOURNAL	SIZE OF THE SUB-CORPUS, WORDS
Robotics	<i>Journal of Field Robotics</i>	4,911
	<i>Robotica</i>	
Biology	<i>Biological Journal of the Linnean Society</i>	9,299
	<i>Journal of Biological Rhythms</i>	
Art history	<i>Art History</i>	7,636
	<i>Oxford Art Journal</i>	
Education	<i>Learning and Instruction</i>	6,113
	<i>Educational Researcher</i>	

Table 1. The size of the Acknowledgements corpus (400 RAs)

To ensure the comparability of the sub-corpora, acknowledgement texts were collected from international, peer-reviewed journals included in *Clarivate Analytics Master Journal List*.² To compile the corpus for this study, two journals per discipline were selected.

The first stage of the analysis involved the calculation of the frequency of acknowledgements in the RAs in each discipline. For this purpose, 300 articles per discipline (totalling 1,200 RAs) were analysed to check the number of articles containing an acknowledgement. Starting from the first issue in 2017 in both journals in each discipline, every research article was downloaded until the number of 300 was reached. Then each article was scanned for an explicit section labelled *Acknowledgements* or for an explicit gratitude expression in the *Notes* section; all these instances were included in the corpus.

The second stage of the research involved the rhetorical move/step analysis of acknowledgements. The first 100 acknowledgement texts were selected from the pool of the previously gathered 300 RAs in each discipline. This resulted in 400 texts in total (100 texts from each discipline) that were subjected to further analysis. A detailed content analysis of all acknowledgement texts was performed

² <http://mjl.clarivate.com/>

following the move and step typology proposed by Hyland (2004: 308), who analysed dissertation acknowledgements.

1 Reflecting Move	Introspective comment on the writer's research experience
2 Thanking Move	Mapping credit to individuals and institutions
1 Presenting participants	Introducing those to be thanked
2 Thanking for academic assistance	Thanks for intellectual support, ideas, analyses feedback, etc.
3 Thanking for resources	Thanks for data access & clerical, technical & financial support
4 Thanking for Moral support	Thanks for encouragement, friendship, sympathy, patience, etc.
3 Announcing Move	Public statement of responsibility and inspiration
1 Accepting responsibility	An assertion of authorial responsibility for flaws or errors
2 Dedicating the thesis	A formal dedication of the thesis to an individual(s)

Table 2. Move and step structure of dissertation acknowledgements (taken from Hyland, 2004: 308)

The following sections present the results of the rhetorical move/step structure analysis. The examples quoted in this paper are coded by indicating the abbreviated name of the discipline followed by the number of the text (e.g. Bio 17).

3. RESULTS AND DISCUSSION

The first results of our research showed that some of the moves and steps that were common in the dissertation acknowledgements in Hyland's (2004) study, were not attested in our study of acknowledgements in the RAs. The categories absent in the RAs include the Reflecting move (introspective comment on the writer's research experience), and the first step of the Thanking move, namely, Presenting participants. The absence of the Reflecting move was expected, as Hyland (2004: 311) himself notes that this move is typically not present in such genres as the RA and is mainly used in students' texts as a means of reflecting on the research experience they have gained. The first step of the Thanking move (Presenting participants) was absent from the RA acknowledgements in our corpus most likely because these are typically much shorter and more focused than dissertation acknowledgements in Hyland's (2004) study.

However, the acknowledgements in our study were found to contain a structural category described by Giannoni (2002), namely, the Citing parent texts and events step, which typically occurs at the beginning of the acknowledgement sections. As a result of these initial findings, we have modified Hyland's (2004) typology by removing the Reflecting move (Introspective comment on the writer's research experience), and the first step of the Thanking move (Presenting participants), and by adding the Citing parent texts and events step as Move 1. A modified framework is provided in Table 3.

1 Introductory Move (Citing parent texts and events)	Introducing previous versions or pre-print presentations of the article
2 Thanking Move	Mapping credit to individuals and institutions
Step 2.1 Thanking for academic assistance	Thanking for intellectual support, ideas, analyses, feedback, etc.
Step 2.2 Thanking for resources	Thanking for data access & clerical, technical & financial support
Step 2.3 Thanking for moral support	Thanking for encouragement, friendship, sympathy, patience, etc.
3 Announcing Move	Public statement of responsibility and inspiration
Step 3.1 Accepting responsibility	An assertion of authorial responsibility for flaws or errors
Step 3.2 Dedication	A formal dedication to (an) individual(s)

Table 3. Move and step structure of acknowledgements (based on Hyland, 2004: 308; Giannoni, 2002: 10)

Examples (1)-(6) from our corpus illustrate moves and steps in the modified framework used in the analysis of the data:

(1) **Move 1:** A version of this essay was delivered at the Frühe Neuzeit Interdisziplinär in Durham, North Carolina, in March of 2012, and at a colloquium at the Max Planck Institute for the History of Science in the spring of 2014. (Art 75)

(2) **Move 2, Step 2.1:** We also thank Daniel Mesquita and two anonymous reviewers for their helpful comments on the manuscript. (Bio 29)

(3) **Move 2, Step 2.2:** We gratefully acknowledge the support of the Defense Advanced Research Projects Agency (<https://doi.org/10.13039/100000185>) via Air Force Research

Laboratory (<https://doi.org/10.13039/100006602>) award FA8750-12-1-0321, and the Office of Naval Research (<https://doi.org/10.13039/100000006>) via award N00014-12-1-0071. (Rob 34)

(4) **Move 2, Step 2.3:** I would like to thank the editors of Art History for their encouragement. (Art 8)

(5) **Move 3, Step 3.1:** Any errors or omissions are my own. (Edu 59)

(6) **Move 3, Step 3.2:** I dedicate this article to Heather V. Vermeulen. (Art 26)

3.1. Frequency and length of acknowledgements

Table 4 provides the number of RAs containing acknowledgements in the four analysed disciplines. For this part of the analysis, 300 RAs per discipline were used.

DISCIPLINE	NO. OF RAS ANALYSED	RAS WITH ACKNOWLEDGEMENTS	
		#	%
Robotics	300	228	76%
Biology	300	291	97%
Art history	300	201	67%
Education	300	208	69%

Table 4. Number of RAs containing acknowledgements across disciplines

Table 4 shows that Biology and Robotics display the highest number of research papers containing acknowledgements, with nearly every article in Biology including this section. Art history and Education journals, on the other hand, have fewer articles with acknowledgements (67% and 69%, respectively). Similar disciplinary trends of acknowledgement distribution between hard and soft fields have been observed by other scholars. McCain (1991), for example, studied RA acknowledgements in Genetics and found that 95% of RAs included an acknowledgement. This trend might serve as an indication that acknowledgements in hard sciences are considered to be more relevant and even essential if compared to social sciences and humanities. Cronin, McKenzie, and Stiffler (1992: 120) argue that “the variation in acknowledgement frequency may be related to the ‘scientific’ (which need not be a synonym for scholarly) character of the journal” suggesting that the more “scientific” or more “mathematically inclined” the journal is, the

more frequent acknowledgements are. This pattern can be explained by the more collaborative nature of the hard sciences, where research is typically conducted in teams, with resources and samples shared and know-how exchanged in various ways.

The second aspect of the comparison is the average length of acknowledgements in the four sub-corpora (Table 5). This part and the following qualitative results are based on the analysis of 400 RA acknowledgements (100 acknowledgement texts per discipline).

DISCIPLINE	WORDS	AVERAGE
Robotics	4,911	49
Biology	9,299	93
Art history	7,636	76
Education	6,113	61

Table 5. The size of the sub-corpora and the average length of acknowledgements by discipline

The results show that researchers in Robotics tend to write the shortest acknowledgements, while academics in Art history and Education compose acknowledgements which are roughly 1.4 times longer than those in Robotics. This is in line with previous studies on dissertations (Chan, 2015; Hyland, 2004), which found that acknowledgements tend to be longer in soft fields as compared to hard fields. The most surprising result, though, is that the longest acknowledgements are written by researchers in Biology (93 words on average). Lengthy acknowledgement sections in Biology articles in our study may be linked to detailed enumeration of funding bodies and extensive lists of people who helped to collect samples (7). Another reason why the word count in Biology RA acknowledgements is so high could be related to researchers' tendency to provide multiple disclaimers, as in (8):

(7) We thank many colleagues for their generous and enthusiastic help during the collection of live *P. apterus*: Carl-Cedric Coulianos, Manuel Baena, Rodolfo Costa, Lucia Salis, Marketa Ondrackova, Adam Bajgar, Milena Damulewicz, Enrico Bertolini, Petra Sekyrova, Radka Zavodska, Lukas Cizek, Lukas Drag, Dora Nagy, Plamen Kalushkov, Jana Pavlova, Magda Hodkova, Julius Lukes, Iva Fukova, Xanti Pagola-Carte, Penelope Mavragani-Tsipidou, Elene Drosopoulou, Frantisek Marec, Matilde Eizaguirre, Ramon Albajes, Stanislav Rada, Vladimir Kostal, Tomas Ditrich, Martin Kaltenpoth, Jaromir Cihlar, Daniel Jablonski and many others (we apologize to anyone not mentioned). L. P. was supported by INsecTIME (FP7-PEOPLE-2012-ITN, grant no. 316790) and J. K-R by Postdok_BIOGLOBE (CZ.1.07/2.3.00/30.0032), and the complete work was funded by the National Science Foundation (GACR, grant no. 14-32654J) to D.D. The work of Petr Kment was supported by the Ministry of

Culture of the Czech Republic to the National Museum (DKRVO 2016/13, 00023272). (Bio 92)

(8) We thank Harald Spitzkopf for designing and building the rotation device. Christian Ehrke and Nikolaj Meyer provided additional close-up photographs and measurements of morphological thumb and foot pads. Bianca Becker and Judith Brückner analysed the photographs of the bats' thumbs and feet. We are grateful to Brock Fenton and two anonymous referees for commenting on the manuscript. The German Academic Exchange Service (DAAD), the German Research Foundation (DFG: KE 746/5-1) and the Universiti Brunei Darussalam [RG/1(193)] funded this project. The authors declare no conflict of interest. All authors have read and agreed upon the manuscript before its submission. The work described has not been published previously. All applicable international, national and/or institutional guidelines for the care and use of animals were followed. The University Brunei Darussalam Research Committee (UBD/PNC2/2/RG105 & 193), the Forestry Department Brunei Darussalam and the Forestry Department Sarawak [NCCD.907.4.4(JLD.10)-209, (JLD.12)-20 and No. 173/2014] gave us permission to capture and handle the bats and to work in the field. All procedures performed in studies involving animals were in accordance with the ethical standards of the aforementioned institutions and adhered to the Animal Behaviour Society (Guidelines for the treatment of animals in behavioural research and teaching 2012). (Bio 30)

Both (7) and (8) are found as separate sections titled Acknowledgements and placed at the end of the articles. Example (7) contains 142 words, which all relate to only two aspects acknowledged – sample collection and funding. Acknowledgements in (8) consist of 198 words in total, and as many as 120 words relate to ethical issues of the study and responsibility for the written text. With the increased concerns about ethical issues in biomedical fields, scholars may be required to provide a carefully considered account of all permissions obtained and ethical standards followed, which results in longer acknowledgement texts in Biology RAs. A similar trend has been noticed by Díaz-Faes and Bordons (2014: 1846), who have explored funding acknowledgements in a number of disciplines and noted that “as the research process gains complexity (increasing role of teams and network-based research, diversity of funding sources, more sophisticated administrative and legal frameworks, growing concern about ethical issues), so does the amount and variety of the information included in the acknowledgement section”. These apparently heterogeneous aspects of acknowledgements, unrelated to the expression of gratitude, point towards the need to reconsider the communicative purpose of such texts so that the genre/genres they constitute could be described adequately (for a more detailed discussion on genre identification and communicative purpose see Askehave & Swales, 2001).

The following section will focus on the structural patterns of acknowledgements in the four disciplines analysed.

3.2. Structural patterns of acknowledgements

Table 6 shows the percentage of texts in which the indicated moves and steps occur at least once.

MOVES AND STEPS	ROBOTICS	BIOLOGY	ART HISTORY	EDUCATION
1 Introductory Move (Citing parent texts and events)	1%	4%	44%	8%
2 Thanking Move	100%	100%	100%	100%
Step 2.1 Thanking for academic assistance	35%	77%	99%	64%
Step 2.2 Thanking for resources	96%	97%	47%	83%
Step 2.3 Thanking for moral support	1%	2%	15%	2%
3 Announcing Move	3%	30%	14%	31%
Step 3.1 Accepting responsibility	2%	29%	9%	31%
Step 3.2 Dedication	1%	2%	6%	0%

Table 6. Percentage of acknowledgement texts with each move and step by discipline

The results show that the Thanking move is the essential move found in every acknowledgement analysed, which is in line with other acknowledgement studies, including other genres (Hyland, 2004; Yang, 2012). This is the only move that can be considered “obligatory” (Peacock, 2002) or “conventional” (Kanoksilapatham, 2005), if we consider the minimal frequency occurrence rate to be 60% of all texts analysed in the discipline, as suggested by Kanoksilapatham (2005). The first (Introductory) and the last (Announcing) moves have been found to be less frequent than the main Thanking move in all four disciplines. The Introductory move is most frequent in Art history (44%), while in Education, Biology, and Robotics it occurs in only 8%, 4%, and 1% of the texts, respectively. The Announcing move, on the other hand, is most prominent in Education and Biology, where 31% and 30% of acknowledgements, respectively, include it.

It is interesting to note that among the Thanking move steps there are different patterns of disciplinary distribution of the obligatory and optional steps which are further discussed in Section 3.2.2.

3.2.1. *Introductory move*

According to Giannoni (2002: 10), the main purpose of the Introductory move is to place the subsequent Thanking move of an acknowledgement in context. In this move authors provide information about parent events, which typically include conferences, presentations, colloquiums, symposiums, lectures, and seminar series (9), in which the work presented in the RA was introduced. In contrast, references to parent texts, which provided the basis for the RA (10), are less frequent in all sub-corpora:

(9) A preliminary portion of this material was presented at the *2015 ASME IDETC/CIE 39th Mechanisms and Robotics Conference* (Boston, MA, USA). (Rob 90)

(10) This article expands significantly on an aspect of my *PhD thesis* on silence in the work of Juan Muñoz. (Art 6)

Generally, the high occurrence rate of the Introductory move in Art history RAs indicates that presenting early results at conferences and other scientific events is a common practice within this discipline, which also suggests researchers' willingness to publicly share the results prior to their publication. This could not be said about Robotics, Biology or Education, which contain only a few instances of this move. As observed by Giannoni (2002: 11), the avoidance of the Introductory move among academics in hard sciences "reflects the different objective conditions in which scientists operate: because of fierce competition for ground-breaking research, public disclosure of findings tends to threaten intellectual ownership."

3.2.2. *Thanking move*

As already mentioned, the Thanking move, which is often considered to be an obligatory move (Borlongan, 2017), is the crucial part of acknowledgements. This is hardly surprising, as the main function of acknowledgements is to express thanks to institutions, individuals or groups of people for different types of assistance provided.

The Thanking for academic assistance step reflects various aspects of academic support, including thanking for assistance with the analysis, for advice and insights, as well as for mentorship and inspiring ideas. Gratitude for academic assistance is expressed mostly to colleagues, but also to editors and anonymous peer reviewers, who play a vital role in the publication process.

Within the Thanking move, the step of acknowledging academic assistance ranks second with the overall 69% occurrence rate. Compared to its occurrence in dissertation acknowledgements, which include thanking for academic assistance in every text and in all disciplines (e.g. Borlongan, 2017), it is considerably less frequent. This generic difference is quite natural considering the amount of

academic assistance novice scholars may need in their first serious research work, i.e. PhD thesis, in comparison to the expertise of the authors of RAs.

The results of our RA acknowledgement analysis show important disciplinary differences. Thanking for academic assistance seems to be an obligatory step in Art history (99%), Biology (77%), and Education (64%) RAs, while in Robotics it is less frequent (35%) and therefore can be considered optional. In hard sciences scholars often express gratitude to research groups and teams rather than to individuals, which suggests a collaborative working environment on a larger scale (11), while scholars in Education tend to recognise individual research assistants' help, usually with data collection, coding and analysis (12):

(11) The authors thank the *Hyper-Dolphin team* and the *R/V Natsushima crew* for *their help and advice* during the NT12-05 cruise. (Rob 16)

(12) We thank the students who participated in our study and the *research assistants* Hannah Nilles, Julian Schulte, and Lisa Sieweke for *conducting the experiment and analyzing the tests*. (Edu 33)

Overall, in all four disciplines gratitude in this step is most frequently expressed for collegial assistance, including general support, for providing comments and feedback on drafts, and for suggestions, discussions, insights, and advice. Comments, suggestions and readings of drafts are especially common in Art history (13) and Education (14):

(13) I would like to thank Tag Gronberg, Leslie Topp and Shearer West for *reading an early draft of this article*. (Art 81)

(14) I thank Andrei Cimpian, Matthew Graden, Peter Halpin, Martha Makowski, and Jennifer Timmer for *helpful comments on earlier drafts*. (Edu 51)

Scholars in Biology frequently express thanks for comments on the manuscript and discussions (15), while scientists in Robotics tend to thank for general, unspecified collegial help (16):

(15) We thank John Allen and Mark Williamson for *preliminary discussions*. Mark Williamson also made *helpful comments on an earlier version of the manuscript*. (Bio 3)

(16) We would like to thank Ghazaleh Panahandeh, Hong-bin Yoon, Martin Miller, Simon Peter, Sunil Patel, and Xichen Shi for *their help*. (Rob 28)

Acknowledgements in Art history and Education display the greatest variety of different types of academic help acknowledged, and writers thanking for academic assistance focus on such types of intellectual support as refining ideas, offering critique, sharing expertise and knowledge, as well as guidance or mentorship:

(17) I am deeply grateful to Helen Weston for *her mentorship* of my early career, and for *her intellectual companionship*. (Art 67)

Scholars in the analysed disciplines express thanks for academic assistance not only to their colleagues, but also to anonymous reviewers and editors. Interestingly, this is especially obvious only in Biology and Art history RAs, where 52% and 48% of all acknowledgements, respectively, include this type of thanks. In contrast, reviewers and editors are less frequently thanked in the acknowledgements of RAs in Education (25%), and barely mentioned in RA acknowledgements in Robotics (5%). These results may suggest that the peer review process is considered essential or that there is a strong conventional disciplinary practice to acknowledge the work of anonymous reviewers in Biology and Art history, in comparison to the other two analysed disciplines, where this practice seems to be much less common.

Researchers in Robotics, Biology, and Education express thanks to reviewers in a rather formulaic way (18)-(20), and mainly for helpful comments, feedback or suggestions on previous versions of the paper:

(18) The authors would also like to thank the anonymous reviewers for *their very useful comments*. (Rob 52)

(19) We thank three anonymous reviewers for *their helpful comments*. (Bio 12)

(20) The author would like to thank two anonymous reviewers for *their helpful comments*. (Edu 88)

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In Art history, on the other hand, the reviewers and editors are thanked not only for academic assistance, i.e. for the improvement of manuscripts, but for moral help as well, which will be discussed further below.

The second step to be discussed, i.e. Thanking for resources, is used by authors to express thanks to institutions or individuals for providing resources in four basic categories, i.e. access to data and materials, clerical help, financial support, and technical support. The results provided in Table 6 above (Section 3.2) show that Thanking for resources is an essential, obligatory step, especially in hard sciences, where 97% of texts in Biology and 96% of texts in Robotics include this step. Table 7 illustrates how Thanking for resources categories are distributed in the acknowledgements across the four disciplines.

RESOURCE CATEGORY	ROBOTICS	BIOLOGY	ART HISTORY	EDUCATION
Access to data	16%	43%	23%	33%
Clerical support	5%	10%	2%	7%
Financial support	91%	91%	36%	69%
Technical support	23%	63%	2%	24%

Table 7. Percentage of categories of Thanking for resources step by discipline

As can be seen in Table 7, the most frequent type of resources acknowledged in all disciplines is funding. Almost all acknowledgements in Robotics (91%) and Biology (91%) mention financial support, while in soft sciences less than three quarters of RAs in Education (69%) and only one third in Art history (36%) include this information. The high percentage of acknowledgements for funding in hard sciences, as opposed to soft sciences, was reported in other studies as well (Costas & van Leeuwen, 2012; Díaz-Faes & Bordons, 2014) and could be explained by the closeness of these research fields to the experimental sciences (Díaz-Faes & Bordons, 2014: 1839).

Other factors that could affect the frequency of funding acknowledgements include the number of authors per article or journal prestige (Díaz-Faes & Bordons, 2014). Table 8 illustrates the correlation between the percentage of funding acknowledgements in the RAs and the average number of authors of the article.

	FUNDING ACKNOWLEDGEMENTS IN RAS, %	AVERAGE NUMBER OF AUTHORS
Robotics	91%	5
Biology	91%	5
Art history	36%	1
Education	69%	3

Table 8. Percentage of funding acknowledgements in the RAs in relation to the average number of authors per RA

Table 8 shows that the higher the number of authors per RA is, the more RA acknowledgements in the sub-corpus include funding information. This could be related to the fact that every scholar involved in a research project may receive funding separately, which increases the possibility of funding being mentioned in

the acknowledgement section. A similar tendency has been observed by Salager-Meyer, Ariza, and Berbesí (2009) in the U.S. sample of acknowledgements in medical research papers, where 3.3 grants in average were mentioned per one funded research paper. In the present study, the multiple funding acknowledgements in the collaborative RAs are most prominent in Robotics, where researchers acknowledge funding received by each individual, as in (21):

(21) *The first author's research is funded by the Austrian Science Fund (FWF): P24927-N25 - "Stewart Gough platforms with self-motions". The second author's research is supported by the Austrian Science Fund (FWF): W1214-N15/DK9 and P26607 - "Algebraic Methods in Kinematics: Motion Factorisation and Bond Theory". (Rob 98)*

The results reveal that funding acknowledgements mainly mention institutions rather than individuals. These are usually large public research institutions of national and international significance or funding programmes, such as national Research councils or Science foundations and European funding frameworks. In hard sciences scholars usually acknowledge funding implicitly by only naming the institution and providing details of the grant (22), while academics in soft sciences are more likely to thank explicitly and frequently in a more emotional manner (23):

(22) *The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under Grant Agreement No. 285417—project ICARUS Integrated Components for Assisted Rescue and Unmanned Search operations. (Rob 31)*

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(23) *I wish to acknowledge the support of the Arts and Humanities Research Council who funded early research on this article, and the Terra Foundation for American Art who funded research travel in 2007 - I am grateful to both. (Art 97)*

Implicit, impersonal and typically quite formulaic funding acknowledgements such as (22) could result from the fact that public funding bodies necessarily require to acknowledge the financial support received, frequently providing the exact required formulation for the acknowledgement text. Salager-Meyer et al. (2009), for example, mention the requirement of Venezuelan national research councils or university research centers to acknowledge the grant number and the name of the funding body in all articles based on the grant received. It could be the case that the authors do not want to change the required formulation or that they do not feel that explicit thanks to such formal institutions as Research councils or Science foundations are appropriate. Even though we encounter such examples as (23) in our corpus, they are not frequent and are primarily restricted to the soft disciplines.

Another acknowledged resources category, access to data, typically includes thanks for providing access to research materials and equipment, and for issuing

permissions. It is most frequently found in the RAs in Biology (43%) and Education (33%), while Art history (23%) and Robotics (16%) seem to be the fields that are less reliant on access to external data. Overall, this category of acknowledgements typically includes thanks for supplying data/materials, for providing specimens and samples, and for granting permissions to collect data, carry out fieldwork, and use copyrighted materials.

The analysis of the Thanking for resources category reveals a number of disciplinary differences. Expressing gratitude for providing, donating or lending technical equipment and tools is only found in Robotics and Biology, which is not unusual considering the nature of these disciplines. Data provided by study participants is frequently acknowledged by academics in Education and Biology, since research in these fields often involves human subjects. Researchers in Art history and Education tend to thank for the sources of the data required for their analysis, including thanks for such resources as images, research materials, drawings, or unpublished manuscripts. Moreover, academics in Art history seem to show more reliance on public institutions for gathering their research materials, as they frequently include thanks to libraries, archives, museums and galleries as well as to their workers.

The third acknowledged category of resources is technical help. It is most frequent in Biology (63%), but less so in Education (24%) and Robotics (23%). Scholars in Art history do not seem to rely on this type of support, since only 2% of all acknowledgements in the RAs of this discipline include thanks for technical assistance. Cronin et al. (1993: 39) suggested that the high number of technical assistance mentions in Sociology RAs might be connected to the interdisciplinary character of this discipline. It seems that the high number of thanks in this category in our study could also be related to the reliance of academics in Biology, Robotics, and Education on experts in other fields.

Generally, thanking for technical support is most frequent when authors express gratitude for fieldwork help, which includes field experiments, trials and testing, as well as data collection. Thanks for data and sample collection expressed to groups, individuals, research assistants and staff, undergraduate students, volunteers and fieldworkers are especially common in Biology, where the total number of occurrences amounts to 31. Additionally, writers in Biology tend to thank for lab work or for sample maintenance (24), or animal care (25):

(24) We thank Barbara Crestanello and Matteo Girardi *for helping during field sampling and lab activities.* (Bio 11)

(25) We thank Marylou Aldering and Franca Kropman *for taking good care of our experimental birds.* (Bio 67)

These categories have not been found in any other field analysed, as they seem to be characteristic of practices exercised by researchers in Biology only.

Thanking for clerical support is the least frequent category in the acknowledgements of the analysed RAs, with a similar percentage in all disciplines, ranging from 2% in Art history to 10% in Biology. Other studies also showed that this category is least frequent in RAs (Alcaraz, 2014) as well as in dissertation acknowledgements (Hyland, 2004). Writers in this section most often thank for proofreading, especially in the field of Education.

Finally, the Thanking for moral support step presents gratitude for emotional support, including encouragement, friendship and care. Compared to other Thanking move steps, the overall frequency of thanks for moral support in the corpus is not high. However, it is occasionally found in Art history (15%). Hard sciences and Education fields show a very low percentage or complete absence (as in Robotics) of this step. In Art history thanks in this step are mostly expressed for encouragement, enthusiasm and patience, and are addressed not only to colleagues, but also towards peer reviewers or editors.

Previous studies have suggested that due to their personal character thanks for moral support are expressed to acknowledge people beyond the academic community (Alcaraz, 2014). This was mostly noted in dissertation acknowledgements, where thanks for moral support generally tended to be addressed to family and friends (Hyland, 2004). However, this is not the case in the present study, where all thanks for moral help are directed towards the academic community members.

A brief look at the lexical realisations of gratitude expressions in the Thanking move has revealed that researchers usually tend to use a fixed set of words to express gratitude. The results show that scholars in all disciplines most frequently use performative verbs *thank* and *acknowledge*, which comprised 96% of all verb forms, nouns *thanks* and *gratitude* with the 96% occurrence rate within all noun expressions, and the adjective *grateful* (82%).

The disciplinary differences are more transparent when the context of the analysed expressions is considered. The main performative verbs, nouns and adjectives denoting gratitude may be modified by adjectives (e.g. *warm*, *special*, *sincere*, *deep*), adverbs (e.g. *gratefully*, *deeply*, *warmly*, *greatly*, *especially*), or quantifying determiner *very* in order to strengthen the act of gratitude. These modifiers are most prominent in Art history, in which 39 gratitude expressions are modified, while Robotics, Biology and Education show preference for plain expressions. Occasionally, nouns are further intensified with a modification by superlative adjectives (e.g. *warmest*, *sincerest*, *profoundest*, *deepest*), but this has been observed only in Art history and occasionally in Education RA acknowledgements:

(26) I would like to express my *profoundest gratitude* to Sheila McTighe, Scott Nethersole, Ben Thomas and Genevieve Warwick *for their suggestions on this text.*
(Art 49)

(27) In addition, we extend our *deepest appreciation to the teachers and students who participated in this study and openly shared their perspectives with us.* (Edu 71)

As can be seen in (26), thanking expressions can be preceded by a formulaic preface (*I would like to*), which, as suggested by Hyland & Tse (2004: 268), weakens the act of gratitude. The present study shows that *I would like to* and *I wish to* are most frequent in Robotics, Education, and Art history, where they account for 52%, 31%, and 30% of all verb and noun gratitude expressions, respectively. In contrast, only 8% of gratitude expressions in Biology include a preface.

Furthermore, as has been already mentioned, in Robotics and Biology there is a tendency to express acknowledgements omitting the actual thanking act, especially when acknowledging financial support. Reference to the funding source in these cases is usually expressed in the passive voice, thus adding to the formality of the acknowledgement:

(28) *This work is supported by National Natural Science Foundation of China under Grants 51475331 and 51005199, and supported by the Fundamental Research Funds for the Central Universities.* (Rob 81)

In Art history, on the other hand, thanks ranged from rather brief and implicit to more overt ones, generally displaying more vigour and less formulaic phrasing than in other disciplines:

(29) I benefited *enormously* from suggestions made by the anonymous readers and Maureen Warren. (Art 40)

(30) *This article could not have been written without the generous support of Dr Teresa Freitas Morna and Dr António Meira Marques Henriques at the Museu de São Roque, Lisbon.* (Art 24)

3.2.3. *Announcing move*

This last move most frequently occurs in the acknowledgements sections in Education (31%) and Biology (30%), and less so in Art history (14%) and in Robotics (3%). It consists of two main steps, namely, Accepting responsibility, and Dedication.

The Accepting responsibility step includes responsibility claims for any remaining errors or omissions as well as notes on conflicts of interest that might have affected the results of the research. The analysis shows that the Accepting responsibility step is more frequent in Education (31%) and Biology (29%), and less so in Art history (9%) and Robotics (2%).

Scientists in Biology tend to declare the absence of conflicts of interest, though more often disclaimers are related to sample collection and analysis, since declaration of approval of methods, protocols, or procedures, and guidelines being followed are mentioned in the majority of Biology acknowledgements. This is hardly surprising, as research in Biology usually includes studies on animals and humans, which are strictly regulated by ethical requirements. Therefore, it seems that authors are expected to declare this information explicitly, which often results in multiple disclaimer statements per one acknowledgement, as in (31):

(31) *All procedures were approved* by the Virginia Tech Institutional Animal Care and Use Committee (protocol 13–105), *collections were made under permits* from The Bahamas Ministry of Agriculture and BEST Commission, and *import of animals was approved* by the United States Fish and Wildlife Service. (Bio 29)

Researchers in soft sciences are more likely to mention responsibilities for their views and opinions, and for the remaining errors. Particularly in Education there is a tendency to provide a disclaimer regarding the authorial responsibility of the views presented in the article, and for the remaining errors, which occurred in 58% and 42% of all disclaimers in Education, respectively:

(32) *The views expressed here are those of the authors* and should not necessarily be attributed to their institutions, data providers, or the funders. *Any and all errors are attributable to the authors.* (Edu 77)

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The disclaimer for the remaining errors expressed in the Acknowledgements section is also common in Art history, where scholars typically claim responsibility for translations, usually using a fixed expression (*translations are my own*) that is frequently preceded by a preface *unless otherwise stated/indicated*:

(33) *Unless otherwise stated, all translations are my own.* (Art 91)

The RA authors in Robotics are least inclined to provide a disclaimer, since it has been found in only two acknowledgement texts.

The Dedication step is the least frequent step found in the corpus. Dedications occasionally occurred in Robotics, Biology, and Art history, with Art history having the highest occurrence of this step (6%). The relatively high occurrence of dedications in Art history might be influenced by the number of authors per RA in each discipline. As seen in Table 8, Art history is a very individualistic discipline, which favours single-authored articles, while research in Robotics, Biology and Education tends to be based on collaboration of three to five authors per RA. Previous studies found that dedications are common in acknowledgements in dissertations (e.g. Hyland, 2004), which involve individually conducted research and seem to allow more personal space in acknowledgements.

It has to be noted that, if the Dedication step is related to the overall aim of acknowledgements to thank somebody for something, the Accepting responsibility step seems to be much less readily linked to the communicative purpose of expressing thanks, traditionally attributed to acknowledgements as a genre.

4. CONCLUSIONS

The aim of this paper is to investigate the rhetorical move/step structure of acknowledgements in RAs from four disciplines (Biology, Robotics, Education and Art history) and explore patterns of scholarly communication that acknowledgements can reveal.

The rhetorical move/step structure analysis has revealed interesting disciplinary preferences and trends of expressing gratitude. The results show that acknowledgements are more frequent in the RAs in Robotics and Biology in comparison to Art history and Education, suggesting that acknowledgements in hard sciences are a more conventional part of RAs than in soft sciences. Scholars in Robotics tend to be most economical with words when writing acknowledgements, and, interestingly, it is researchers in Biology who compose the longest acknowledgements in comparison to their colleagues in Robotics, Art history and Education. This is partly due to lengthy disclaimers of conflicts of interest and descriptions of the ways to adhere to the ethics of research dominating in Acknowledgements sections of Biology RAs.

The structural analysis confirmed the already established trends of acknowledgement construction with the Thanking move being the obligatory move in all disciplines. Within the Thanking move, however, disciplines cluster in various ways regarding their preference for one or another type of resources received and acknowledged. Financial support is mentioned in nearly every article in Robotics and Biology, whereas it is quite scarce in Education and especially in Art history. The greatest variety of academic support types can be observed in Art history and Education RAs, whereas peer review feedback seems to be mostly appreciated in Biology and Art history. Thanks for moral support have been mostly found in Art history, suggesting a more interpersonal nature of acknowledgements in this field, in comparison to other fields. The interpersonal dimension of acknowledgements in Art history is also confirmed by vivid, elaborate and emotional formulations of gratitude.

The distribution of the remaining moves has revealed certain disciplinary differences, with scholars in Art history tending to introduce the main Thanking move by providing information about previous scientific events, in which the results of the study were presented. This shows that sharing research results prior to publication is a common phenomenon in this discipline. Lastly, responsibility claims typical of the Announcing move are an important part of acknowledgements in Biology and Education. This tendency could be related to the fact that studies in

these fields are based on animal and human subjects and require careful handling of ethical aspects of research.

Overall, it seems that the structural characteristics of acknowledgements in each discipline are pre-determined by distinct disciplinary practices. However, even though this study has revealed a number of cross-disciplinary differences, it has also displayed some features that seem to be universal in all fields analysed. Acknowledging academic support and provision of resources in particular seems to be the most important practice in all four disciplines. Understanding and following disciplinary trends of acknowledging is essential for novice and experienced writers alike, and as such, it should be an important part of EAP/ESP training.

Interestingly, the results of the study show that in all of the analysed disciplines there is a tendency for the Acknowledgements section to pursue more communicative purposes than the traditional expression of gratitude.³ Responsibility statements, disclaimers, proof of compliance with the ethical conduct rules appear in this section alongside very frequent implicit impersonal funding acknowledgements that do not show whether the author(s) feel grateful for the finances received at all. Acknowledgements sections thus seem to become a convenient place within the RA to present more aspects relevant to the research conducted than a mere gratitude expression. They can also be viewed as reflective of the aspects of research that receive increasing importance in certain science fields.

This research could be extended further by conducting interviews with scholars from the analysed disciplines in order to get a glimpse at traditions and patterns of disciplinary communication from an insider's perspective. Another interesting area of acknowledgement studies could be interdisciplinary fields, for example, Behavioural economics, or Computational linguistics; such studies could show whether the merger of different disciplines may have any effect on acknowledging practices. Cross-linguistic studies of acknowledgements (cf. Giannoni, 2002 or Salager-Meyer et al., 2009, for example) are still scarce, yet very interesting, as they could show whether it is the big culture or the small culture which dominates in the world of acknowledgements.

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GABRIELĖ GUŠČYTĖ is a graduate of English Philology programme at Vilnius University, Lithuania. Her research interests include corpus linguistics and genre analysis studies.

JOLANTA ŠINKŪNIENĖ is Associate Professor of English Linguistics at the Faculty of Philology, Vilnius University, Lithuania. Her research interests focus on research writing patterns and epistemological traditions of various disciplines and cultures, academic rhetoric, elements of persuasion in academic discourse, research publication practices, evaluation of research, academic identity aspects. She has co-edited a volume *Intercultural perspectives on research writing* (John Benjamins, 2018).