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A Quantitative Investigation of the Titles of Research Articles on Education for Sustainable Development

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Abstract

Education contributes to the vision of a sustainable world by promoting sustainability and sustainable development in the teaching and learning processes both globally and locally (Salīte et al., 2024, p. 2). The idea of an environmentally-balanced and sustainable planet forms an intrinsic part of Education for Sustainable Development (ESD). Fairly recently, there has been a surge in research publications that focus on ESD (Kapranov, 2020a). Concurrently, studies on the ESD-related discourse are on the rise as well (Collins & Garrity, 2025; Luchenko & Yurchenko, 2023). However, there is insufficient research on the titles of research articles (RAs) on ESD (Kapranov, 2021). Seeking to address the current research gap, this contribution presents a quantitative study that aims to establish the frequency of lexical items in the titles of RAs on ESD. Specifically, the study involves a corpus of titles of RAs that are published by the Journal of Teacher Education for Sustainability within the period of time from 2014 to 2024. The corpus is processed in the computer program AntConc (Anthony, 2022) in order to identify the frequently occurring lexica associated with the titles. The results of the quantitative examination indicate that the titles in the corpus are characterised by such frequently occurring lexica as prepositions (e.g., of) and such notional words as education. These findings are illustrated and discussed in relation to the existing literature on titles in RAs. The article concludes with an outline of the major findings and their applicability to academic writing in the domain of ESD.

Keywords: *academic discourse, research article (RA), research article title, education for sustainable development (ESD), a quantitative analysis*

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INTRODUCTION

In today's world, humanity is plagued by an unprecedented level of existential problems associated with such issues as climate change, environmental pollution, and a spectacular lack of resources (Kapranov, 2018). Accordingly, scholarly literature points to the need to increase people's awareness of the notions of the environment, climate change, and sustainability (Fløttum & Dahl, 2012; Fløttum & Gjerstad, 2013; Fløttum et al., 2014; Kapranov, 2017a, 2017b). Fortunately, there are multiple actors, inclusive of business circles, media, nongovernmental organisations (NGOs), politicians, and societal leaders, who are responsive to the problems of the environment, environmental protection, climate change, sustainability, and sustainable development (Fløttum et al., 2014; Harrington, 2023; Kapranov, 2016a, 2022a; Oliver Yébenes, 2024). In this regard, we should note that education providers and as well as individual teachers appear to exhibit a noticeable level of awareness of the aforementioned problems (Collins & Garrity, 2025; Kapranov, 2022b; Luchenko & Yurchenko, 2023; Salīte et al., 2024).

In this light, there seems to be a growing understanding of education as a pillar of sustainability and sustainable development (Chen et al., 2021; De la Fuente, 2022; Kapranov, 2020a, 2020b). Indeed, education serves as a catalyst for a sustainable world by promoting sustainability and sustainable development in the teaching and learning processes both globally and locally (Salīte et al., 2024, p. 2). With this in mind, it is not surprising that Education for Sustainable Development (ESD) is a commonly used and accepted approach to education that provides a clear path to a sustainable future by means of empowering learners, education providers and individual education practitioners to become aware of sustainable practices (Kapranov, 2013; Rieckmann, 2018; Salas-Zapata & Ortiz-Muñoz, 2019; Sposab & Rieckmann, 2024), which are applicable to the glocal (i.e., global and local) teaching contexts, as well as to daily instructional routines (Salīte et al., 2024). On this point, Zeyer (2024, p. 2) argues that ESD seems to be "a possible guiding framework for science-based and value-sensible discourse on sustainable development in schools and in the public sphere", which provides a holistic and scientifically grounded approach to sustainable development (SD) in the teaching and learning processes. In connection with Zeyer's (2024) argument, Zhou (2024) specifies that

> ESD now incorporates human rights, gender equality, cultural diversity, and other related issues in constructing a sustainable future (UN, 2015). ESD was given a fundamental role as a tool for spreading values and knowledge related to SD and as a practical approach to training learners in skills and competencies that can contribute to SD. (Zhou, 2024, p. 3)

Understandably, there is a thriving research milieu in the domain of ESD studies that offers scientific insight into a variety of ESD-related topics (Chen et al., 2021; Collins & Garrity, 2025; Luchenko & Yurchenko, 2023; Luchenko et al., 2024; Rieckmann, 2018). Remarkably, there is a

substantial body of research on the ESD discourse (Kapranov, 2021; Chang & Kidman, 2018; Macintyre et al., 2024; Stevenson, 2006) and its peculiarities, which are represented by lexical, pragmatic, rhetorical and other discursive means. Discourse, according to Foucault (1971), can be conceived of as a social use of language that takes place in particular cultural and historic conditions that are reflective of human experiences. Furthermore, Foucault's (1971) approach to discourse involves an idea of specific language patterns, which are defined by regularity. In turn, the patterning of discourse is informative of the socio-cultural and historic peculiarities of people, who not only generate discourse but also are, to a substantial extent, defined by it (Fairclough, 1985). In other words, Foucault's (1971) approach is indicative of discourse as a force that creates discursive spaces by (i) determining people's perceptions of the world, as well as (ii) producing and organising socially meaningful networks of meanings and associations (Kapranov, 2016b, 2016c), which permeate people's quotidian existence. Additionally, the Foucauldian take on discourse involves a contention that discourse is intricately connected to the notion of power (Foucault, 1971), which is socially and, importantly, discursively embedded into a variety of socio-cultural and political types of power. It should be reiterated that discourses are manifested by specific means, which involve, inter alia, lexical items and, in particular, frequently occurring lexica.

In terms of the lexical means that are involved in ESD-related discourses, there are very few studies, if at all, that investigate how research articles (RAs) on ESD are titled. It should be, perhaps, noted that the title of an RA is a text in miniature (Haggan, 2004), which

> brings about an identity for any academic piece of work; that is why it is worth investigating. Furthermore, as Haggan (2004) mentioned, authors work on the title, and readers read it as the first part of an article. Therefore, the title has a critical role in readers' decision to read a paper or ignore it; in other words, it can motivate or demotivate the readers to read an article (Moslehi & Kafipour, 2022, p.1).

Moreover, a good RA title "should indicate the topic of study, should indicate the scope of the study, and should be self-explanatory to readers in the chosen area" (Swales & Feak, 1994, p. 205). According to Jiang and Hyland (2023, p. 239), titles of RAs represent a crucial feature of the papers and are seen as an increasingly important part of RAs due to the changes in publishing practices and the explosion of published research. Importantly, the title of an RA "illuminates the study by highlighting its most crucial points" (Cheng et al., 2012, p.1) and "conveys essential information aiming to condense the whole article" (Roldan-Riejos, 2022, p. 311).

Taking into account the aforementioned considerations and seeking to address the current research gap, this contribution presents a quantitative investigation that aims at establishing the frequency of lexical items in the titles of RAs on ESD. Particularly, the study involves a corpus of titles of

RAs that are published by the Journal of Teacher Education for Sustainability, which is one of the leading scholarly journals in the field of ESD. The present study aims at answering the following **research question** (RQ): What are the frequently occurring lexical items that are used in the titles of RAs in the Journal of Teacher Education for Sustainability?

Driven by the RQ, this article proceeds as follows. First, an outline of the literature on titles in RAs is provided. Second, the present study is introduced and discussed. Third, the major findings of the study are encapsulated and summarised.

TITLES IN RAs: AN OUTLINE OF THE LITERATURE

There is a plethora of academic publications on the topic of titles in RAs (Cheng et al., 2012; Haggan, 2004; Jiang & Hyland, 2023; Moslehi & Kafipour, 2022; Pułaczewska, 2009; Roldan-Riejos, 2022; Soler, 2011; Xie, 2020). According to Xie (2020), the literature seems to examine such aspects of RA titles as their syntactic structure, pragmatic functions, and lexical means. Let us dwell upon these aspects in more detail.

In terms of the syntactic structure, Moslehi and Kafipour (2022) argue that the titles of RAs in medicine and applied linguistics, respectively, are characterised by the frequent use of nominal constructions, as well as verbal and prepositional constructions. Furthermore, Moslehi and Kafipour (2022) demonstrate that the most frequent syntactic components of nominal structures in their corpus of RAs are post- and pre-modifiers. Additionally, Moslehi and Kafipour (2022) show that whilst the titles in RAs in medicine tend to use syntactically complete sentences, the titles in applied linguistics typically employ gerund phrases and incomplete sentences. Moslehi and Kafipour's (2022) findings resonate with an earlier study conducted by Nagano (2015), who examines the structure of titles of RAs in such scientific disciplines as botany, engineering, geology, medicine, economics, education, history, and sociology. Quite similarly to Moslehi and Kafipour (2022), Nagano (2015) reports that the so-called soft sciences (for instance, education, history, etc.) resort to shorter titles with a less frequently occurring noun phrases in contrast to the hard sciences (e.g., geology). Contrary to Nagano (2015), however, Xie (2020) asserts that the titles of English-medium RAs involve, predominantly, noun phrases as the preferred type of titles, whereas titles with verb phrases occur not so often. Xie's (2020) findings lend support to the study by Soler (2011), which is focused on the structural construction of scientific titles in English and Spanish RAs in the biological and social sciences. Particularly, Soler's (2011) study reveals that there is a clear prevalence of nominal-group titles as a linguistic strategy of scientific discourse. Furthermore, she indicates that the titles of RAs in biological sciences are characterised by the frequently occurring full-sentence constructions (Soler, 2011).

As far as the functions of the titles of RAs are concerned, Haggan (2004) argues that their pragmatic roles in hard sciences, literature and linguistics seem to be different depending on the discipline. Haggan (2004) shows that there are clear-cut differences in pragmatic intentions in the RA titles in the aforesaid disciplines. Additionally, the pragmatic differences are concomitant with the fundamental differences in terms of frequency and form of the titles across these disciplines. The study conducted by Haggan (2004) demonstrates that the major pragmatic roles of titles consist in (i) informing the readers as to what the paper is about and (ii) attracting the readers to read the paper. Furthermore, Haggan (2004) notes that the pragmatic functions of RA titles rest on techniques involved in information packaging and advertising. However, Haggan (2004) observes that researchers from each discipline, presumably, decide intuitively upon the linguistic and pragmatic features that they consider important in imparting the readers an idea of what the RA is about. According to Haggan (2004), in order for the title to be pragmatically successful, the title design may rely upon such constructions as full sentences, compounds, and noun phrases with or without post-modification. To an extent, the findings provided by Haggan (2004) are supported by a fairly recent publication by Jiang and Hyland (2023). They posit that the RA titles from the leading journals from six disciplines show a considerable increase in the length of titles coupled with more interrogative and compound titles. Jiang and Hyland (2023) explain this phenomenon by the need to accommodate the pragmatic functions associated with mentioning the methods in the titles of RAs in hard sciences and a more frequent inclusion of results in the RAs of soft disciplines. Presumably, these functions are reflective of the differences in characteristics of the research domains and the changing dynamics of publishing contexts (Jiang & Hyland, 2023). Also, the results of the study by Haggan (2004) and Jiang and Hyland (2023) seem to resonate with an investigation conducted by Cheng, Kuo, and Kuo (2012), which reveals the following pragmatic functions of the titles in RAs in applied linguistics, namely Topic-Scope, Topic-Method, Topic-Description, Topic-Source, Metaphor-Topic, and Topic-Question. In contrast to Cheng, Kuo, and Kuo (2012), Pułaczewska (2009) reckons that the titles of RAs may serve the following two functions

> Non-gradable functions:
> - Onomastic (indexical). It is a part of the article's proper name (its bibliographic address) and can function metonymically as its proper name
> Gradable functions:
> - Informative. It describes the macrostructure (topics) of the text and/or its superstructure (genre). In accordance with the principle proclaimed above of using the word "function" to mean "what it is good for" rather than "the way it works," this translates into three sub-functions: (a) Selection — it helps the reader to decide whether the text is of interest to her (b) Categorisation — it helps the reader to classify the text (e.g. librarians, indexers) (c) Interpretation — it instructs the reader how to decode the text, enabling her of creating a cognitive macro- and

superstructure to be filled in with text items while reading, and interpreting particular text items by locating them in the existing macro- and superstructure
- Marketing. It appeals to the potential reader promising that the reading of the article will be rewarding (e.g. in terms of the cognitive gain, practical applicability or entertainment)
- Mnemonic. It helps the reader and the author to remember, retrieve, and refer to the article and its contents. (Pułaczewska, 2009, p. 275)

In addition to the pragmatic functions and syntactic structures of the titles of RAs, there seems to be a research direction that focuses on the frequently occurring lexical features (Roldan-Riejos, 2022). Specifically, a study by Roldan-Riejos (2022) looks into a corpus of 60 RAs titles pertaining to civil constructions, hydrology and urban services. She uses AntConc (Anthony, 2022) in order to generate word frequency lists associated with the titles of RAs in these scientific disciplines. The results of her quantitative investigation reveal that prepositions, for instance, *of*, *on*, and *in*, as well as nouns (e.g., *study*), and verbs in either -ing or -ed forms (for instance, *reinforced*, *using*, etc.) are the most frequently occurring lexical items in the corpus. Furthermore, Roldan-Riejos (2022) maintains that in terms of tokens, the most frequent function words in the corpus are represented by the prepositions *of*, *on* and the conjunction *and*. She argues that a relatively high frequency of the occurrence of the aforementioned function words is explained by the syntactic roles that they perform in prepositional groups and/or in linking nominal clauses.

Having surveyed the literature, let us proceed to the present study, which is based upon a quantitative computer-assisted methodology of corpus analysis.

THE PRESENT STUDY

The present study, as already mentioned in the introduction, is motivated by insufficient research on the frequency of lexical items in the titles of RAs on ESD. Presumably, a quantitative investigation of the frequently recurrent lexica in the titles of RAs on ESD can (i) provide a deeper understanding of the topic/topics of ESD-related scholarly studies, as well as (ii) shed light on their scope (Swales & Feak, 1994). Given that the titles of RAs on ESD could be seen as a crucial feature (Jiang & Hyland, 2023, p. 239) that illuminates their essence (Cheng et al., 2012, p.1) and presents the most important information about the whole article (Roldan-Riejos, 2022, p. 311), the present study aims at generating new knowledge about the titles in RAs on ESD by establishing the frequency of the occurrence of lexical items that are found in the titles (see the RQ that is provided in the introduction). In this light, the study involves a corpus of the titles of RAs found in the Journal of Teacher Education for Sustainability. This journal is one of the leading scholarly outlets in the field of ESD and indexed in a number of prominent databases, such as Scopus.

Accordingly, the corpus of the study is comprised of the titles of RAs on ESD published by the Journal of Teacher Education for Sustainability from 2014 to 2024, which are freely available at https://sciendo.com/journal/JTES. The descriptive statistics of the corpus are summarised in Table 1 below.

Table 1. The Descriptive Statistics of the Corpus

#	Descriptive Statistics	Value
1	The total number of titles in the corpus	224
2	The total number of words in the corpus	2946
3	Mean words	13.3
4	Standard deviation words	4.5
5	Maximum words	30
6	Minimum words	4

In terms of the procedure and the methodology, the following should be noted. The titles of RAs in the corpus were accessed at https://sciendo.com/journal/JTES, downloaded and saved as a Word file. The file was subsequently processed in the computer concordance program AntConc (Anthony, 2022) in order to compute the frequency of the occurrence of lexical items used in the titles. That was done by means of the application of the word list function of AntConc. Additionally, the function of N-gram (i.e., collocations with an N number of words) was used to look for the contextual environment of the most frequent lexica in the corpus. Essentially, the methodology of the present investigation replicated the methods that were described in the study by Roldan-Riejos (2022). The results of the quantitative analysis of the corpus are further given and discussed in the following section of the article.

RESULTS AND DISCUSSION

The application of AntConc (Anthony, 2022) to the corpus has yielded the occurrence of the most frequent lexica that are presented in Table 2 below. It should be noted that Table 2 summarises 15 most frequently occurring lexical items in the corpus.

Table 2. The Most Frequently Occurring Lexica in the Corpus

#	Type	Rank	Frequency
1	*Of*	1	171
2	*The*	2	141

3	*In*	3	118
4	*Education*	4	108
5	*And*	5	106
6	*For*	6	102
7	*Sustainable*	7	81
8	*A*	8	68
9	*Development*	9	63
10	*Sustainability*	10	58
11	*Teachers*	11	57
12	*Teacher*	12	54
13	*To*	13	32
14	*Learning*	14	30
15	*On*	15	28

It follows from Table 2 that prepositions, such as *of*, *in*, *for*, *to*, and *on* seem to be the most frequently occurring lexica in the corpus. These findings lend support to the study conducted by Moslehi and Kafipour (2022), who also have established that the titles of RAs can be described in terms of the frequently used prepositional constructions. Furthermore, the present results bolster Soler's (2011) research, which reveals that the titles of RAs may involve frequently occurring noun phrases with prepositions. Moreover, the findings that are reported in this study (see Table 2) provide direct support to the previously discussed article by Roldan-Riejos (2022), who demonstrates that the prepositions *of*, *on*, and *in* are among the most frequently occurring lexica in the titles of RAs in her corpus. Notably, the present findings seem to reinforce the argument made by Roldan-Riejos (2022), who suggests that the high frequency of the occurrence of the aforementioned prepositions is accounted for by the syntactic roles that they perform in prepositional phrases (PPs) and/or in linking nominal clauses. Indeed, the analysis of the preposition *of*, which is the most frequent preposition in our corpus, in the function of AntConc (Anthony, 2022) that is called N-gram supports the argument by Roldan-Riejos (2022). Below, in Table 3, the N-grams consisting of the most frequent (N = 15) four-word collocations with the preposition *of* are presented.

Table 3. The N-gram with the Preposition *Of*

#	**N-Gram Consisting of Four Words**	**Rank**	**Frequency**
1	*Of education for sustainable*	1	5
2	*Of educational institutions in*	2	2
3	*Of pre-service preschool*	2	2
4	*Of pre-service teachers*	2	2

5	*Of teacher education for*	2	2
6	*Of a consumption specific*	6	1
7	*Of a global pandemic*	6	1
8	*Of a positive school*	6	1
9	*Of a short story*	6	1
10	*Of a student teacher*	6	1
11	*Of academic staff in*	6	1
12	*Of academic staff the*	6	1
13	*Of academic staff training*	6	1
14	*Of action of future*	6	1
15	*Of an instrument the*	6	1

Judging from the data summarised in Table 3, the preposition *of* collocates rather frequently with the noun phrase (NP) *education for sustainable* (frequency = 5, rank = 1). Normally, the preposition *of* is used in the corpus as a postmodifier that involves, at least, some sort of reference either to the notional words *education/educational* or *pre-service teacher/teachers* (see Table 3).

In a similar fashion, let us further illustrate one of the frequently occurring prepositions *in* by its involvement in the four-word N-grams (see Table 4 below).

Table 4. The N-gram with the Preposition *In*

#	**N-Gram Consisting of Four Words**	**Rank**	**Frequency**
1	*In pre-service teacher*	1	4
2	*In the context of*	2	3
3	*In blended e-studies*	3	2
4	*In Estonian preschool child*	3	2
5	*In teacher education for*	3	2
6	*In a grammar and*	6	1
7	*In accessing higher education*	6	1
8	*In Bangladesh a gap*	6	1
9	*In business administration education*	6	1
10	*In creating our lived*	6	1
11	*In Croatian schools diagnosis*	6	1
12	*In cross sectional human*	6	1
13	*In cultural negotiation probing*	6	1
14	*In didactics applying self*	6	1
15	*In education effectiveness of*	6	1

Analogously to the frequently occurring preposition *of*, the N-grams with *in* show a high frequency of the occurrence with the NP *pre-service teacher* (frequency = 4, rank = 1). Unlike these findings, however, the frequently occurring preposition *for* collocates, predominantly, with an NP *sustainable future*, as exemplified by Table 5 below.

Table 5. The N-gram with the Preposition *For*

#	N-Gram Consisting of Four Words	Rank	Frequency
1	*For a sustainable future*	1	4
2	*For education for sustainable*	2	2
3	*For English acquisition in*	2	2
4	*For sustainable development a*	2	2
5	*For sustainable development an*	2	2
6	*For sustainable development in*	2	2
7	*For sustainable development investigating*	2	2
8	*For sustainable development the*	2	2
9	*For the implementation of*	2	2
10	*For a changing world*	10	1
11	*For a more sustainable*	10	1
12	*For a sustainable world*	10	1
13	*For adults a holistic*	10	1
14	*For adults within the*	10	1
15	*For all learners the*	10	1

Additionally, the frequently occurring preposition *for* collocates with the NP *sustainable development* (see Table 5). As far as the N-grams with the frequent notional word *education* are concerned, their highest frequency is represented by the NP *education for sustainable development* (frequency = 18, rank = 1), as evident from Table 6.

Table 6. The N-gram with the Notional Word *Education*

#	N-Gram Consisting of Four Words	Rank	Frequency
1	*Education for sustainable development*	1	18
2	*Education for sustainability the*	2	2
3	*Education in Estonian preschool*	2	2
4	*Education a study on*	4	1
5	*Education a transdisciplinary approach*	4	1

6	*Education admission perspectives from*	4	1
7	*Education among Iranian EFL*	4	1
8	*Education an analysis of*	4	1
9	*Education and care services*	4	1
10	*Education and distributed leadership*	4	1
11	*Education and leadership for*	4	1
12	*Education and presentation of*	4	1
13	*Education and sustainability a*	4	1
14	*Education and sustainability international*	4	1
15	*Education at eastern and*	4	1

It is inferred from Table 6 that the frequently occurring notional word *education* serves as an attractor that focuses the reader's attention on *education for sustainable development*. We may argue that the high frequency of the occurrence of *education* in the cluster NP + PP (i.e., prepositional phrase) *education for sustainable development* is explained by what Pułaczewska (2009) refers to as the gradable pragmatic function of the titles of RAs. In unity with Pułaczewska (2009), we may contend that the frequent cluster NP + PP *education for sustainable development* performs an informative subfunction by describing the macrostructure of the text and pointing clearly towards its overarching topic associated with ESD. In addition, the frequently occurring cluster NP + PP *education for sustainable development* is related to the subfunction of categorisation, since it guides the readers to the category of texts that fall under the aegis of ESD.

CONCLUSIONS

The present contribution has presented and described a quantitative computer-assisted study whose aim is to establish the most frequently occurring lexical items in a corpus of the titles of RAs on ESD published by the Journal of Teacher Education for Sustainability. By means of applying (i) the word list function and (ii) the N-gram function of the computer program AntCont (Anthony, 2022), it has been found that the most frequently occurring lexica in the corpus are associated with such prepositions as *of*, *in*, *for*, and the notional word *education*, which collocates frequently with the four-word N-gram *education for sustainable development*.

The frequent occurrence of the prepositions *of*, *in*, and *for* in the corpus does not seem to be fortuitous. Arguably, they appear to be extensively involved in forming a rather crucial pragmatic focus that points the readers to the NPs *education for sustainable* and *education for sustainable education*, and to the notional words *education/educational* and teacher/*teachers*. Additionally, it has been discovered that the notional word *education* occurs highly frequently in corpus. Its

frequency of the occurrence seems to guide the readers to the overarching topic of the journal, which permeates the majority of the titles, namely ESD.

These findings could be interpreted as a discursive manifestation of the importance of the notions of education and ESD, respectively, which infuse the titles of RAs published in the Journal of Teacher Education for Sustainability. Their frequent occurrence in the titles of RAs is reflective of (i) the ethos of the journal and (ii) the journal's orientation to ESD. Hopefully, these findings will facilitate the composition of titles of RAs that are submitted for publication to the Journal of Teacher Education for Sustainability.
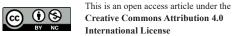
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