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Analysis of Students' Academic Literacy Skills: A Pilot Study on The Development of A Scientific Writing Module Based on Douglas Walton's Witness Arguments

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Abstract. Academic literacy encompasses all literacy practices, including the scientific writing skills. This sort of writing requires critical, analytical, and evaluative thinking skills, which are closely linked to the construction of arguments within academic texts. This study aims to analyze students' academic literacy skills as a pilot study for the development of an instructional module on scientific writing based on argumentation. The type of argumentation used in this study is the *witness argument* model proposed by Douglas Walton. A qualitative approach was employed through document study. The data sources for this research included the course syllabus and students' journal article manuscripts. Content analysis was used for data analysis, involving procedures of data collection, reduction, and verification. The research findings are described as follows. First, the Academic Literacy course syllabus was designed to incorporate three competencies at the lower taxonomy levels (C1 and C2), four competencies at the medium levels (C3 and C4), and seven competencies at the higher levels (C5 and C6). Second, the representation of the witness argument type in students' journal articles included expert opinion arguments, analogy arguments, practical reasoning arguments, fact-hypothesis arguments, exception arguments, and precedent arguments. The results of this pilot study may serve as a foundation for further research, particularly in the development of an instructional module for scientific writing based on the witness argument model.

Keywords: academic literacy; scientific writing; course syllabus; student journal articles; witness argument.

INTRODUCTION

In the context of 21st-century skills, knowledge transformation is rooted in higher-order thinking skills. Higher-order thinking represents a new mode of operation in academic settings, encompassing critical thinking, creativity, communication, and collaboration (Cañas et al., 2017; Singh et al., 2018). This aligns with the view of Kiili et al. (2013), who argue that academic literacy involves cognitive, social, and cultural competencies, technological proficiency, and the ability to communicate and collaborate effectively. In brief, academic literacy can be defined as a set of skills and competencies necessary to critically use, interpret, and produce information.

Scientific writing is one form of academic literacy expression, aimed at revealing or solving problems through scientific theories, methods, and procedures (Carstens, 2014). As such, scientific writing closely associated with cognitive domains of higher-order thinking such as analyzing, evaluating, synthesizing, and creating is considered a vital academic activity (Armstrong et al., 2015). In line with this, the higher-order thinking skills in this study refer to the revised version of Bloom's cognitive taxonomy (Anderson et al., 2001). This taxonomy classifies six cognitive levels using operational verbs: remembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), and creating (C6). Anderson et al. (2001) note that when this taxonomy is operationally applied in instructional design, it facilitates both educators and learners in constructing various messages and meanings to achieve learning objectives. Accordingly, reviewing instructional design documents becomes essential, particularly to improve teaching and learning practices.

The quality of a scientific paper, among other factors, can be evaluated by the construction of arguments presented by the author. This study adopts Douglas Walton's *witness argument* model, which focuses on critical arguments, evaluating the components within an argument structure, including statements, reasons or evidence, and conclusions. According to Walton (2006, 2013), witness arguments take several forms: (1) expert opinion arguments, (2) analogy arguments, (3) practical reasoning arguments, (4) fact-hypothesis arguments, (5) exception

arguments, and (6) precedent arguments.

Several previous studies have investigated academic literacy with a focus on students' scientific writing skills based on argumentation. For example, Van Lacum et al. (2014) explored the relationship between the argumentative structure of student scientific articles and rhetorical aspects, including discourse categories and citation contexts. They collected annotated scholarly publications using a four-layer rhetorical annotation method with explanations of argumentation and examined student assignment construction to improve learning on argumentative writing topics.

Marinkovich et al. (2016), using a qualitative approach, explored academic literacy practices through an analysis of student scientific writing across five different academic disciplines. Their findings showed that each student's paper reflected a specific genre characteristic of its respective discipline. They concluded that student papers, whether book reviews, essays, or presentation materials from five different faculties, demonstrated two distinct orientations: formative and prescriptive. Although student work still differed significantly from expert writing, it nonetheless reflected their identity as learners. Unlike these studies, the present pilot study uses data sources and research subjects from the same discipline, Indonesian language education pre-service teachers.

Specifically, in relation to scientific writing literacy based on argumentation, McKinley (2015) suggested the need to integrate academic literacy across disciplines, especially by fostering a culture of critical, argument-based scientific writing. Critical argumentation, according to McKinley, is a combination of logical reasoning and evaluative thinking, particularly evaluating supporting evidence for claims and examining the logical relationships between claims, evidence, and conclusions. What distinguishes McKinley's study from the current research is that this study focuses on evaluating students' thinking levels and argument quality based on Walton's witness argument model.

Solikhah (2015) conducted a study on academic literacy in reading and writing skills within an English for Academic Purposes (EAP) program. Employing a quantitative approach and inferential statistical analysis, she found a gap between students' academic reading and writing literacy, particularly in the use of academic vocabulary, grammar, data (argumentation), and citations. Meanwhile, Lubis (2020) conducted a case study on journal articles written by non-native English-speaking students. He analyzed the rhetorical structure of scientific arguments in 113 articles, focusing on the argument construction in the 'results and discussion' sections. The findings showed that students often interpreted their research results by referencing authoritative arguments or previous studies. However, many of the articles examined contained unresolved or incomplete claims.

This pilot study does not focus on journal articles written by non-native English speakers but rather on scientific papers written by students who are learning Indonesian as a second language (L2). In Flores, East Nusa Tenggara, student-teachers typically acquire their local vernaculars as their first language. When they begin formal education, they learn Indonesian as their second language. Based on this context, the present study aims to analyze the academic literacy skills of students, serving as a pilot study for the development of a scientific writing module based on Walton's witness argument framework.

METHODS

This study is a pilot investigation conducted at Universitas Katolik Indonesia Santu Paulus Ruteng, Flores, East Nusa Tenggara. The pilot study aims to provide an initial assessment of issues related to students' academic literacy, with a particular focus on scientific writing instruction. The research was designed using a descriptive qualitative approach. The data sources for this study consist of the course syllabus for the Academic Literacy course and 20 student-authored scientific papers in the form of journal articles. Data collection was carried out using documentation methods (document study), which involved the examination of the course syllabus and student journal articles. The data were analyzed using content analysis techniques, including data reduction, data display, and conclusion drawing. The data analysis procedure involved the following steps: (1) data from the course syllabus and scientific articles were

identified and entered into a data tabulation format; (2) the data were reduced to determine their analytical relevance; (3) the data were interpreted and given meaning; (4) conclusions were drawn based on the interpreted data

RESULTS AND DISCUSSION

Results of the Syllabus Review

The learning outcomes for the Academic Literacy course, as outlined in the Semester Learning Plan (RPS), comprise five core competencies comprising (1) students are able to write essays; (2) students are able to write papers; (3) students are able to write journal articles; (4) students are to write internship or community service reports; and (5) students are able to write scientific reports based on community service. These five competencies are further broken down into 14 Basic Competencies. The results of the identification and analysis of the syllabus are presented in the table below:

Table 1. Result of KD and RPS studies based ob taxonomy

No.	Basic Competency (KD)	Operational Verb	Level Description
1	Understand	C2	Low
2	Explain	C2	Low
3	Distinguish	C2	Low
4	Apply	C3	Medium
5	Explain	C3	Medium
6	Analyze	C4	High
7	Apply	C3	Medium
8	Apply	C3	Medium
9	Analyze	C4	High
10	Analyze	C4	High
11	Evaluate	C5	High
12	Create/Produce	C6	High
13	Create/Produce	C6	High
14	Create/Produce	C6	High

Based on the competency mapping shown in table 1, it is evident that 7 Basic Competences are formulated at higher-order thinking levels: Basic Competence 6 (C4), Basic Competence 9 (C4), Basic Competence 10 (C4), Basic Competence 11 (C5), Basic Competence 12 (C6), Basic Competence 13 (C6), and Basic Competence 14 (C6). Meanwhile, 4 Basic Competences are at the medium level (C3), and 3 Basic Competences are at the lower level (C2).

The syllabus also includes structured assignments consisting of group and individual tasks. Individual assignments require students to prepare a presentation paper, while group assignments involve writing a type of scientific work as a final output of the course, with topics assigned based on group distribution. These outputs are expected at a high cognitive level (C6), and are linked in practice to other medium and high-level domains such as C3, C4, and C5.

From the syllabus analysis, it can be concluded that the overall Study Program Learning Outcomes align with the course description, particularly in developing students' capacity to produce high-quality and impactful scientific writing. Such writing is typically the result of thoughtful academic engagement and higher-order thinking processes. According to Krathwohl (in Singh et al., 2017), indicators for assessing higher-order thinking include the domains of analyzing (C4), evaluating (C5), and creating (C6). The analyzing domain refers to the ability to deconstruct and interpret a concept into several aspects and identify logical relationships to build comprehensive understanding. The evaluating domain involves determining the value of a concept based on certain norms or criteria to draw logical conclusions. The creating domain reflects the ability to combine components into a new, original, and functional product (Cañas et al., 2017).

Discussing the learning plan for academic writing, Scott et al. (2017) highlight the importance of designing instruction that enhances students' overall basic literacy as a foundation for scientific writing competence. Students must be equipped with social, cultural, and digital literacies, especially the ability to connect their reading (both online and offline) to their writing. Hence, both learning activities and assignments should incorporate feedback, whether through written comments or grades, to guide students in improving their writing. This approach is particularly vital for supporting effective online learning (Rokhman et al., 2022; Syaifudin et al., 2020).

This description aligns with Glew et al. (2019), who argue that the integration of academic literacy support, student retention, and quality instruction can significantly enhance academic writing instruction. Writing as a productive language skill is inherently different from other learning activities, and academic writing is a literacy form oriented toward producing concrete outputs.

Accordingly, learning design must take into account four key aspects: context, input, process, and product. All these aspects should be carefully evaluated in a comprehensive manner, and it is crucial that such evaluation aligns with the targeted outcomes (Kessler, 2018; Owen, 2015).

Results of the Student Journal Article Review

From the analysis of 20 student-written journal articles, a total of 32 argumentative paragraphs were identified in the background and discussion sections, all categorized under the witness-type arguments**.** The breakdown is as follows: (1) 14 paragraphs employed expert opinion arguments; (2) 4 paragraphs used analogy arguments; (3) 5 paragraphs presented practical reasoning arguments; (4) 2 paragraphs contained fact-hypothesis arguments; (5) 3 paragraphs included exception arguments; (6) 4 paragraphs used precedent arguments. The distribution and representation of witness-type arguments used in the students' journal articles are summarized in **Table 2.**

This analysis indicates that students are relatively more inclined to use expert opinions as the dominant argumentative strategy. The use of precedents, exceptions, and other logical structures is less frequent, suggesting a possible gap in the diversity and complexity of argumentation styles employed. This trend may reflect the students' familiarity with or preference for referencing authoritative sources over constructing more nuanced or varied logical frameworks. The findings imply the need for instructional emphasis not only on sourcing credible references but also on diversifying and strengthening argumentative writing techniques to foster critical and higher-order thinking skills.

Based on the review presented in Table 2, it can be concluded that the students' thinking skills levels reflected in their journal article products are primarily at the explaining (C3) and analyzing (C4) levels. As exemplified in data (Art 4/D11), expert opinions serve mainly as conceptual information. According to Walton (2013), expert opinion arguments are not only conceptual foundations but also tools for testing or comparing concepts from various expert perspectives. This means not all expert opinions are automatically accepted (Nesi et al., 2022). In academic literacy, expert opinions can be used to evaluate concepts because experts may have differing views depending on the evidence they present. Hence, researchers or writers must justify their choices by reviewing diverse expert opinions and deciding which to reference, supported by evidence (Von der Mühlen et al., 2019). This process of citing, comparing, and evaluating expert opinions to develop or create new concepts constitutes critical literacy (Bobkina & Stefanova, 2016; Hendriani, 2018).

Data (Art 8/D2) is analyzed as an analogy argument at cognitive level C4 (analysis). Although analogies appear as high-level thinking, in Walton's witness argument typology, analogies primarily serve as introductions via comparison. Beyond that, analogy arguments can be evaluated by scrutinizing their premises (Walton, 2010). Thus, analogy reasoning is case-based, where a writer compares similar cases to evaluate and create. This creative thinking allows the author to draw conclusions and potentially develop new concepts.

According to Macagno & Walton (2018), practical reasoning arguments aim to solve practical problems by logically justifying acceptance or rejection of decisions. They seek to clarify relative truths or degrees of truth. Data (Art 17/D3) is categorized here, showing students narrating socio-cultural contexts, supported by interviews and expert opinions, leading to justification and synthesis. This descriptive narrative, backed by data, reflects critical literacy in scientific writing.

Data (Art 12/D1) is categorized as fact-hypothesis arguments. Walton (2006) describes these arguments as fact-based but requiring verification, illustrated by differing perspectives on the same fact in a legal case. Such arguments are crucial in academic literacy, particularly in inductive research, where conclusions are drawn from analyzed facts. Fact-hypothesis arguments must undergo evaluation and synthesis to confirm truth.

Occasionally, writers need to exclude certain elements to avoid overgeneralization and ensure conclusions are valid and reliable (Keraf, 2007; Walton & Zhang, 2016). Data (Art 20/D5) shows exception arguments, indicating analysis based on field facts where "Religion and English teachers" are excluded from the general category of elementary school teachers. This analytical exclusion demonstrates higher-order thinking at level C4. Data (Art 7/D2) reflects precedent arguments, where students review and analyze three relevant studies, describing topics, methods, and results. Reviewing related research is vital to identifying gaps and novelty. Precedent arguments refer to existing examples and involve analysis and evaluation (Walton, 2006, 2013).

Table 2. Examples of argument types in student journal articles

No.	Data Quotation	Type of Argument	Context and Analysis	Cognitive Level
1	"Payong (2016:164) states that the aim of the 2013 Curriculum is to prepare Indonesians to live as faithful, productive, creative, innovative, and affective individuals, capable of contributing to society, nation, state, and global civilization." (Art 4/D11)	Expert Opinion Argument	Quoted from the results and discussion section. The student uses an expert's opinion to explain the goals of the 2013 Curriculum. The expert's statement is placed at the beginning of the paragraph, followed by the student's own claim. The expert's view is used solely to support an explanation, not for analyzing or evaluating data.	C3
2	"Like two sides of the same coin with different images but equal value, sociopragmatics and sociolinguistics fall under the same linguistic domain but study different subjects." (Art 8/D2)	Analogy Argument	Taken from the introduction section. The student compares the relationship between two disciplines using analogy. The explanation demonstrates both understanding and analysis, thus reflecting higher-order thinking.	C4
3	"The Wae Rebo community in Manggarai, Flores, has long preserved their ancestral cultural heritage. One example is Tudak, a ceremonial prayer in the Congkolokap ritual, expressed by the head of the clan to convey gratitude to God and ancestors." (Art 17/D3)	Practical Reasoning Argument	Taken from the background section. The student narrates socio-cultural practices, followed by interview results and expert opinions. The argument demonstrates justified reasoning, hence categorized as higher-order thinking.	C4
4	"Initial observations revealed that the speech of youth in Ranggu village, West Manggarai, indicates a lack of linguistic politeness." (Art 12/D1)	Fact-Hypothesis Argument	Quoted from the background section. The student uses field observations as supporting data, followed by analytical interpretation. This is categorized as high-level analytical thinking.	C4
5	"Prospective elementary teachers must master competencies across all disciplines since they generally teach multiple subjects. However, some teachers focus only on specific subjects like Religion or English." (Art 20/D5)	Exception Argument	From the results and discussion. The second sentence introduces an exception, based on real classroom practice. The argument involves analysis of field data, demonstrating higher-order cognitive skills.	C4
6	"The three studies discussed above led the researcher to identify the novelty of this study, namely the use of cooperative learning in Indonesian language teaching—specifically in group work for reading descriptive texts intensively. However, in this study, group work is contextualized within online learning through e-learning platforms." (Art 7/D2)	Precedent Argument	From the background section. The student summarizes three previous studies relevant to the topic, detailing their topics, methods, and findings. The argument reflects comparative analysis and higher-order thinking.	C4

CONCLUSION

Based on the results of this study, the author draws three conclusions. First, the Standard Competences within the Academic Literacy course syllabus (RPS), designed for teaching scientific writing, accommodate some higher-order cognitive levels; however, some competencies are still designed at lower and medium cognitive levels. Second, the document study shows that the implementation of witness argument types in student journal article products generally operates at the C4 cognitive level (analyzing).

Based on these conclusions, the author offers several recommendations. First, academic literacy development through scientific writing should be designed to incorporate 21st-century skills, including critical thinking, communication, collaboration, and creativity. Second, teaching scientific writing should consider multi-literacies, particularly the integration of reading, writing, and information and technology literacy. Third, the author views the development of a scientific writing learning module based on witness arguments as urgent to improve the quality of learning in the Academic Literacy course.

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