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Viat Map vs Open Ended Toulmin Arguments: Effects in Low vs High Ability EFL Learners

Rizqy Ghaniyyu FADHILAH[a*], Banni Satria ANDOKO[a], Ely Setyo ASTUTI[a] & Aguk SRIDARYONO[b]

[a]*Politeknik Negeri Malang, Indonesia*
[b]*Politeknik Angkatan Darat, Indonesia*

*acmilrizqy17@gmail.com

Abstract: Comparing closed-ended and open-ended learning in understanding argumentation using the Toulmin method for second-year students at the State Polytechnic of Malang, this study evaluated how free-form learning and constructivism influenced student engagement, and the extent to which low and high pre-test proficiency moderated the impact of both platforms on learning improvement. High-ability students were grouped based on high pre-test scores, while low-ability students were grouped differently. Pre-test and post-test data from each learning group were classified and analyzed using ANOVA. The results showed that the parametric ANOVA interaction was marginal ($p \approx 0.06$), but Aligned-Rank ANOVA confirmed that the interaction between device and proficiency yielded significant results ($p = 0.045$). These findings suggest that constructivism improved more than free-form learning alone among low-ability students. Meanwhile, high-ability students showed minimal improvement in both conditions, with no significant differences between the two learning conditions. This study provides theoretical and practical information, which guides the design of more effective and adaptive educational technology.

Keywords: Sentence Reconstruction, Argument Toulmin, Constructivism, Viat-Map

1. Introduction

The constructivist approach emphasizes that learning occurs through active student participation supported by social interaction and teacher guidance, thus developing critical thinking skills (Chen & Wang, 2016; Duke et al., 2021; Efgivia et al., 2021; Mohammed & Kinyó, 2022). The Toulmin Claim, Grounds, Warrant model provides a systematic framework for formulating and evaluating arguments and honing language skills (Hakim et al., 2023; Niki Bagus S et al., 2020; Stephen et al., 2011). In the context of argumentation learning, constructivism encourages students to build their own understanding through reconstruction and structured arguments, such as the Toulmin sentence method, which helps systematically construct and critique arguments. (Andoko et al., 2020, 2022, 2023; Rismanto et al., 2021; Sauppe & Flecken, 2021)

This study aims to compare sentence reconstruction-based learning with open-ended learning using Toulmin argumentation in constructing sentences and arguments. The main focus is to examine how open-ended and closed-ended learning affect the improvement of students' argumentation skills with varying initial ability levels. This research is expected to make a significant contribution to optimizing adaptive and effective argumentation learning methods for various learner profiles.

2. Method

2.1 Experimental Setting

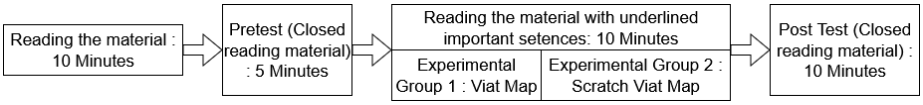

Figure 1. Flowchart Research

Figure 1 shows the research flow, which began with a 10-minute reading of English material about computers and iPods, followed by a 5-minute pre-test to measure basic understanding through 10 statements related to the topic. Next, students read the material with important sentences underlined to facilitate understanding of Toulmin's argument. Experimental group one used a closed-ended approach, while group two used an open-ended approach in answering the same questions for 10 minutes, where the open-ended group was free to answer without choice. The subjects were second-year students of the Information Technology Study Program at the State Polytechnic of Malang who were divided based on class schedules without randomization. Learning outcomes were measured by comparing pre-test and post-test scores, with the pre-test score as an indicator of basic ability and detection of ceiling effects, and the post-test score reflecting improvements after learning using the Toulmin-based Scratch Via Map application.

2.2 Materials and Tools

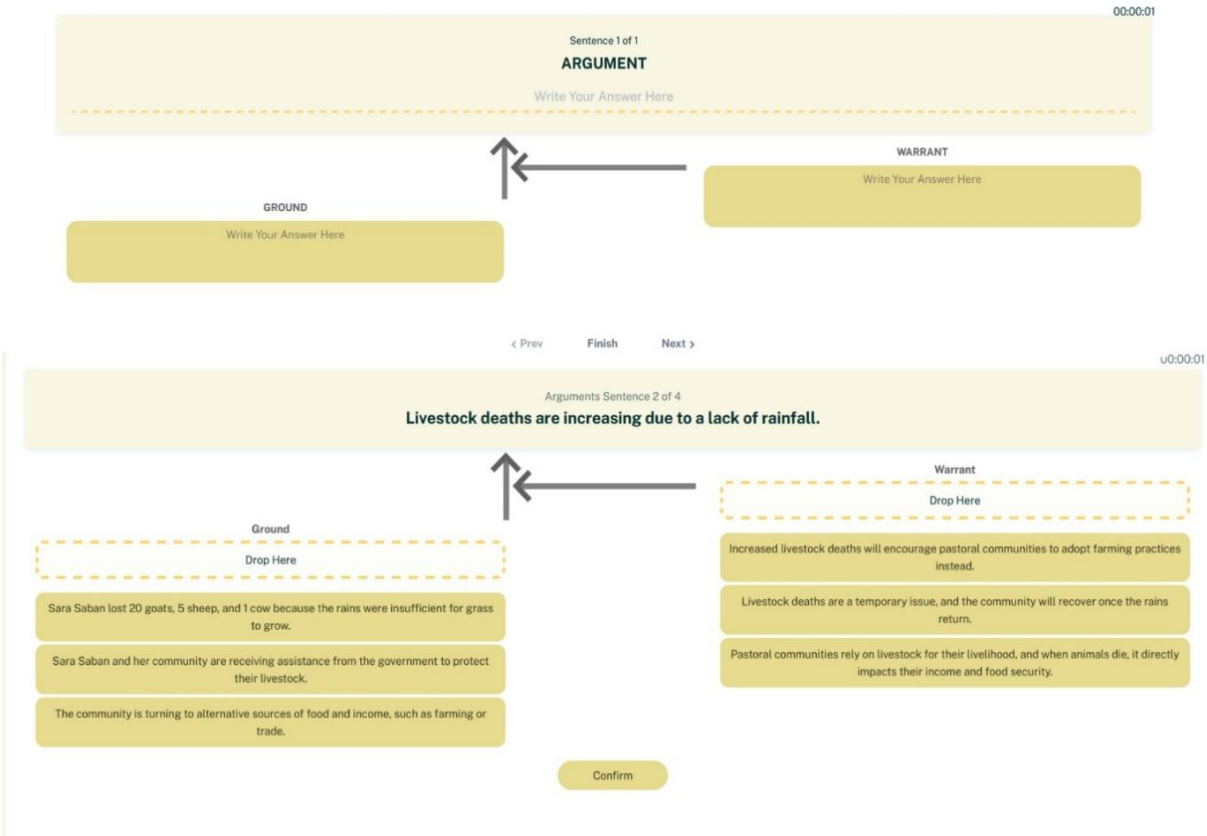

Figure 2. Application: Close-ended & Open-ended

The open-ended platform (Figure 2 Top) allows students to fill in the blanks with their own answers based on the reading, without any provided options, encouraging them to construct arguments actively. Students fill in the Ground and Warrant with reasons that support the claim, such as filling in the Ground with "Sara Saban lost 20 goats..." and the Warrant with "Pastoral communities rely on livestock...". In contrast, the closed-ended platform (Figure 2 Bottom) provides options that can be selected from the teacher's understanding and dragged to the

relevant zones, such as the Ground and Warrant. Students select statements that support the main claim, such as "Sara Saban lost 20 goats..." for the Ground and "Pastoral communities rely on livestock..." for the Warrant.

2.3 Data Analysis

Table 1. *Data Analysis Open-ended & Closed-ended*

Name	Group	Pre	Post	Gain	Name	Group	Pre	Post	Gain
M01	Scratch	6,00	8	2,00	V01	Viat-Map	3,00	3	0,00
M02	Scratch	6,00	6	0,00	V02	Viat-Map	6,00	8	2,00
M03	Scratch	9,00	9	0,00	V03	Viat-Map	3,00	3	0,00
M04	Scratch	2,00	3	1,00	V04	Viat-Map	6,00	7	1,00
M05	Scratch	8,00	8	0,00	V05	Viat-Map	7,00	9	2,00
M06	Scratch	4,00	6	2,00	V06	Viat-Map	4,00	4	0,00
M07	Scratch	5,00	5	0,00	V07	Viat-Map	3,00	4	1,00
M08	Scratch	4,00	5	1,00	V08	Viat-Map	6,00	7	1,00
M09	Scratch	6,00	7	1,00	V09	Viat-Map	5,00	7	2,00
M10	Scratch	6,00	6	0,00	V10	Viat-Map	5,00	6	1,00
M11	Scratch	5,00	5	0,00	V11	Viat-Map	5,00	5	0,00
M12	Scratch	6,00	8	2,00	V12	Viat-Map	5,00	6	1,00
M13	Scratch	4,00	5	1,00	V13	Viat-Map	7,00	6	-1,00
M14	Scratch	6,00	7	1,00	V14	Viat-Map	4,00	6	2,00
M15	Scratch	7,00	6	-1,00	V15	Viat-Map	7,00	9	2,00
M16	Scratch	3,00	4	1,00	V16	Viat-Map	7,00	7	0,00
M17	Scratch	7,00	7	0,00	V17	Viat-Map	3,00	5	2,00
M18	Scratch	3,00	3	0,00	V18	Viat-Map	8,00	8	0,00

Table 1 displays the scores of two groups to identify high-ability students (high pre-test) and compare the difference in improvement (gain) from the post-test. Gain was calculated from the pre-test and post-test scores, along with an analysis of true-false patterns during the task. The pre-test scores were also used to detect ceiling effects in high-ability students. Statistical tests used the Aligned-Rank Transform ANOVA to test for differences in gain between groups and the interaction between learning method and initial ability.

3. Results and Discussion

3.1 Aligned-Rank Transform (ART) ANOVA

Table 2. *ART ANOVA on Aligned-Rank Transformed Gain Scores*

Source	df	F	p
Group	1, 32	0,6861	0,328
Ability	1, 32	9.319	0.0045
Group × Ability	1, 32	4.365	0,447

Based on Table 2 with Aligned-Rank Transform, ability remained highly significant, $F(1,32)=9.319$, $p=0.0045$; the tool X ability interaction was significant, $F(1,32)=4.365$, $p=0.0447$, confirming that the effect of instructional tools differed by ability; the main effect of tools was not significant. Consistently, low-ability learners recorded greater gains than high-ability learners, so the Viat map was most beneficial for the low-ability group, with the effect most pronounced when rank-based analysis was used to handle non-normal residuals.

4. Conclusion

Results showed that closed-ended learning outperformed open-ended learning only for low-ability students; high-ability students improved minimally and did not differ between methods. The parametric ANOVA interaction was marginal ($p = 0.06$), but a more robust nonparametric analysis confirmed a significant tool × ability interaction ($p = 0.045$). Initial ability was the strongest predictor; beginners made greater gains regardless of method.

However, the limitations of small cell sizes ($n \approx 8–10$) limit generalizability; marginal p values in parametric tests suggest the need for larger samples. Non-normal residuals necessitate nonparametric methods; median splitting of pre-test scores reduces precision. Further research employs regression or ANCOVA for continuous ability, involves larger and more diverse samples across grades and schools, incorporates a longitudinal design, and qualitatively analyzes interaction logs and think-alouds to map cognitive strategies.

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