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Argumentation and mathematical communication in textbooks for the eighth grade of primary education

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ABSTRACT

The purpose of this article is to characterise the questions that focus on the ability to argue and communicate in textbooks, from the curricular perspective and the Krummheuer's model. For this, we carried out a content analysis by applying two checklists to the students' texts, the teacher's teaching guide, and the students' workbook for the 8th grade of basic school in Chile. After the analysis of 50 activities, we found that the questions that focus on the ability to argue and communicate lack collaborative work. This means the students assume a passive role within the work involving skill, since they work alone, without the necessary interaction to generate the development of the skill. It is also evident that the Krummheuer's model complies with developing this skill, however, elements of the Toulmin Model -qualifiers and rebuttal- appear, which makes the process and work with this skill more complex and complete than is believed. Finally, it is necessary to alter the teaching guide, since it does not develop guidelines on how teachers should work with argument and communication skills in the classroom.

Keywords: Argumentation, communication; textbooks; Krummhuer's model; Primary education

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INTRODUCTION

Over the past 20 years, in Chile, the curricula proposed by the Ministry of Education (MINEDUC) have been changing. Among these changes, we highlight the implicit incorporation of the ability to argue and communicate (AAC) in the curriculum of the 8th grade of basic education (MINEDUC, 2001), the introduction of skills in the curricular bases of the 1st to 6th grade of basic education (MINEDUC, 2012), and greater accuracy in the definition and characterisation of the AAC of the 7th to II grades (year 10) of secondary education (MINEDUC, 2015). Thus, in MINEDUC (2001), some scopes related to AAC are developed implicitly, highlighting that students could 1) communicate a process, results, and conclusions; 2) justify, argue, and substantiate results; 3) seek patterns and regularity; and 4) develop collective and group work, encouraging discussions.

Continuing with those changes, in 2012, a modification to the curricular bases of basic education was proposed, in which work with mathematical skills came into play. Thus, MINEDUC (2012) notes that in basic education the development of mathematical thinking is sought, in which four skills are involved: 1) representing; 2) discussing and communicating; 3) solving problems; and 4) representing, where these aim at providing the student with the development of new skills, concepts, and their application in different mathematical contexts.

In 2015, the curricular bases were altered again, from the basic education to the 2nd grade of secondary education. Thus, MINEDUC (2015) proposes a definition of AAC with greater precision and aspects related to it. In this change, elements related to the interpretation and

identification of logical chains in relation to mathematics, the raising of hypotheses in everyday life situations and the resolution of problems are integrated, where students can develop examples and counterexamples, allowing them to verbalise their intuitions and conclusions.

All these changes are closely related to important issues that have to do with both the teacher and the student and their role within the AAC. The National Governors Association Center for Best Practice and Council of Chief State School Officer (NGAC & CCSSO, 2010), both agencies in charge of the management of the Departments of Primary and Secondary Education in the United States, propose standards related to mathematics teaching. They state that the teacher oversees encouraging students to raise conjectures, use examples and counterexamples, verbalise their conclusions and results and compare arguments between peers. Hence, Toro and Castro (2020) state that the teacher must support the argumentation by orchestrating discussions and designing tasks based on argument structures that can be pointed out by the students.

On the other hand, and regarding the students' role in the work with the AAC, the NGAC and CCSSO (2010) indicate that it focuses on the raising of conjectures and logical progressions that can be divided into small cases so that they can be verified by counterexamples. On their side, Acosta & Hermosa (2015) mention that one of the tasks that the student has in the AAC consists of activating sequences of processes where they can perform mathematical formulations of the situations, as well as employ concepts, data, procedures, and mathematical reasoning to interpret and validate their results.

Likewise, the Organization for Economic Cooperation and Development (OECD, 2017) emphasises that in the argumentative process, the student must design and implement strategies that allow them to find solutions to mathematical problems by applying rules and algorithms, to develop the use of different representations and apply a generalisation of the results obtained. It also proposes the following criteria that the students must consider when approaching the work with the argumentative process: 1) *Mathematical formulation of situations*, which refers to explaining, defending, or providing a justification of the identified or elaborated representation of a real-world situation; 2) *Use of concepts, data, procedures, and mathematical reasoning*, it consists of explaining, defending, or justifying the processes and procedures used to determine a mathematical result or solution; to reach a mathematical solution, make generalizations, or make a multi-step argument the data must be related; 3) *Intervention, application, and assessment of mathematical results*, it focuses on reflecting on mathematical solutions and elaborating explanations and arguments that support, refute, or provide a mathematical solution to a contextualised problem.

Following the above considerations, we observe that the development of the AAC should be incorporated into the mathematics classroom. For this, it is important to include the AAC, together with the other competencies, in the initial and continuous training of teachers as well as in textbooks. Textbooks play a fundamental role in the instructional process since they have been and are widely used in the classroom and have been able to adapt to technological changes (Braga & Belver, 2016), allowing compliance with and implementation of curricular guidelines (Cantoral et al. 2015). This is a resource that not only supports the teacher's work in organizing instruction, but it is also a source of help and consultation that the student can access constantly and that allows families to supervise and/or collaborate in the student learning process (Díaz-Levicoy et al. 2017).

On the development of curricula, MINEDUC notes that the best performing countries are migrating to curricula based on objective-based learning, also called learning standards. For this reason, MINEDUC develops a construction of its teaching plans and programmes based on the experience of international curricula of countries such as Argentina, Australia, Canada, Cuba, Spain, the United States (some states), Finland, England, Mexico, New Zealand, and Singapore (MINEDUC, 2012).

On the other hand, a review of the international assessment frameworks was carried out, such as the Programme for the International Assessment of Students (PISA), the Study of Trends in Mathematics and Sciences (TIMMS), the International Study on Civic and Citizen Education (ICCS) and the International Study on Digital Competences (ICILS). This review allowed us to have the necessary information to compare them, which contributed to decision-making regarding

the issues to be addressed in each course, where sequences of content and skills were identified, enabling us to equate the requirements of the Chilean curriculum with the requirements at the international level (MINEDUC, 2015).

AAC is one of the four skills MINEDUC has included in the study plans and programs, which plays an important role in acquiring new skills and learning in the math subject. Therefore, the AAC becomes an important ability to be analysed since it is present in the textbooks delivered to students by MINEDUC.

In this context, MINEDUC (2015) notes that the AAC seeks to convince others of the validity of the results obtained in developing mathematical processes. Adding to this, it is established that the AAC is achieved when the student is able to develop oral and/or written expressions around objects or mathematical issues, including explanations and application of basic properties, development of calculations, procedures, and managing to express their results in more than one way.

In a similar vein, Pedreros (2016) presents some of the characteristics that the AAC must have, in which the main indicators that allow generating learning situations through the use and application of the AAC are exposed: 1) Communicate results with a language or a mathematical expression; 2) Explain procedures using mathematical language; 3) Formulate and verify conjectures: Communicate and substantiate based on inductive reasoning; 4) Identify and explain errors using mathematical language; 5) Check rules and properties: Make deductions.

From the indicators presented, we can see that they are involved in aspects related to the teacher and the student. Regarding this, MINEDUC (2016) establishes that the teacher must be in charge of providing students opportunities to explain, discover, and develop discussions collectively about the solution of a problem, the arguments and inferences proper to it, managing to listen to the students and correct them when necessary.

From the above, we can highlight that the teacher's role in the work with the AAC is mainly focused on providing students with opportunities to participate, allowing them to experiment and discuss the solutions of a problem collectively, thus facilitating the development through collaborative work. Thus, MINEDUC (2015) indicates that, when working with the AAC, it is possible to implement students' collaborative work, which is mainly based on the search for new solutions to a problem. In this sense, it indicates that with collaborative work, students may learn to express ideas and listen and have their creativity and reflective attitude boosted.

On the other hand, the students' role is also part of the process and work with the AAC. Regarding this role, MINEDUC (2015) mentions that the learner must be able to convince others by expressing their position about problematic situations and encounter opportunities to experiment. Through this they may raise collective discussions with their peers that may lead them to verbalise different approaches, arguments, and inferences while confronting different problematic situations.

Regarding the work with the AAC, Stephen Toulmin is one of the most important authors. Moreno et al. (2015) state that Toulmin defines argumentation as an activity in which a hypothesis or general idea must be raised. This hypothesis aims to develop a process of questioning, where a search for foundations that can support it must be carried out, and in turn, find reasons that allow a refutation of what has been raised, to reach a valid conclusion.

In the same line, Solar et al. (2012) point out that Toulmin proposes a model that considers a sequence composed of six elements (Figure 1): 1) Data: the facts or factual information that are invoked to justify and validate the statement; 2) Conclusion: the thesis that is established; 3) Justification: the reasons (rules, principles) proposed to justify the connections between the data and the conclusion; 4) Foundation: the basic knowledge that allows ensuring justification; 5) Qualifiers: provide an implicit comment on the justification; In fact, they are the force that justification gives to the argument; 6) Rebuttal: they provide an implicit comment as well, but they also point out the circumstances in which the justifications are not true.

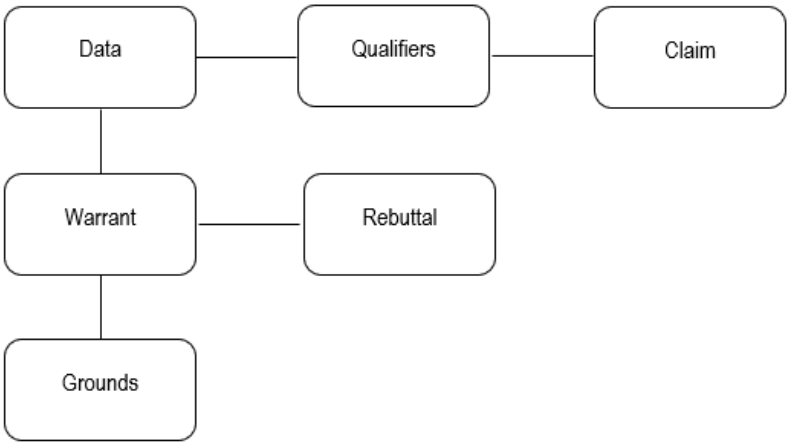

Figure 1. Toulmin's Model of Argumentation.
Extracted from Solar et al. (2012).

Grounded on the model proposed by Toulmin (1958), Krummheuer (2015) defines argumentation as a specific characteristic of social interaction, mainly related to face-to-face interactions that have to do with an intentional explanation of the reasoning of a solution to a problem. This explanation can be carried out during or after applying the activities proposed in classes, which can be done in small groups and around all the class activities.

Based on this position adopted by Krummheuer with respect to AAC, he develops an adaptation of the Toulmin model, to be able to analyze the various arguments that arise in math classes. Based on the above, it proposes a model (Figure 2) composed of four elements: 1) *data*: corresponds to the facts that allow the information to be validated and justified; They are the basis on which the argument is developed and which allows us to reach the conclusion; 2) *justification*: they support the foundations by giving categorical arguments about the main convictions that guide the thoughts of individuals when arguing. It is basically the connection between the data and the conclusion; 3) *foundations*: they correspond to the reasoning to develop inferences applied in the argumentation, which allow the assurance of justification; and 4) *conclusion*: corresponds to the validation of what was doubted at the beginning of the argument. Krummeheuer's model is shown in figure 2 below.

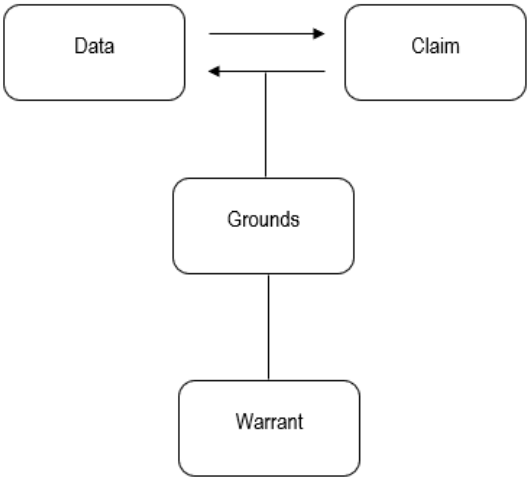

Figure 2. Krummheuer's Model of Argumentation.
Extracted from Cobb and Bauersfeld (1995)

In this reduction of Toulmin's model, Krummheuer leaves aside the elements *qualifiers* and *rebuttal*. Regarding this, Inglis (2007) points out that it is not very clear why Krummheuer made

this reduction, but that this could potentially be justified if it is taken into consideration that the specific focus of his study was the observations of arguments made by students in the classroom.

In this scheme, the conclusion corresponds to a statement sustained by the representation of a statement. In this sense, every argument is defined as a statement that is based on something, which can be evidence, facts, information, or other statements. In this aspect, the bases given for a statement correspond to the data. These can be sustained for several reasons, and their validity can be questioned by others. The problem arises when questioning the importance of the data, in which a justification is necessary. This justification is where the legitimacy of the data is established; in short, it is why the data is considered as substantial support to the claim. Foundations are responsible for providing greater support for the justification, i.e., they indicate why claims should be accepted (Krummheuer, 1995).

Then, it is relevant to answer the question: What are the characteristics of the questions that focus on the AAC, as stated in the curricular bases and the Krummheuer's model in the ministerial texts for the student and the teacher at the 8th grade of basic education?

METHOD

The sample used for this research is of a documentation type, corresponding to texts of MINEDUC for the 8th grade of basic school: student text (ST) (Catalan et al. 2017), teaching handbook (TH) (Muñoz & Manosalva, 2017) and workbook (WB) (Muñoz & Chacón, 2017), from which we selected the questions focused on the AAC, following a system of categories (Bardin, 1986).

Then, we determined the keywords to identify each of the questions selected for this study, achieving certain coding rules related to the AAC. These coding rules emerge from the definition and characteristics delivered in the curricular bases of MINEDUC and Krummheuer's model for the AAC. The keywords (original Spanish words in parenthesis) related to the AAC were *argue (argumentar, argumenta)*, *argumentation (argumentación)*, *identify the error (identifica el error)*, *discover the error (descubre el error)*, and *describe the procedure (descubre el procedimiento)*.

After this, we counted the activities in the number unit, with which we decided to work in this research. From this, we obtained that the number of activities to consider were 50, namely, 20 from the ST, 15 from the TH and 15 from the WB.

Data collection tools

To carry out the study of each of the 50 questions selected from the ministerial texts, we used two lists of comparisons, one for what MINEDUC indicated and the other addressing Krummheuer's model regarding the AAC.

These lists of comparisons were previously validated by the judgment of three experts, all with a PhD in mathematics, with specialization in didactics of mathematics and the AAC. The first comparison list consists of eight indicators, all related to what MINEDUC points out regarding the AAC, which have three evaluation indicators: "meets" (the indicator is present), "not specific" (the presence of the indicator is unclear), and "does not meet" (the indicator is absent).

The indicators for the assessment of questions that focus on the AAC by MINEDUC are: 1) The question gives the opportunity to look for arguments that can convince others of the validity of the results through their arguments, foundations, and procedures; 2) The question allows the student to raise conjectures; 3) The question allows the student to determine erroneous and/or absurd statements that arise in the problem; 4) The question provides opportunities to discover, explain, and discuss the solutions to the problem posed; 5) The question allows the student to develop collaborative work with their peers, to enhance or promote arguments; 6) The question provides opportunities to develop oral and/or written expressions around mathematical issues; 7) By asking, the student can explain basic properties around mathematical objects and their calculations; 8) The question indicates that the student represents their results through different ways or paths.

The second comparison list consists of seven indicators all related to those indicated by Krummheuer's model regarding the AAC. This information collection instrument also has three evaluation indicators: "meets" (the indicator is present), "not specific" (the presence of the indicator is unclear), and "does not meet" (the indicator is absent).
The indicators included in the comparison list for the assessment of questions that focus on the AAC according to Krummheuer's model are 1) The question allows you to develop explanations and reason about your solution; 2) The question manages to develop interaction, debate, and work in a group to promote or enhance the argumentation; 3) The question provides arguments that allow you to deduce the solution to the problem; 4) The question allows the student to develop the differentiation between basic properties and qualities of mathematical objects; 5) The question confirms that the conclusions reached are correct; 6) The question allows validating the conclusions through mathematical foundations and justifications (axioms, definitions, theorems, etc.), allowing the questioning of others. The question allows you to communicate the results at the end of their development and argumentative process.

FINDING AND DISCUSSION

Finding

Frequency of the skill in the questions based on MINEDUC

The results corresponding to the 20 ST questions, 15 TH questions and the 15 WB questions are reflected in Table 1.

Table 1. Results of the comparison lists of the ST, TH, and WB based on MINEDUC.

Indicator	Meets			Does not meet			Not specific		
	ST	TH	WB	ST	TH	WB	ST	TH	WB
1	20	15	15	0	0	0	0	0	0
2	19	14	15	1	1	0	0	0	0
3	12	9	2	3	1	13	0	5	0
4	20	15	15	0	0	0	0	0	0
5	5	14	0	15	1	15	0	0	0
6	20	15	15	0	0	0	0	0	0
7	20	15	15	0	0	0	0	0	0
8	1	2	1	5	1	8	16	12	6

From Table 1, we can see that indicator 1, whose focus is on *providing opportunities to look for arguments that can convince others of the validity of the results*, is present in all the questions analysed in the three texts, i.e., it relates to what is indicated in MINEDUC (2016), which specifies that the student must have tools to explain and verbalise the results and calculations obtained from the resolution of problems and questions focused on the AAC, in order to evidence and convince others of the results they obtained. This also aligns with what was pointed out by Ayalon and Hershkowitz (2018) and OECD (2019).

Regarding indicator 2, focused on *allowing the student to raise conjectures*, which is related to the role that the student assumes in the development of the AAC, it was evident that the questions analysed in the three texts allow the student to make statements regarding the resolution of the problem and its resolution strategies. This can be established in MINEDUC (2015) and Goizueta (2019), which imply that the students must address situations in which they could raise conjectures by using trial and error, explaining their ideas, and understand mathematical reasoning.

About indicator 3, which states that *the student determines erroneous and/or absurd statements that arise in the problem*, it was evident that in the questions that comply with this in ST, TH, and WB, it is explicitly stated that the question has some error or that the student has to discover an error from the development, which is one of the indications MINEDUC (2015) points out for the work with the AAC. Thus, the student's workbook was the only instance where the questions analysed did not meet this indicator, of a total of 15 questions, 13 of them, did not meet it. This can be an obstacle to the teaching and learning processes, as it creates a challenge for

teachers to encourage group discussion in the classroom, to test the validity and relevance of the arguments (Smith & Stein, 2021). As an example, in Figure 3, a question extracted from the student's text is presented, in which indicator 3 can be evidenced:

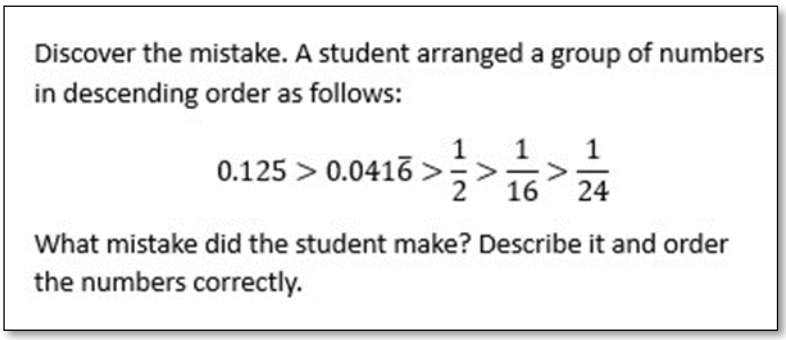

Figure 3. Example of a Question Proposed in the Text for the Student (Catalan et al., p. 25)

Indicator 4, which proposes *giving the opportunity to describe, explain and discuss the solutions to the problem*, showed that all the questions from the ST, TH, and WB allow students to explain and discover the solutions of a problem through the reflection about and analysis of the data delivered, as pointed out by Manouchehri et al (2019), in addition to being present in the Curricular Bases for 7th grade to II grade (year 10) of Secondary Education (MINEDUC, 2015).

Indicator 5, which refers to *verifying whether the questions allow collaborative work to be developed to enhance the argumentation*, as indicated in MINEDUC (2015), the following results were obtained. First, in the ST and the WB, we verified that there is no presence of the indicator in the analysed questions, but rather, the learning process is autonomous, where the exposure to the course group on the results is also not observable. This can also affect the teacher's approach to group activities (Smith and Stein, 2011) and the work on other competencies such as modeling, which may influence the quality of the argumentation developed by students (Aydın-Güç and Kuleyin, 2021).

Second, the TH was the only of the three texts in which the questions analysed respond to indicator 5. In this case, we see that there is a development of collaborative work, since the indications present in the questions allow the student to share the proposed ideas with their peers, listen to each other, generate a debate about them and allow them to correct each other. Therefore, it encourages collective argumentation (Conner et al., 2014).

On the other hand, we have indicator 7, which indicates whether it is possible to *identify properties around mathematical objects and their calculations*. We realised that in the questions analysed in ST, TH, and WB, this indicator is present in each of them. In this way, we observed that the questions allow the student to connect the mathematical language, its properties, and the corresponding calculations to find the solution to the problems in the teaching texts. We can also mention that the questions allow applying properties and calculations to the question context, which helps students manage to apply the previous knowledge they already have. In this context, Cervantes-Barraza and Cabañas-Sánchez (2018) point out that, in any argumentative process, the student's prior knowledge is necessary, since this facilitates the understanding of mathematical activities by relating them to properties and calculation tools for the development and verification of the results obtained. Furthermore, according to Castillo et al. (2022), textbooks must present situations in which students argue (describe, explain, verify) and conjecture about mathematical relationships, as well as allow communication using precise mathematical language.

Another of the indicators, specifically number 6, is related to developing oral and/or written expressions around mathematical objects. Given the above, MINEDUC (2016) establishes that students must express their results orally and in writing, besides explaining and discussing the solutions of a problem. From table 1, we can see that in the ST, TH, and WB, it is present in all the questions analysed in each of the texts. Among the characteristics found, we can highlight that

the questions allow the student to express their solutions both orally and in writing, which is visible in the instructions that the questions have in the ministerial texts. In addition, the questions expect that the students write their calculations and develop how they solved them, which encourages oral and written discourse when explaining the procedure and result to a partner (Solar & Delofeu, 2016).

Finally, regarding indicator 8, which is about representing the results in more than one way, we can point out that in the ST, TH and WB, the presence of the indicator is not specific. In this sense, we can point out that the questions of the three texts analysed lack indications for the student that allow them to address the question in more than one way, which shows no clarity in the development of the questions and the variety of forms of resolution for the same problematic situation. This would be an obstacle in the argument, since, according to Solar and Deulofeu (2016), this indicator promotes the use of different strategies and representations.

Frequency of the skill in the questions based on Krummheuer's model

The results corresponding to the 20 ST questions, 15 TH questions and the 15 WB questions are reflected in Table 2

Table 2. Results of the comparison lists of the ST, TH, and WB based on Krummheruer's model.

Indicator	Meets			Does not meet			Not specific		
	ST	TH	WB	ST	TH	WB	ST	TH	WB
1	20	15	15	0	0	0	0	0	0
2	5	10	0	15	5	15	0	0	0
3	17	15	15	2	0	0	1	0	0
4	19	15	15	0	0	0	1	0	0
5	12	15	14	1	0	1	7	0	0
6	20	15	15	0	0	0	0	0	0
7	6	12	0	3	3	15	11	0	0

From Table 2, we can point out that indicator 1, which is about developing explanations and reasoning about the solution to a problem, belongs to the definition of the AAC proposed by Krummheuer (2015), where he emphasises that argumentation is a specific characteristic of social interaction, which is related to face-to-face interactions versus the resolution of a problem. In the questions of the ST, TH and WB, we can highlight that this indicator is present in each of the questions analysed in the three texts, since they allow an approach to the students regarding the development of their calculations, where they incorporates indications related to the why, explanations about procedures, and justification about the comparison of statements, which encourages argumentative activity (Ayalon & Even, 2016).

Regarding indicator 6, which points to the validation of the conclusions employing mathematical foundations and justifications, this refers to the grounds and warrant in Krummheuer's model (2015). The first refers to the reasoning that allows developing inferences applied to the argumentation, and the second supports the foundation by giving categories on the main knowledge that the individual has when arguing (Krummheuer, 1995). Regarding the above and the analysis of the text questions, we can point out that this indicator is present in the ST, TH, and WB. We can also highlight that, in the questions, a validation of the claims can be carried out through a warrant and grounding of the results, from which we can highlight indications related to the comparison of exercises, description of the step by step in terms of the resolution of the questions, and a justification of the form of resolution chosen (Goizueta & Solar, 2019).

By analysing the data of indicator 2, which is about interaction and group work, the following results were obtained. First, in the ST and WB, we can highlight that this indicator is not present in the questions analysed in these texts. Given the above, it is evident that there is no peer work or interaction between them, but rather, the work that is done with the questions focuses on an autonomous process of the student, which implies that there is no comparison and debate about the resolution strategies and the solutions found. This situation is critical for the

development of argumentation, given that interaction between peers is necessary (Mariotti & Goizueta, 2018) and, therefore, collective argumentation (Conner et al., 2014; Krummheuer, 1995).

Second, in the TH, we found that the work and interaction between peers are present in 10 of the 15 questions. In the indications presented to the teachers, the development of work between peers can be highlighted, clear indications of sharing between students, getting them to compare and explain their solutions. However, there is a clear difference between the questions in the texts for the student and the teacher, where in the first, the absence of peer work is evident, while in the second, the development and interaction between peers are worked, which implies that the teacher must oversee promoting the argumentation process and peer work. This arrangement of the texts demands that teachers, through classroom management, promote collective argumentation in the math classroom (Lee, 2006; Solar and Delofeu, 2016).

On the other hand, when analysing the questions with indicator 4, it points to the identification and use of basic properties around mathematical objects, and that is part of the data in Krummheuer's model (1995), where these are facts on which any person must be based to validate and justify the information in the process of arguing. In this sense, in the ST, TH and WB, it was evident that this indicator is present in the questions of the texts. Moreover, the questions have clear indications regarding the delivery of data of the problem, which allows the student to differentiate between properties and mathematical definitions to start with the argumentation process. Regarding the above, Valbuena et al. (2020) point out that it is important to generate a reflective environment for both the student and the teacher, since good prior preparation in knowledge and the establishment of tasks allow the construction of formal knowledge from the individual contribution of the student. which causes interest to be formed from participation and the identification of mathematical structures based on the problem.

Indicator 5, about corroborating whether the student's solutions are correct, highlights the following results. In the ST, 12 of the 14 questions respond to this indicator, in which the indications given in the questions allow students to corroborate their results. In the case of TH, this indicator is present in the 15 questions. In these questions, the indications towards the student are in the comparison of the results and procedures with their colleagues, which allows them to validate the results. Finally, in the WB, this indicator is present in 4 of the 15 questions analysed. Against this, the questions expect that students perform procedures and calculations, but there is no verification process that allows the students to know whether what they have developed is correct. This situation is detrimental to the argumentation, given that it does not take advantage of the full potential of the activities for their development, for example, the use of rebuttal (Toulmin, 1958; Solar & Delofeu, 2016).

Compared to the results obtained in indicator 7, which is about communicating the results obtained at the end of the argumentation process, the following results can be obtained. In the ST, this indicator is present in only 6 of the 20 questions analysed. Consequently, it was evident that the process of communicating the data is affected, since the student cannot verbalise their results to their peers, course group, or teacher. Regarding the TH, this indicator is present in 12 of the 15 questions that were analysed; thus, we can see that the student can express orally or in writing the procedures used for the resolution of the questions established in this text.

However, in the WB, this indicator is not present in any of the 15 questions analysed. Faced with this result, we can mention that in the WB, there is a lack in terms of students' verbalisation and the communication of results. Instead, the questions only allow the student to develop their resolution procedures, without their corresponding verbalisation. Clearly this does not encourage interaction, but rather keeps the responsibility of developing it on the teacher, coinciding with what Rees and Roth (2017) point out.

Finally, in the analysis of indicator 3, which is related to arguments that allow you to deduce the problem's solution, we can find the following results. As for the ST, in 17 of the 20 questions, this indicator is present, and in the TH and WB, this indicator is present in all the questions analysed in these texts. Faced with these results, we can observe that through the resolution of the questions, students can deduce the solutions of the problem, which is done through the data delivered from them. In addition, we observed that, in these questions, the students could produce

their arguments, deduce solutions and, at the same time, manage to justify and argue their resolution procedures.

This is in accordance with what was pointed out by Van Eemeren et al. (2013), in that the main goal of argumentation is to persuade about the validity of the solution found.

Discussion

The purpose of this study was to investigate the knowledge, attitudes, and practices of secondary school English language teachers about differentiated instruction in English classes. To do this, a one-sample t-test and descriptions were used. According to the one-sample t-test, secondary school English teachers had a good theoretical understanding of differentiated instruction. Table 1 show that the mean of 37.85 was significantly higher than the projected mean of 31. This was likely because most of the instructors had received differentiated instruction training, and because it is already included in the Educational and Training Policy, these teachers were likely also familiar with the government's Educational Policy. This varies with the findings of Aldabbagh, et al., (2020) who found that elementary school instructors lacked awareness of differentiated instruction. Although the levels of education in Aldabbagh et al and my study are different, secondary education levels, it is crucial to note the inconsistency of instructors' awareness of differentiated teaching since it informs where we are. The disparity in performance is almost certainly due to the training provided to secondary school English language teachers, whereas this was not the case in basic education institutions.

Participants also recognized that differentiated instruction (DI) plays a key role in boosting students' motivation, social interaction skills, bringing emotional changes, and physical development, even if they did not use it in EFL lessons. Contrary to what one may think and the goals of using differentiated instruction (DI) in Ethiopian schools from the primary to the secondary level (ETP, 1994), the participants revealed that DI has a lower impact on students' intellectual development than it does on other abilities. That is, the observed mean did not deviate considerably from the expected mean. This can be understood as teachers implying varied education for pupils' intellectual development on a regular basis. However, when this result is compared with DI's beneficence to the development of social, physical, and emotional changes, it is very infinitesimal.

The outcome also differs from the responses of the participants to the open-ended items. As a result, they've stated that differentiated instruction (DI) is important for improving students' ability by providing teachers with the opportunity to follow up, boost students' achievement, and other factors associated to their intellectual development. Only 7.0 percent of respondents said DI helps with both intellectual and physical growth. Over 28% of participants believe that differentiated instruction (DI) never results in behavioral changes because of students' erroneous perceptions, and that this is only a figment of their imagination. This demonstrates instructors' proclivity to reply to closed-ended questionnaire gadgets according with socially preferred hope. Taking the contributors' sensible responses into account, it can be viable to finish that the final results does now no longer correspond to Joseph, S., Thomas, M., Simonette, G., & Ramsook, L. (2013) evaluation of DI's characteristic in comparing students' typical growthWhen we look at the practical thought of the exercises teachers delivered, it also differs with Sharma, S., Mannan, F., & Veeriah, J. (2016) beliefs because DI seldom resulted in cognitive, affective, or behavioral consequences in this study.

According to the results of the one-sample t-test, English language teachers in the investigated general secondary schools showed a negative attitude toward differentiated education (DI). Positive attitudes motivate people to act. In the context of this investigation, however, this was not the case. The discrepancy between the actual and predicted mean for teachers' attitudes was considerable, as indicated in Table 1, with the observed mean (26.24) being significantly lower than the expected mean (29). As a result, it is possible to persuade the participants that they had a negative attitude toward differentiated education (DI). Some of the participants' responses to the open-ended questions could indicate that they disliked DI. Differentiated instruction can be used as a steppingstone for teachers to be biased. That is, when assessments were differed,

students questioned the fairness of the process. It was also thought to be time-consuming and exhausting.

In instructors' perceived practices, the observed mean (28.98) was significantly lower than the projected mean (42). This shows that the participants were not incorporating DI into their instruction. This fact was also highlighted by teachers' DI practices in English language classrooms, as well as their replies to open-ended items and interviews. What was happening on the ground was a complete departure from what was envisaged when using differentiation.

Experts in the field also point out that implementing DI tactics is difficult for instructors, and as a result, they prefer to teach in a one-size-fits-all manner, even when they are aware of their students' strengths and limitations, as well as their preferred mode of learning (Joshi & Verspoor, 2012). According to Hertberg-Davis (2009), differentiation is ineffective owing to time limits and the fact that it includes repetitive actions. In terms of varying teachings, particularly for secondary school pupils, Tomlinson (1995) asserts that it is difficult to differentiate instruction for kids in middle school. DI is time-consuming to implement since kids have a variety of requirements, communication hurdles, learning skills, and achievement gaps (Tomlinson, 1995). However, the same author also stated that, while implementing DI is difficult, teachers are responsible for their pupils and must do all possible to assist them learn more effectively. Teachers, in her opinion, should be optimistic and zealous in their support of their students, as they have promised to the teaching profession (Tomlinson, 1995). According to Shibeshi (2009) studies, the energy of any instructional machine is primarily decided through the individuality and engagement of instructor**s**. Furthermore, Bondley (2011) claims that if DI is not properly planned, teachers' workload would be increased, causing them to grow frustrated.

Because big class sizes are one of the most censorious issues in most Ethiopian schools, research reveals that small group education is one of the most effective ways to differentiate instruction and alleviate the problem of giving individual instruction in such conditions (Tomlinson, 1995). The author also argues that implementing DI is discouraging and time demanding, but that it is doable because it involves execution, and all that is required is teachers' passion and conviction in using differentiation. Similarly, Palmer & Maag (2010) encourages teachers to utilize DI to target students' interests because differentiation promotes positive learning by involving and challenging students in the classroom. In general, the researchers believe that, despite the numerous issues that cause Ethiopian teachers to be unsatisfied with their jobs, they should devote time to their students to generate qualified citizens in all aspects. Thus, the researchers attempted to place a heavy emphasis on teachers, since they are the key to educational transformation, even though different impediments such as inadequate resources, huge class sizes, and so on have persisted over time.

CONCLUSION

Based at the facts and conversations, it's far viable to deduce that at the same time as EFL instructors are aware about DI, they're now no longer devoted to placing it into exercise of their classrooms. As a result, it seems that there has been a disconnect between instructors' theoretical recognition and differentiated practices in EFL classrooms. Teachers had been skeptical of the targets and effectiveness of assorted practice in getting to know and had a terrible mind-set closer to it. According to the data accrued from the respondents, there are several of things that save you differentiated practice from getting used as one of the additives of coaching English. Large magnificence sizes, time constraints, a loss of determination and force thanks to inadequate remuneration, and paintings disappointment are only some of them.

To summarize, there may be a discrepancy between what the coinciding literature says approximately DI and what's surely done. According to the studies, youngsters withinside the equal study room round the sector have various preparation, hobbies, and getting to know profiles, and instructors must adjust their coaching to deal with this variety. Based at the facts and conclusions reached, it become counseled that each one instructor gets hold of ongoing schooling in theoretical and sensible orientations on the way to use DI in English language classes.

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