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Amplification Technique: Cases in Translating Mathematical Terms and Concepts in Children's Picture Books from English into Indonesian

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ABSTRACT

This product-oriented study investigates types and functions of the amplification techniques applied in rendering mathematical terms and concepts in children's storybooks. The application of amplification techniques in children's storybooks is crucial since it adds some information to the target text. Therefore, applying amplification techniques has the potential to decrease or maintain the translation quality in terms of accuracy, acceptability, and readability. Therefore, it is important to assess the translation quality. In analyzing the translation quality, the present research applied Nababan et al's instrument. The data were collected from 18 children's storybooks and analyzed through content analysis and focused-group discussion (FGD). In FGD, the researchers discussed the accuracy and acceptability with three raters who were selected based on several criteria. In addition, this research also conducted an interview session with children from of various ages and levels to assess the readability. This multiple case study analyzed the data by using Spradley's four stages, namely domain, taxonomy, componential, and cultural-theme analyses. Based on the result, translators often employ amplification techniques to address these challenges to provide detailed explanations by using explicitation techniques with a new amplification function discovered through this research, namely the tuning function, reaching a high score of translation quality of nearly 3. This paper delves into amplification uses in translating mathematical terms and concepts in children's picture books from English to Indonesian.

Keywords: Amplification; Functions; Mathematical Terms and Concepts; Picture Books; Children Literature

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1. Introduction

Translating children's stories that integrate mathematical education presents distinct challenges, as it requires balancing narrative engagement with educational value. These texts serve a dual function: to entertain young readers through compelling storytelling and to introduce or reinforce foundational mathematical ideas in age-appropriate ways. This dual-purpose nature demands translations not only accessible and comprehensible but also tailored to the cognitive and linguistic abilities of the target audience. As Oittinen emphasizes, translating for children is not merely a matter of linguistic transfer, but a process shaped by the child's developmental stage, cultural context, and interpretive abilities [1]. Moreover, according to Nida's dynamic equivalence theory, the translation must evoke a similar response in the target audience as the original does in its readers, which is an expectation that becomes particularly complex in educational narratives [2]. To bridge the linguistic and cognitive gaps between source and target readers, who may differ significantly in terms of language proficiency, prior knowledge, and socio-cultural background, translators often apply specific translation techniques.

Theoretically speaking, the term "translation technique" is understood as an instrument of textual analysis that, in combination with other instruments, allows us to study how translation equivalence works in relation to the original text [3]. As Molina and Albir state that the amplification technique occurs when a translation uses more signifiers to cover syntactic or lexical gaps, it potentially adds some information in the target text to achieve high readability. Amplification, as defined by Molina & Albir, involves the explicit addition of information that is implicit in the source text to enhance clarity, context, and comprehension. However, Nababan et al state that adding information in the target text may reduce the accuracy [4]. Hence, based on this statement, the amplification technique may reduce the accuracy if the translator tries to add a message in the target text. In the context of children's educational literature, amplification not only facilitates understanding of abstract or unfamiliar mathematical concepts but also supports the narrative flow and emotional engagement essential for young readers [3]. Therefore, an investigation on amplification techniques and their impact on translation quality should be conducted to see if the amplification techniques applied by the translators maintain or decrease the quality. Expertise and Professional Services Group (*Kelompok Kepakaran dan Layanan Profesional*/*KKLP Penerjemahan*) of the Language Development and Fostering Agency, Republic of Indonesia. In the context of stories enriched with mathematical content, amplification plays a crucial role in supporting both literacy development and mathematical knowledge transfer. However, despite its importance, the application of amplification in these contexts has not been extensively studied.

So far, product-oriented translation studies have investigated translation techniques as research data, not data. However, some studies successfully examined particular translation techniques. Joice et al have examined transposition and modulation techniques in Indonesian newspapers [5,6]. Besides, reduction techniques were conducted by Romel et al [7]. Unfortunately, those studies did not work on the amplification technique in children's storybook translation. There is a critical need to examine the characteristics of amplification and evaluate its effectiveness in creating translations that are both engaging and educationally valuable for Indonesian children. While previous studies on amplification in translation have offered valuable insights, most have centered on adult-oriented texts, such as novels [8], scientific articles [9], legal documents [10], and technical manuals [11]. In contrast, research on amplification in children's literature remains limited and has largely focused on genres like folktales and culturally embedded realistic stories [8]. A notable gap exists in the investigation of amplification techniques applied in the translation of educational stories, particularly those incorporating mathematical content. Moreover, studies on amplification in children's literature have primarily concentrated on specific sub-techniques, such as addition [8], explicitation [8,9], and amplification in general [11]—with limited attention given to less-studied types like paraphrasing, description, and the use of footnotes. Although prior research has discussed the characteristics and functions of amplification, most of this work emphasizes explicitation, aiming to render implicit content more explicit in the target text. However, the broader influence of amplification on translation quality has received only superficial treatment, with emphasis placed largely on acceptability and readability [8,11]. These studies often neglect the involvement of target readers as respondents to measure readability levels comprehensively.

Similarly, while accuracy has been briefly explored[11], this has been confined to the context of folktale translation, leaving educational stories—particularly those with embedded mathematical learning—underexamined.

To address these gaps, the present study investigates the use of amplification techniques in the Indonesian translation of children's stories with mathematical content. Specifically, it aims to:

1. identify the types and functions of amplification techniques employed by translators in these texts; and
2. assess the translation quality in terms of accuracy, acceptability, and readability.

By addressing these objectives, this research aims to contribute to a deeper understanding of the role and effectiveness of amplification in translating children's stories.

2. Literature Review

2.1. Children's Literature and Math Loaded Children's Picture Books

Mathematics is the study of logic, shapes, structures, quantities, and their interrelated concepts. It includes algebra, analysis, and geometry[12]. For school-aged children, mathematics aims to develop skills in counting, measuring, deriving, and applying formulas relevant to daily life. Mathematics has a hierarchical structure, usually introduced in primary education through facts, concepts, operations, and principles. Facts are conventional symbols, such as "7" representing seven. Concepts are abstract ideas used to classify objects, like "triangle," which children master when they can distinguish triangles from non-triangles. Operations involve arithmetic and algebraic procedures, such as addition, subtraction, multiplication, and division. Principles are complex relationships between concepts, such as the formula for a triangle's area, which involves length, height, and the concept of area itself. In educational storybooks, these structures are embedded in entertaining narratives. Children learn mathematics indirectly by following characters' problems, identifying mathematical objects, and seeing how characters solve them. This helps children realize that mathematics can solve real-life problems, making it more enjoyable and accessible. Moreover, a child's understanding of math-based stories is influenced by several factors. These include the readability of the text, determined by sentence length, new vocabulary, and grammatical complexity[4]; cultural differences between the source and target language communities, which may affect interpretation; and the children's prior knowledge, experience, and literacy levels. To ensure translations are accessible and engaging while conveying mathematical concepts, amplification techniques are applied.

Children's literature is crafted for young audiences and includes genres like picture books that blend visual and textual storytelling to capture attention and foster early literacy. Picture books, especially those integrating educational content, play a critical role in cognitive and language development, as well as in fostering creativity and moral values[13]. According to Lovitt et al (cited in Van den Heuvel Panhuizen et al) torybooks often serve a dual role: they both entertain and educate. In particular, math-enriched storybooks provide cognitive "hooks" that support the exploration of mathematical concepts in an engaging, story-based context[14]. Through these books, children develop an understanding of mathematical ideas by connecting them to relatable experiences within the stories, supported by visual and textual elements. By embedding mathematical ideas within narratives and illustrations, these books help children build connections between abstract concepts and real-life experiences. Children are not merely passive readers; they engage actively by interpreting visual cues, questioning scenarios, seeking solutions, and applying reasoning to solve the issues presented. This process supports both cognitive growth and the development of problem-solving skills.

In the context of elementary school education, mathematics has a specific purpose. According to the National Education Standards Agency/BNSP[15], as cited in Kennedi et al[16], the purpose of mathematics learning in elementary school is to enable students to understand the concept of mathematics, such as numbers, shapes, and operations. Students are expected to explain the relationship among one concept with the others (e.g. the concept of addition can be connected to the concept of calculating the perimeter of a rectangle), to use the right concept to solve problems, to make sense of patterns and traits (e.g. the multiples of 2 and 5), to manipulate mathematics in making reports (e.g. such as performing calculations and using formulas to measure the perimeter and area of geometric shapes), and to explain

mathematical ideas (understanding the problem, selecting appropriate formula, and obtain correct results).

2.2. Amplification Technique

Translating children's picture books that incorporate mathematical education requires meticulous attention to ensure that translations are engaging, comprehensible, and accurately convey mathematical terms and concepts. In this context, the amplification technique is particularly essential for addressing these challenges. Molina and Albir define amplification as a translation strategy that involves adding information to the target text that is not explicitly present in the source text, with the aim of enhancing clarity and understanding[4,17]. This technique is further categorized into five subtypes: addition, annotation, description, explicitation, and paraphrasing. Addition involves inserting accurate information absent from the source text to aid comprehension. For instance, the English sentence "She gave him a tamal" might be translated into Indonesian as "*Dia memberinya tamal, makanan khas Amerika Latin yang dibungkus daun jagung dan diisi daging atau sayuran*," providing context for unfamiliar terms without disrupting narrative flow. Annotation, on the other hand, offers supplementary information outside the main text, often through footnotes or endnotes; for example, a term like "isosceles triangle" may be translated as "*segitiga sama kaki*" with a footnote explaining "*Segitiga dengan dua sisi yang sama panjang*," supporting mathematical literacy without overwhelming the story. Description embeds explanations directly into the narrative, such as translating "He solved it using an abacus" to "*Dia menyelesaikannya dengan alat hitung tradisional yang terdiri dari manik-manik dan batang*," ensuring comprehension of culturally specific or technical terms. Explicitation makes implicit information explicit, as when "She finally understood it" is rendered as "*Dia akhirnya memahami konsep pecahan yang diajarkan gurunya*," clarifying what "it" refers to. Finally, paraphrasing rephrases sentences into simpler language to facilitate understanding, exemplified by translating "The triangle reflected across the y-axis" into Indonesian as "*Segitiga itu berpindah posisi seperti bayangan yang berlawanan arah di sisi lain dari garis vertikaly*," making abstract mathematical concepts more accessible to young readers.

Amplification serves to bridge syntactic and lexical gaps[3] as well as differences in language and cultural systems[3], and its application is observable in the resulting translation product. Purnomo et al. identify three primary functions of amplification in children's literature: naturalizing, synchronizing, and stylizing[11]. Naturalizing enhances readability by making translations flow smoothly and easier to understand, helping readers grasp both the story's chronology and underlying values. Synchronizing strengthens the connection between verbal and visual elements, sometimes by adding tactile sensory words that evoke congruent experiences for children, enabling them to understand events and character emotions more fully. Stylizing reflects the translator's personal approach and the evolution of translation style through collaboration with editors or publishers, shaping both the interpretive and aesthetic qualities of the final product[11]. Together, these functions demonstrate that amplification is not merely an addition of words but a strategic intervention that enhances comprehension, aligns multimodal storytelling, and maintains the stylistic integrity of translated children's literature.

2.3. Translation Quality

Yet, the success of amplification cannot be measured solely by its technical application; it must also be evaluated through the lens of translation quality. One of the defining characteristics of translation techniques is their impact on the resulting translation[3]. This perspective underscores the need to examine translation quality comprehensively as a consequence of the techniques employed. Nababan's framework provides a useful perspective by emphasizing three interdependent criteria: accuracy, acceptability, and readability[4]. Accuracy refers to the extent to which the translated text conveys the same message as the source text[4]. A good translation avoids unnecessary additions or omissions, although translators may incorporate additional information to aid comprehension, such as brief explanations of terms, or reduce redundant elements to streamline the text. Accuracy is fundamental because the core of translation lies in maintaining equivalence between the source and target messages. Shuttleworth and Cowie define accuracy in translation evaluation as the degree to which a translation matches its original, highlighting its central role in assessing translation quality[18]. Acceptability, on the other hand, concerns whether a translation conforms to the linguistic, cultural, and normative conventions of the target language at both micro- and macro-

levels [4]. Parameters of acceptability include grammatical structure, text organization, technical terminology, sentence structure, and idiomatic expression. A translation that reads naturally and aligns with these norms is considered highly acceptable, whereas a text that feels awkward or unfamiliar reflects lower quality. Readability emphasizes the ease with which a target audience can understand a translation. Richards et al define readability as "how easily written materials can be read and understood," indicating its relevance to assessing the quality of all written materials, including translations [19]. Nababan et al. further stress that readability involves both the source and target texts and should be evaluated by the intended readers [4]. High readability ensures that the translation effectively mediates between the original author and the audience who lacks access to the source language, enabling the text to convey meaning clearly and function as a bridge across linguistic and cultural gaps.

2.4. Previous Studies on Amplification Technique

Research on amplification has been conducted with diverse emphases, including addition, explicitation, paraphrase, description, and footnotes. One strand focuses on explicitation. Vesterager investigated explicitation in Spanish-Danish legal translations, showing that professionals applied it more systematically than amateurs, who used it selectively for system-bound terms and elliptical phrases [20]. However, the study did not explore amplification broadly or its relationship to translation quality. Corpus-based studies by El-Nashar [21], Ali et al. [22], and Zhang et al. [10] further reveal that explicitation often occurs via paraphrase, conjunctions, reference, lexical repetition, specification, amplification, substitution, ellipsis, and lexical broadening. In children's literature, explicitation clarifies imperative sentences, pronouns, and cultural references to aid comprehension [9,10,23], yet prior research rarely links these strategies to translation quality or target reader assessment. Erfiani categorized explicitation into obligatory, optional, and pragmatic [9], while Yang, using a Systemic Functional Linguistics approach, classified it into ideational, interpersonal, and textual types [23]. Although these studies illuminate explicitation, they do not fully connect its types and functions to overall translation equivalence.

Beyond explicitation, amplification has been examined through footnotes. Maniacco [24], Shirinzadeh and Sepora [25], and Haroon [26] showed that footnotes preserve meaning, explain cultural references, and enhance comprehension without overloading the main text. Paraphrasing, another sub-technique, has been analyzed in novels [27] and scientific texts [28], demonstrating its role in readability, though its impact on accuracy and acceptability remains underexplored.

Overall, these studies reveal several gaps. Most amplification research has focused on adult-oriented texts—novels [22,24–27,29–31] legal documents [20], scientific texts [28], and manuals [21]—while studies on children's literature remain limited [8,11,23], mainly addressing folktales and realist stories. No research has investigated amplification in educationally oriented children's texts, particularly mathematics-focused picture books. Prior studies also concentrate on certain sub-techniques, such as addition [8], explicitation [9,23], or pronoun explicitation [10], without examining paraphrase, description, or footnotes. Analyses of amplification's nature have largely been confined to explicitation, leaving other sub-techniques unexplored. Additionally, although functions of amplification in children's stories have been identified [11], these have not been studied in mathematics-oriented texts, and assessments of translation quality mostly rely on researcher judgment rather than reader evaluation [8,11,23], with accuracy receiving minimal attention [11].

Addressing these gaps, the present study investigates amplification in translating children's picture books with mathematical content, examining its application and contribution to accuracy, acceptability, and readability. It emphasizes amplification's role in bridging cultural and conceptual differences, enhancing both the clarity of mathematical concepts and the narrative and stylistic flow, thus linking translation techniques to educational outcomes and providing novel insights for translation studies and children's literature scholarship.

3. Methods

This study employed a qualitative, descriptive, multiple case study design within the field of translation studies, using a translation approach as the primary analytical framework. The approach was selected because the research focuses on the amplification translation technique as the primary data, enabling an in-depth exploration of its sub-techniques,

functions, nature, and effects on translation quality. By comparing the source and target texts, the analysis examined the degree to which the message was conveyed, the naturalness of the translation, and the ease of comprehension.

The source data comprise 18 English-language children's storybooks enriched with mathematical content, together with their official Indonesian translations distributed as part of the National Literacy Movement (Gerakan Literasi Nasional, GLN). The dataset includes titles such as *Polygon Family* by Lindiwe Tshabalala, translated as *Keluarga Poligon* by Anies, focusing on shapes, and *Mr. Motuang's Thirst* by Sukanya Sinha, translated as *Pak Motuang dan Hausnya* by Ivani Lela, which teaches fractions. Other examples include *How Far is Far?* (Lindiwe Tshabalala; translated by Khairina Eka) introducing the concept of distance, *Sam's Sneaker* by Nat Gabriel (*Petak Sepatu Sam*; Surya) covering area, and *A Thousand Towers* by Lori Haskin Houran (*Seratus Menara*; Theo) on multiples. Additional books cover diverse mathematical topics, such as time, division, addition, subtraction, least common multiples, counting, percentages, and number operations. Each storybook combines narrative elements with mathematical concepts, and the Indonesian translations retain these educational components while adapting them for cultural and linguistic accessibility. These materials were selected because they contain translations of both mathematical and non-mathematical units rendered through amplification, including subcategories that have received limited scholarly attention. The selection criteria also reflect a research gap in the investigation of amplification's nature, functions, and influence on translation quality in educational children's literature. By focusing on works produced by an official government translation body for a national literacy initiative, this research situates amplification not only as a technical phenomenon but also as a practice embedded in sociocultural and educational objectives.

The study follows purposive, criterion-based, and theoretical sampling to ensure alignment with its research aims, alongside total sampling to incorporate all amplification data identified. Data were drawn from two primary sources: documents (the storybooks and their translations) and informants (a data validator, accuracy and acceptability raters, and child reader respondents). The validator's role was to ensure the validity and focus of the collected data, while expert raters assessed accuracy and acceptability using Nababan et al.'s translation quality assessment model[4]. Readability was evaluated by nine child readers representing diverse ages and literacy levels, reflecting the intended readership of the texts. Triangulation—both by source and by method—was employed to enhance trustworthiness, with the former ensuring data verification across different sources, and the latter mitigating methodological bias.

The study began with the collection of data consisting of linguistic units that underwent amplification in their translations. These data were then analysed to identify the sub-techniques of amplification—addition, annotation, description, explicitation, or paraphrase—based on the framework proposed by Molina and Albir. Next, the functions of amplification—naturalizing, synchronizing, or stylizing—were determined according to Purnomo et al.[11]. Translation quality was subsequently assessed in terms of accuracy, acceptability, and readability, following the criteria established by Nababan et al.[3]. Accuracy was evaluated by raters who are experts in linguistics and translation, acceptability was assessed by raters with expertise in linguistics and/or translation, and readability was evaluated by child respondents aged 7–9 years from several different schools. A more in-depth analysis was then conducted to examine the relationships between the use of amplification techniques, the categories of linguistic units amplified, their sub-techniques, characteristics, and functions, and the overall translation quality. Finally, conclusions were drawn to address the research questions.

For data analysis, the study applies Spradley's ethnographic model, adapted by Santosa, comprising domain, taxonomy, componential, and cultural theme analyses[32,33]. The domain analysis isolates amplification data based on Molina and Albir's framework, followed by taxonomy analysis to identify amplification purposes, adapted from Purnomo et al. and modified according to the findings. Componential analysis then relates these purposes to translation quality outcomes, while cultural theme analysis synthesizes the broader implications. Focus group discussions (FGDs) with expert raters further informed the classification of amplification sub-techniques—addition, explicitation, paraphrase, footnote, and description—and functions, namely naturalization, synchronization, and stylization. These discussions also helped substantiate the link between amplification purposes and their qualitative impacts, thereby contributing to

the ongoing scholarly discourse on translation strategies in children's literature.

4. Results

Before the further explanation about the result, this research discovers a tuning function in the amplification technique that differs from that of Purnomo et al [11]. Tuning, as one of the amplification functions exists when the translator intends to clarify the mathematical terms, although the terms have been understood and sound familiar to the target readers, children. The research findings reveal that the explicitation technique occurs most frequently in the data, followed by the paraphrase technique. In translating mathematical terms, explicitation is predominantly used for tuning, with naturalization as the second most common function, and only a few instances of synchronization and synchronization combined with tuning. Paraphrase techniques serve the functions of naturalization and tuning, while annotation and description techniques are used solely for naturalization. The final technique, addition, functions as tuning. Overall, the translation preserves the mathematical terms effectively; however, the use of explicitation and paraphrase for naturalization and tuning occasionally reduces accuracy, acceptability, and readability. **Table 1** below shows the results.

Table 1. The types and functions of amplification technique in children's storybooks and their impact on translation quality.

Types of amplification techniques	Function	Translation quality								
		Accuracy			Acceptability			Readability		
		Accurate	Less	Inaccurate	Acceptable	Less	Unacceptable	High	Less	Low
Explicitation	Tuning	199			199			166	31	2
	Naturalization	90	1		90	1		69	13	9
	Synchronization	9			9			9		
	Sync + Tuning	2			2			2		
Paraphrase	Naturalization	8	2		10			8	1	1
	Tuning	6			6			3	1	2
Addition	Tuning	2			2			2		
Annotation	Naturalization	2			2			1	1	

4.1. Types and Function of Amplification Techniques

This section discusses the types of amplification used in translating mathematical terms and concepts in math-loaded children's picture books. The analysis discloses four types of amplification used, including addition, annotation, explicitation, and paraphrasing. The following shows the distribution of the types of amplification techniques in 20 children's storybooks.

4.1.1. Explicating the Meaning by using Explicitation as Tuning, Naturalizing, and Synchronization

Explicitation is the most frequently observed technique in the data. It makes information implied or unstated in the source text explicit in the target text [3]. In these children's storybooks, it is primarily used to clarify implicit information in the source text, enabling young readers to more easily understand the concepts presented. This technique predominantly serves the functions of tuning and naturalizing, with only a few instances of synchronization and mixed function, synchronization combined with tuning. The examples below illustrate the application of explicitation.

Datum 047

ST: Raju has noticed that there are 8 coconuts in the first tree

TT: *Raju menyadari ada delapan **buah** kelapa di pohon pertama.*

Datum 004

ST: "Who is coming? I hope all the Polygons will be there. I miss my cousins," said Khosi.

TT: "*Siapa saja yang akan datang, Ma? Semoga semua **keluarga** Poligon* datang.*
**Poligon: segi banyak*

Datum 021

ST: So the Polygons and Circle played happily together until the delicious food was ready.

TT: *Akhirnya,* ***anak-anak*** *Poligon dan Lingkaran bermain bersama dengan gembila sampai makan siang lezat tiba.*

These three examples show the use of explicitation techniques as tuning, naturalization, and synchronization functions. As Molina and Albir) state that explicitation introduces something implicit in the source text explicitly in the target text, it functions as three different functions based on the translator's intention[3]. Explicitation as a tuning function shown in data 040 adds '*buah*' (fruit) in the target text. However, this explicitation is actually not needed since '*kelapa*' (coconut) is known as one kind of fruit and the target readers are familiar with it. Therefore, the translator's intention is only to make it clearer that this sentence is talking about the amount of fruit. In addition, the word '*keluarga'* (family) in data 004 should be explicit in the target text to sound natural. Without it, the children will be misunderstood about what kind of Poligon this story is talking about. The last, explicitation functioning as synchronization, shown in data 021, synchronizes the word '*anak-anak'* to the image as shown below (**Figure 1**).

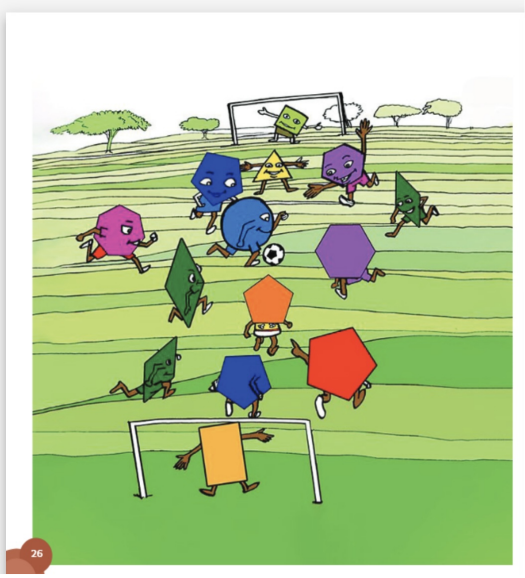

Figure 1. *Keluarga Poligon* (Polygon Family) page 26 from Penjaring website.

Figure 1 shows the children of many plane figures playing soccer. Therefore, the translator tried to synchronize the translation with the figure by adding '*anak-anak'* to clarify that this sentence is talking about the children of plane figures.

4.1.2. Naturalizing and Tuning Translation Through Paraphrase Techniques

Paraphrasing, the second most commonly identified type of amplification in this study, involves rephrasing or elaborating on a term or phrase to convey its meaning more clearly in the target language. In Molina and Albir, Nida, Taber, and Margot distinguish between legitimate and illegitimate paraphrases[2,3]. The paraphrase techniques found in this data are used to give the detail to clarify the writer's intention when technical or unfamiliar terms for audiences were translated by making them longer in the target text. Paraphrasing also functions as naturalizing and tuning. Therefore, the children can understand the target text although they may not be familiar with the original terminology. The examples below show how the paraphrase technique works in the data.

Datum 20

ST: All the Polygon children started to **tessellate**.

TT: *Semua anak mulai* ***menghubungkan sisi-sisi mereka****.*

Datum 292

ST: You go to the shop and realise that vadas come in packets of 3 each and **pavs come in packets of 4 each**

TT: *Setelah sampai di sana, ternyata tokonya menjual dagangannya dalam satu paket berisi tiga kentang dan* ***satu paket berisi empat roti***

These two data show the translator's attempt to clarify the term by changing the lexical terms, which makes them longer in the target text. As we know that children are still learning many things, especially in math, the unusual terms in the source text should be clear and understandable for children, by translating 'tesselatte' into '*menghubungkan sisi-sisi mereka*' (connect the vertices). By translating it that way, it naturalizes the translation, making it easier to understand the meaning of a term. In Datum 292, the clause 'pavs come in packets of 4 each' is confusing if the translator translates it in a literal way. However, the translator paraphrased it to make the children easily understand the meaning. In addition, the translator could drop the exact phrase '*satu paket berisi*' (come in packets of). However, the translator tends to repeat the same, although the readers could also understand if it were dropped in the target text. That is why paraphrasing in Datum 292 functions as tuning.

4.1.3. Tuning Translation through Addition Techniques

Addition involves inserting accurate information into the target text that was not originally present in the source text[3]. It differs from explicitation since it actually clarifies an elliptic expression that is implicit in the source text becoming explicit in the target text[2,3]. Besides, this technique is often used to adjust tone, clarify meaning, or enhance the reader's engagement—particularly in children's literature where a friendly and inviting tone is important. Therefore, the addition techniques found here function as tuning. Addition techniques are found in fewer number compared to the previous techniques. However, the data show the existence of this technique. The phenomenon can be seen in the following example.

Data 035

ST: Add up objects around your home, such as pennies, pieces of cereal, or Popsicle sticks.

TT: ***Coba*** *jumlahkan benda-benda di sekitar rumah, contohnya uang receh, potongan sereal, atau stik es krim*.

As the source text shows, there is no word '*coba*' (try). However, the translator added '*coba*' in the target text. It is added in the Indonesian version to make the instruction sound more polite, child-friendly, and encouraging, aligning with the tone typically used in children's books in the target language. The mathematical action "*add up*" refers to an arithmetic operation, and by adding "*coba*", the translator softens the imperative mood and invites children to engage with the activity rather than commanding them. This extra linguistic element not only adjusts to cultural and pedagogical norms in Indonesian children's education but also supports the educational aim of fostering a positive and exploratory attitude toward mathematical tasks. Therefore, this paraphrase functions to tune by adjusting the culture of how Indonesians ask someone to do something, particularly children.

4.1.4. Annotation

The last technique, annotation, is the least common in the data. An annotation is called a footnote. Nida and Margot in Molina and Albir define annotation (footnotes) as another adjustment technique and cultural adaptation to add information about terms[3]. In other words, it provides additional explanatory information—often in the form of a footnote or endnote—that is separated from the main body of the translated text. This technique is typically employed when a specific term may be unfamiliar to the target audience or when a cultural or technical concept needs clarification without interrupting the flow of the stories. An annotation describes a term separately from the translated text, often in the form of footnotes. Annotation functions as naturalizing since it aims to make the translation understandable for children.

Datum 004

ST: "Who is coming? I hope all the **Polygons** will be there. I miss my cousins," said Khosi.

TT: "*Siapa saja yang akan datang, Ma? Semoga semua keluarga Poligon* datang.*
****Poligon: segi banyak***

An example of annotation can be seen in the translation of the English sentence "I hope all the Polygons will be there", into Indonesian "*Semoga semua keluarga Poligon datang*." A footnote follows with "*Poligon: segi banyak*" (Polygon: a many-sided shape). In this example, the term "Polygons" is translated into Indonesian as "*Poligon*" and accompanied by an annotation in the form of a footnote that briefly defines the term. This use of annotation illustrates a translation technique in which explanatory information is

offered outside the main body of the text, usually through footnotes, to clarify unfamiliar or technical terms for the reader. By placing the explanation separately, the translator tries to help readers, especially children, understand the mathematical concept of a polygon, which refers to a flat shape with multiple sides, without interrupting the flow of the narrative. By giving the footnote (annotation), the children learned about the term they might not have understood. Therefore, it functions as a naturalizer. It is expected to make the target readers easily understand the term without dropping it.

4.2. The Impact of The Use of Amplification Techniques on Translation Quality

As **Table 1** shows, the amplification techniques used in translating the mathematical terms in children's storybooks are proven to give a good impact on translation quality in terms of accuracy, acceptability, and readability. The overall score of each type of amplification technique reaches a score above 2.5 out of 5 indicating that the translation is well-maintained. The explicitation technique reaches an overall score of 2.89, paraphrase 2.85, addition 3, and annotation 2.91. The overall score of the explicitation technique, paraphrase, and annotation cannot reach the perfect score of 3 because of the readability level. It happens because the translator used unusual words that they are not familiar with. Each indicator of translation quality is divided into three levels: 3 (high), 2 (medium), and 1 (low).

4.2.1. Accuracy

According to Nababan et al, accuracy refers to the degree to which a translation faithfully conveys the meaning of the source text[4]. Assessment is done by assessing the sentence level of the entire text. Accuracy is divided into accurate, less accurate, and inaccurate. An accurate translation has no distortion in meaning. However, a less accurate translation contains slight distortions. In contrast, an inaccurate translation fails to convey the message of the source text into the target text. Moreover, there is no inaccurate translation found in the data caused by the amplification techniques. Instead, the translations were either accurate or less accurate. In most cases, amplification techniques successfully conveyed the intended meaning with minimal reduction. The following examples illustrate how accurate and less accurate translations operate in practice.

Datum 001

ST: "This year we are going to have a special family gathering," announced Mom Polygon.

TT: *Mama mengumumkan kalau hari ini akan ada pertemuan keluarga yang istimewa* ***di rumah****.*

Datum 003

ST: "Who is coming? I hope all the Polygons will be there. I miss my cousins," said Khosi.

TT: *"Siapa saja yang akan datang,* ***Ma?*** *Semoga semua keluarga Poligon* datang.*
**Poligon: segi banyak*

Datum 094

ST: The hour hand was on 7, so that meant it was 7–**something**.

TT: *Jarum jam berada di angka 7, berarti pukul 7-****sesuatu****.*

The bolded parts show how amplification techniques make translation become accurate and less accurate. Data 001 and 003 remain accurate. The words '*di rumah*' (at home) in Datum 001 and '*Ma?*' (Mom) in Datum 003 does not decrease the accuracy since the addition here is based on the context which makes the target text more explicit. Datum 094 is considered a less accurate translation since the word '*sesuatu'* (something) fails to convey the meaning. Here, the word 'something' in the source text is.

4.2.2. Acceptability

Acceptability refers to the extent to which a translation conforms to the culture and grammatical norms of the target language[4]. According to Nababan et al., acceptability is categorized into three levels: acceptable, less acceptable, and unacceptable[4]. An acceptable translation, which is scored 3, adheres to the culture and grammar of the target language and sounds natural. A less acceptable translation generally follows these norms but contains specific terms or expressions unnatural in the target text. Finally, an unacceptable translation neither follows the grammatical rules of the target language nor sounds natural to target readers. In the application of amplification techniques, only one instance was found to be less acceptable, while the rest were considered acceptable. The examples below illustrate both acceptable

and less acceptable translations.

Datum 021

ST: So the Polygons and Circle played happily together until the delicious food was ready.

TT: *Akhirnya, **anak-anak** Poligon dan Lingkaran bermain bersama dengan gembira sampai makan siang yang lezat tiba.*

Datum 159

ST: "He's a deep thinker," said Dave.

TT: *"Dia pemikir mendalam," kata Dave **memotong perkataan Ibu.***

Datum 094

ST: The hour hand was on 7, so that meant it was 7–**something**.

TT: *Jarum jam berada di angka 7, berarti pukul 7-**sesuatu**.*

Data 021 and 159 represent acceptable translations that conform to the cultural and grammatical norms of the target language, Indonesian. In Data 021, the phrase *anak-anak* ('children') expresses plurality through reduplication, consistent with Indonesian grammar since it still functions as the sentence's subject. Similarly, the phrase *memotong perkataan ibu* ('interrupting his mother') in Data 159 also conforms to Indonesian grammar. In Indonesian, retaining the verb form without changing it is permissible, unlike in English, which requires using present or past participles.

However, the last datum illustrates a less acceptable translation. In Indonesian, the word *sesuatu* ('something') sounds unnatural because it cannot be directly combined with a numeral. In this context, the English word something refers to an indeterminate number of minutes on the clock. Thus, it would be more appropriately rendered as *pukul 7 lebih sekian menit* ('a few minutes past seven'). Here, the word *sekian* in Indonesian conveys the sense of uncertainty.

4.2.3. Readability

The last indicator of translation quality, readability, shows the easiness degree of the target readers to understand a translation[4]. Same as the previous indicators, it also has three levels: high, medium, and low. High readability means that the target readers can easily understand the translation. Medium readability indicates the translation is a bit hard to understand. The last, low readability shows that the translation is hardly understood by the target readers. The results have shown that the readability varies from one child to another. Some could easily understand the translation and some could not. After interviewing the children, the researchers found those three levels of readability. However, the amplification techniques applied in the data still maintain a high level of readability, indicating that the children are able to comprehend the stories in these books although some translations are less comprehensible even incomprehensible. The data below depicts the high, medium, and low readability translations.

Datum 047

ST: Raju has noticed that there are 8 coconuts in the first tree

TT: *Raju menyadari ada delapan **buah** kelapa di pohon pertama.*

Datum 021

ST: So the Polygons and Circle played happily together until the delicious food was ready.

TT: *Akhirnya, **anak-anak** Poligon dan Lingkaran bermain bersama dengan gembila sampai makan siang lezat tiba*.

Datum 094

ST: The hour hand was on 7, so that meant it was 7–**something**.

TT: *Jarum jam berada di angka 7, berarti pukul 7-**sesuatu**.*

Datum 101

ST: What do I do at 7:05?

TT: *Apa yang kulakukan pada pukul 07.**05**?*

Datum 287

ST: Here, **2 is common to one pair**, but it occurs twice in the list for 20.

TT: *Di sini, **kedua bilangan memiliki angka 2 sebagai salah satu faktornya**. Akan tetapi, pada bilangan 20, angka 2 muncul 2 kali*

The data above illustrate varying readability levels in amplification techniques in children's storybooks. As mentioned in the methodology, the translations were tested on children of specific ages following their reading levels. The

amplification techniques applied in Data 047 and 021 were still understandable for children. The children benefited from these techniques, as the translations became clearer in indicating who and what was being referred to in the story. However, the use of amplification techniques does not always have a positive impact on readability. For example, in Datum 094, the translator introduced an unfamiliar term. As explained in the discussion on acceptability, this particular amplification application tended to confuse the target readers, as it sounded unnatural and unclear.

Furthermore, the level of readability also depends on each child's ability to process the information they read, as seen in Data 101 and 287. In Datum 101, one out of three children failed to grasp the meaning of 05 in 07.05, becoming confused because they did not understand the concept of 05 in the time expression. Similarly, in Datum 287, all children aged 8–10 struggled to understand the sentence '*kedua bilangan memiliki angka 2 sebagai salah satu faktornya*' (both numbers have 2 as one of their factors). Although the children did not explicitly articulate the reason for their difficulty, their responses indicated confusion caused by the repetition of *kedua* ('both') and 2 ('two'). In Indonesian, the word *kedua* phonologically resembles the numeral *dua* ('two'), which likely contributed to their difficulty in processing the meaning.

5. Discussion

The findings of this study reveal four distinct types of amplification employed in translating math-loaded children's picture books into Indonesian: addition, annotation, explicitation, and paraphrasing. These techniques are not applied randomly; each performs a specific function aligned with the linguistic, pedagogical, and cultural needs of child readers. The amplification application reflects the translator's attempt to render mathematical concepts comprehensible, engaging, and developmentally appropriate.

An important observation in this study is the identification of the tuning function. This occurs when amplification techniques are used to introduce elements even though the target readers would be able to understand the translation without any additional information. Crucially, this type of amplification does not introduce new meaning into the target text. The identification of tuning, therefore, represents a novel contribution that extends the framework of Purnomo et al [11].

As presented in **Table 1**, mathematical terms translated using explicitation techniques appear in four variations: tuning, naturalization, synchronization, and a mixed function combining synchronization and tuning. Synchronization functions to align verbal text with visual elements, which is a critical practice in translating children's picture books. In translating these storybooks, images constitute a central meaning-making resource. Within this context, amplification strengthens textual coherence with illustrations, reinforcing narrative clarity and supporting conceptual comprehension, particularly in conveying mathematical ideas. This is in line with the view of Purnomo et al. that synchronization aims to establish congruity between verbal text and images [11]. Oittinen likewise emphasizes that in children's literature, verbal and visual elements must "speak together" to effectively convey meaning [1]. In this study, the amplification of quantifiers or descriptive elements frequently bridged such gaps. This practice is not merely lexical addition but also a synchronizing act that enables young readers to perceive the intended mathematical sequence. Nevertheless, synchronization is not entirely neutral. While it enhances alignment and promotes pedagogical clarity, it can also reshape the precision of the source content, thereby introducing a degree of interpretive intervention by the translator. Overall, most mathematical terms were found to be accurate and acceptable. However, certain translations were difficult for children to understand, indicating that accuracy and acceptability alone are not sufficient; translators must also carefully evaluate whether additional information is essential for child readers' comprehension. Previous research has highlighted that explicitation assists children in understanding implicit information not explicitly presented in the source text [23]. Amplification in translating mathematical terms and concepts also appeared in a combined form, tuning-synchronization. This dual function enhances linguistic precision while ensuring verbal explanation and illustration coherence by adding information that is absent from the source text. This explicit information clarifies the abstract concept of area division (tuning) and reflects the illustrated image of multiple small, equal squares (synchronizing). Such alignment enables young readers to connect language with images, supporting comprehension and engagement. By merging verbal precision with visual

coherence, tuning-synchronization amplification proves effective in fostering mathematical understanding in picture books. As Oittinen cautions, excessive addition can alter the rhythm and style of the source text [1]. Accordingly, tuning in this study underscores a new dimension: explicitation in this context is possible to fail to improve readability if it does not meet the reader's needs. Nonetheless, the number of cases with high readability remains greater than those with medium or low readability, indicating that translators successfully bridge mathematical concepts from the source text to the child readers. This study further reveals that explicitation reflects translators' awareness of children's cognitive developmental stages, where young readers benefit from direct and concrete information, particularly in mathematical contexts. This supports Erfiani's finding that explicitation in translating children's literature enhances comprehensibility by making implicit information explicit [9]. The technique thus responds to both cognitive and cultural characteristics of child readers, ensuring that messages are conveyed with greater clarity and effectiveness.

Paraphrasing, the second most frequent technique, primarily served the function of naturalization. The data contained 16 instances of paraphrase, most of which demonstrated high translation quality, although some resulted in reduced accuracy and readability. In naturalization cases, paraphrasing was employed to restate complex or abstract mathematical concepts in more straightforward and more accessible language. As such, naturalizing amplification is essential for rendering mathematical content comprehensible to child readers by aligning linguistic expressions with familiar cultural and cognitive frameworks. This application reflects Molina and Albir's conception of amplification as a tool for clarifying meaning [3]. By inserting the intended mathematical relationship more explicitly in the data, this result aligns with Purnomo's argument that amplification facilitates comprehension of abstract concepts [20]. This also highlights the importance of balancing accuracy, acceptability, and readability, as translation must preserve the source message while also respecting the linguistic and cultural norms of the target language and the understanding of its readers [21,22,34]. Nonetheless, the use of the term '*pukul*' demonstrates how naturalized choices may confuse children, contradicting the principle of readability as outlined by Nababan et al., which stresses that translation must be highly understandable to the target audience [22,23,34]. Similarly, a paraphrased explanation of fractions that omits the phrase "of the whole" demonstrates how naturalization can unintentionally obscure key mathematical relationships. This aligns with Newmark's warning that translation must be natural but not distort the original's meaning [35]. Overall, these cases demonstrate that while naturalizing amplification can enhance readability and engagement, it must be applied with precision to ensure linguistic clarity, cultural familiarity, and pedagogical effectiveness. Baker notes that paraphrasing is commonly employed to simplify potentially complex concepts for readers, though oversimplification may reduce accuracy if the intended meaning is not fully conveyed [36]. This risk was observed in the data, where paraphrasing used as naturalization slightly reduced accuracy due to failure to adequately transfer specific source terms. As Nababan et al explain, accuracy is central to translation quality because it concerns semantic integrity [4]. Furthermore, paraphrasing functioning as tuning was found to reduce readability in half of the cases identified, and as such, tuning failed to adequately bridge meaning with children's understanding. Based on O'Sullivan's findings, the translator was found to add judgements that make the translation more explicit than needed, damaging the subtlety and reducing readability for the children who could have grasped the irony [37]. This corresponds with the pedagogical principle of concretization, whereby abstract ideas are conveyed through tangible or relatable imagery. Thus, paraphrasing simultaneously serves cognitive and linguistic simplification, which is crucial for young learners engaging with mathematical language.

The addition technique was identified in two cases, both functioning as tuning. Addition was used to refine tone and communicative intent, softening imperative expressions and rendering them more polite and child-friendly. Nababan et al. argue that overly verbose messages may reduce accuracy, yet the additions observed in this study maintained accuracy [4]. Tuning amplification in this sense represents a pedagogically motivated refinement: rather than reacting to ambiguity, it proactively enhances clarity and instructional effectiveness. This function reflects a translator's sensitivity to the pedagogical features of picture books, particularly in mathematical storytelling, by refining already adequate expressions to better support mathematical literacy. The added information did not serve a corrective purpose but instead

sharpened semantic precision, assisting children in recognizing abstract patterns. This illustrates the double-edged nature of tuning. On the one hand, it enhances precision through using formal or accurate terms, especially beneficial in mathematical or instructional contexts. On the other hand, it may introduce unfamiliar expressions, such as the use of the term '*operasi*', which children often associate with surgery rather than arithmetic. Feedback from young readers confirmed that pedagogical enrichment must remain subordinate to semantic clarity and age-appropriate phrasing. These findings suggest that addition also carries an interpersonal function, aligning translation with the tonal conventions of Indonesian children's literature, while simultaneously negotiating the cultural and emotional nuances of mathematical instruction. This observation is consistent with Haapakoski's report that addition can provide contextual cues to facilitate reader comprehension [12].

Finally, annotation was identified in two cases, functioning as naturalization. This technique was used to explain unfamiliar or technical terms through footnotes. Such use of annotation demonstrates sensitivity to children's comprehension needs, particularly for younger audiences who may not yet have mastered formal geometric vocabulary. By presenting definitions outside the main narrative, annotation preserved narrative flow while still supporting mathematical understanding. In this sense, annotation reflects a dual commitment to both literary integrity and educational support. Taken together, these findings indicate that amplification in the translation of math-loaded children's picture books functions not only to bridge lexical or cultural gaps but also to promote learning, engagement, and narrative continuity.

6. Conclusions

This study shows that amplification in translating math-loaded children's picture books into Indonesian is a purposeful and multi-layered translation technique. It is not used randomly, but rather tailored to meet the linguistic, pedagogical, and cultural needs of young readers. The four identified types—addition, annotation, explicitation, and paraphrasing—serve specific roles in making mathematical concepts more accessible. In addition to these types, the study identifies four key functions of amplification: naturalizing, synchronizing, tuning, and tuning-synchronizing. Naturalizing adapts content to familiar linguistic, cultural contexts and comprehension of mathematical concepts. Synchronizing ensures coherence between text and illustrations. Tuning enhances clarity by refining terms, and tuning-synchronizing combines both accuracy and visual alignment. Each function reflects the translator's active role in bridging the gap between source text fidelity and the learning needs of the target audience. The findings highlight the importance of balance. While amplification can clarify meaning and support instruction, overuse or inappropriate choices, such as overly formal or culturally unfamiliar terms, may reduce readability. Translators must remain sensitive to both the developmental level of their readers and the educational intent of the books they translate.

In the specific area of translating math-enriched children's picture books, the proposed taxonomy of amplification functions may assist researchers and translators in determining which functions—such as naturalizing, synchronizing, and tuning—are most appropriate for supporting age-appropriate comprehension and the effective delivery of mathematical concepts.

Author Contributions

Conceptualization, N.S., M.N., R.S., D.; methodology, N.S., M.N., R.S., D.; validation, N.S., M.N., R.S., D.; formal analysis, N.S. and M.N.; investigation, N.S., M.N., R.S., D.; writing—original draft preparation, N.S. and M.N.; writing—review and editing, R.S. and D.; supervision, M.N., R.S., D.; project administration, M.N. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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