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MATHEMATICS THROUGH LANGUAGE AND LANGUAGE THROUGH MATHEMATICS: CONDENSATION TRANSCRIPTION AS A POINT OF SYMBIOSIS

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ABSTRACT

This paper explores the idea of condensation transcription—which is defined as the reduction of lengthy collections of lexical elements or mathematical descriptions into short forms—as the point where mathematics and language learning cross-influence one another notably. To elaborate, condensation transcription is defined as the linguistic ability and procedure that permits the reconstruction and compacting of larger lexical sets into more manageable forms while maintaining the basic meanings of those sets. Such a phenomenon occurs when mathematical concepts are rewritten from page-long descriptions to figures and numerical entities, and when literary passages are compressed into their main ideas.

Formulation of the problem. Word problems, main idea identifications, and essay writing are some of the most dreaded topics of study in mathematics and language. In order to suggest improvements in these challenging areas within the education of both disciplines, this paper's research emphasizes the significance of condensation transcription and makes readers aware of it by examining lexical elements in language and mathematical entities, pinning their origins, and explaining what learning strategies can be extracted from language that could be useful in mathematics learning, and vice versa.

Materials and methods. The resources used in this investigation include a comprehensive dictionary entry, a word problem, literary text passages, and written explorations of mathematical concepts, all of which are dissected through the implementation of condensation transcription's conventional procedures, which are termed 'analysis,' 'coding,' and 'decoding.' This procedure is necessary to show, first-hand, how condensation transcription works and how it is applied, as well as what can be gleaned from its functions and applications.

Results. The results point to condensation transcription being a basic concept in mathematics and language that powers mathematical learning through comprehension of language, and reversely.

Conclusions. As a whole, this paper underscores the importance of having the knowledge of condensation transcription in language and mathematics. By recognizing the role of condensation transcription as a foundational language process, practitioners in both language and mathematics could make some of the most difficult concepts in both disciplines easier for students to grasp.

KEYWORDS: *Condensation Transcription; Analysis; Coding; Decoding; Mini Essay.*

МАТЕМАТИКА ЧЕРЕЗ МОВУ ТА МОВА ЧЕРЕЗ МАТЕМАТИКУ: КОНДЕНСАЦІЙНА ТРАНСКРИПЦІЯ ЯК ТОЧКА СИМБІОЗУ

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АНОТАЦІЯ

У цій статті досліджується ідея конденсаційної транскрипції, яку визначають як зведення довгих наборів лексичних елементів або математичних описів до коротших форм, тобто точку дотику математики та мови, в якій вони значно впливають одне на одного. Для уточнення, конденсаційна транскрипція визначається як лінгвістична здатність та процедура, яка дозволяє відновлення та ущільнення більших лексичних наборів до більш зручних форм, зберігаючи основні значення цих наборів. Таке явище відбувається, коли математичні концепції зводяться з довгих описів до символічних записів, а також коли літературні уривки стискаються до основних ідей.

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Формулювання проблеми. Текстові задачі, визначення основних ідей та написання есе – це одні з найбільш важливих завдань при вивченні математики та мови. З метою полегшення навчання математики та мови автори дослідження підкреслюють значення конденсаційної транскрипції та знайомлять читачів з цими поняттями, розглядаючи лексичні елементи у мові та математичні об'єкти, встановлюючи їх походження та пояснюючи, які стратегії можна перенести з навчання мови на навчання математики, і навпаки.

Матеріали та методи. Ресурси, використані у цьому дослідженні, включають в себе комплексне словникове визначення, текстові задачі, уривки літературного тексту та письмові дослідження математичних концепцій, які досліджуються за допомогою використання стандартних процедур конденсаційної транскрипції – «аналіз», «кодування» та «декодування», з метою демонстрації, як працює на практиці конденсаційна транскрипція, як її застосовують та які висновки можна зробити з цих застосувань.

Результати. Результати вказують на те, що конденсаційна транскрипція є базовим поняттям в математиці та мові, яке забезпечує навчання математики через розуміння мови, і навпаки.

Висновки. Загалом, дане дослідження підкреслює важливість знання конденсаційної транскрипції в мові та математиці. Розуміння ролі конденсаційної транскрипції як базового мовного процесу, полегшить вивчення студентами як мови, так і математики

КЛЮЧОВІ СЛОВА: конденсаційна транскрипція; аналіз; кодування; декодування; міні-есе.

INTRODUCTION

The process within each language that could be considered responsible for the manufacturing of its dialect's lexical items could be properly identified as condensation transcription. Condensation transcription is a linguistic capacity and process that allows speakers and writers to compact and reconstruct longer or more expansive sets of lexical items into more shortened, one-word versions that are concise but still preserve their more extended emphasized counterparts' main meanings. If one were to open their preferred and frequently referenced dictionary, they will find that most all the words and lexical objects in there have long and drawn-out definitions neatly written right beside them, respectively. As an example, we will examine an English language word from the popular Merriam-Webster dictionary. This word will be 'haughty.' Just below Merriam-Webster's (Loughran & Berry, 2016) visual virtual presentation of the word 'haughty,' there is a definition that reads as the following: *Blatantly and disdainfully proud: having or showing an attitude of superiority and contempt for people or things perceived to be inferior.*

Definitions like this one are a part of all words in all languages globally and their lexical components, according to the linguistic processes of analysis and synthesis, are the building blocks of said words, respectively. The process of analysis is simply language practitioners' and utilizers' scrutinizing and through examination of each lexical item in a word's potential, to-be definition and the overall idea communicated by a to-be word definition's string of lexical items. Once this examination of lexical item and lexical item string is complete, language practitioners and utilizers will work towards the process of synthesis, which is essentially condensation transcription or the construction of a single word based on the mentioned examination, thus underscoring and indicating that lexical item and lexical item string of any to-be definition, or basically already-official definition, are indeed the constituting elements of any word in any lexicon, and proving that condensation transcription is the catalyst in the creation of any lexicon's words since it is responsible for essentially packaging and coding elements of any lexicon's definitions into the words that would come to dominate it.

Now, mathematics, like any other product of human intellectual activity, is based upon language, and naturally, it borrows its function of condensation transcription. In mathematics, condensation transcription extends its coding functions over to the area of algebra or other disciplines. Thus, algebra, as a one of the key disciplines of mathematics, contains items and entities that are pretty much used as bodies or hosts of mathematical and scientific ideas, concepts, and principles. This indicates and implies that algebraic or mathematical items and entities are pretty much analogs of linguistic concepts in all lexicons, as they are the dominant communicative features of an intellectual subject and its scope. If algebraic lexical objects are like that of standard language words in essence, then they are also produced by condensation transcription and are subject to the word-generative processes of analysis and synthesis (i.e., condensation transcription). As with conventional linguistic words or communication items, algebraic and mathematical figures and entities start off as overly detailed, lengthy definitions and definitive descriptions that could, in some cases, span an entire page in prioritization of the effort to communicate a scientific notation, set of rules, formula, or dogmatic law in raw written form. The traditional linguistic analysis process thoroughly makes sense of each piece and constituent in such expansive definitions and definitive descriptions, and synthesis (i.e., condensation transcription) is provided with a comprehensive template or blueprint of key ideas and material that it must then convert and code into units and communicative items that are of a reasonable magnitude and dimension, detail and span-wise. And thus, algebraic configurations, symbols, signs, and notations are born.

Now, from the assessment of all the information that has been conveyed, it should be worth noting that condensation transcription is one of mathematics' most ruthlessly efficient features. Going back to the matter of conventional language (Loughran & Berry, 2016), by reasonable observation, it can be properly deduced that words are essentially more trimmed and extremely concise restructurings of the ideas and information presented by their blueprints (i.e., definitions). The definitions are briefer but preserve and encapsulate words' crucial meanings and implications. Thus, condensation transcription presents language users with communication devices that are free of excessive distractions in their delivery of thought and simultaneously sufficient in how they aid users in their expressions of their intended messages. As a result, users have the advantage of not overthinking the words they use and stumbling over any disorientations when they share information or communicate.

For mathematics, condensation transcription performs the same job after its preceding analysis procedure decodes all the components in a rather long scientific description, "hands" it the overall, main ideas of said description and its components,

and enables it to code these main ideas into straightforward, direct, cohesive, and concise mathematical text. With the condensation transcription, mathematics practitioners and mathematicians have a clean, refined, and polished version of their laws, rules, theorems, conjectures, etc. With this being said, it can be properly argued that condensation transcription is a major asset and convenience to mathematics practitioners and mathematicians, for it manages to advance their studies forward with vessels that communicate dense material concisely yet effectively. This makes it, again, one of mathematics' most ruthlessly efficient aspects.

MATERIALS AND METHODS

The resources used in this investigation include a comprehensive dictionary entry, a word problem, literary text passages, and written explorations of mathematical concepts, all of which are dissected through the implementation of condensation transcription's conventional procedures, which are termed 'analysis,' 'coding,' and 'decoding.' This procedure is necessary to show, first-hand, how condensation transcription works and how it is applied, as well as what can be gleaned from its functions and applications.

RESULTS

The results point to condensation transcription being a basic concept in mathematics and language that powers mathematical learning through comprehension of language, and reversely.

Mathematics Through Language: Examples

English Reading Comprehension Main Idea Identification Exercises and Mathematical Word-Problem Solving

In addition to being the key tools in the generation of all languages' words, analysis and condensation transcription also play key roles in the critical language learning practice of reading comprehension, which is a subject of language taught in literature and language arts classes around the world. In particular, each word-generative process offers a critical and vital tactic for robust and effective main idea detections in literary texts, and ones that could be applied to mathematics studies, particularly word problem-solving. Let us look closely at a reading comprehension student's main-idea detection work (Two large and 1 small pumps can fill a swimming pool in 4 hours) below.

Exercise 1. Summer is a wonderful time to spend at West Beach. It is a beach with light-colored, soft sand. The coastline goes on for a long way and many people enjoy walking along it. Children like to play in the surf and walk along the rocks that are visible at low tide. This is a fun beach for people of all ages.

Analysis. In this paragraph:

- the topic is *West Beach*;
- the main idea (what the writer is saying about the topic) is that summer is a wonderful time at West Beach.

Exercise 2. The movie Apollo 13 was a blockbuster for the summer of 1995. It is an exciting story about space exploration. In the movie, the astronauts get in trouble while they are trying to return to Earth. People in the audience are on the edge of their seats waiting to see what happens. What makes it even more exciting is that it is a true story.

Analysis. In this paragraph:

- the topic is the movie *Apollo 13*;
- the main idea is in the first sentence: *Apollo 13 was a blockbuster for the summer of 1995.*

Exhibit 1. English Reading Comprehension Main Idea Identification Exercises. Adapted from (Two large and 1 small pumps can fill a swimming pool in 4 hours)

The process of analysis in these worked-out exercises can be found in the identification of the main topic of each little excerpt/paragraph, as the purpose of analysis is to provide condensation transcription or synthesis, as has been discussed earlier, with the material it needs to cut down vast and wordy communicative content and clues into a focused and compact lexical vessel carrying its most significant, overall meaning, or, in essence, its main idea. This identification of topic that is taught and encouraged in reading comprehension and language arts classrooms will be denoted as the tactic of "What" (Landmark, 2024) or finding what a text's primary linguistic focus is. With regards to condensation transcription, it can be observed that it does its job with its analysis-given, phrasal main-idea manufacturing resources in the student work samples, using the main topics as points of coordination and orientation in its generation of a shortened, rewritten, meaning-preserving versions of said samples. Such an action, or rather utilization by student, of condensation transcription can reveal the tactic that we will refer to as "What about the What," (North Carolina Department of Public Instruction) or a brief, one-sentence thought highlighting an information body's main topic and correctly communicating its central message. Now that we have pinned down the specific main idea tactics that are frequently employed in the language discipline of reading comprehension, and generally language studies, we will now observe how such tactics can be integrated into mathematics classrooms, specifically said classrooms' word problem-solving practices. As a matter of reasonable observation, both analysis and condensation transcription are very useful in equipping students with the devices that are critical in their word problem-solving endeavors. Let us examine this point in the high school sophomore-level word problem (Reading Rockets) and its correct solution process shown below.

Problem. Two large and 1 small pumps can fill a swimming pool in 4 hours. One large and 3 small pumps can also fill the same swimming pool in 4 hours. How many hours will it take 4 large and 4 small pumps to fill the swimming pool. (We assume that all large pumps are similar, and all small pumps are also similar.)

Solution. Let R and r the rate of work of the large and the small pumps respectively

$$4(2R + r) = 1 : 2 \text{ large and } 1 \text{ small work for } 4 \text{ hours to do } 1 \text{ job}$$

$$4(R + 3r) = 1 : 1 \text{ large and } 3 \text{ small work for } 4 \text{ hours to do } 1 \text{ job}$$

$$T(4R + 4r) = 1 : \text{Find time } T \text{ if } 4 \text{ large and } 4 \text{ small are to do one job.}$$

Solve for R and r the system of first two equations then substitute in the third and solve for T to find the time. $T = 5/3$ hours = 1 hour 40 minutes.

Exhibit 2. Mathematics Time, Speed, & Distance Problems. Adapted from (Reading Rockets)

Analysis. The analysis process immediately begins once a student tasked with solving this word problem starts studying it, closely examining its communicative data set of lexical items for the meanings and messages they are conveying, thus gathering facts and knowledge from the word problem. As is indicated by our word problem's solution above, the student's analysis, based on its findings and the student's initial reading of the word problem's scenario, noted the following: 'There are three pumps of different sizes (i.e., two big and one small) that have an important role in filling up a swimming pool; Both the small and the large pool pumps are capable of completing their job in the time span of four hours; The same job can be successfully carried out in the same time frame by one large pump and three small ones; All of the pumps within each size category have a consistent likeness and the word problem is asking how many hours it will take four large and four small pumps to fill up a swimming pool.' Once all of these details are written out, comprehended, and accounted for, the student, with their understanding of what the word problem's question asks of them (i.e., How many hours will four large pumps and four small pumps need to fill out a swimming pool?), can now have the material necessary for the crucial procedure of breaking down the conveyances of their presently emphasized word problem's text and extracting its main ideas (i.e., decoding or condensation), and then writing those ideas out as functional units of mathematical solution (i.e., coding or transcription). Below, in (7.04: Graphing Linear Equations in Two Variables; Table 1.), your attention will be directed towards the pupil's demonstration of this breakdown and translation process of condensation transcription. The analysis notes will be marked as "Source Material," the breakdown will be labeled as "Decoding," and the mathematical entities will be referred to as "coding."

Table 1. The Analysis and Condensation Transcription Process of a Word Problem
(adapted from (Two large and 1 small pumps can fill a swimming pool in 4 hours))

Source Material	Decoding	Coding
There are three pumps of different sizes (i.e., two big and one small) that have an important role in filling up a swimming pool.	Let R and r be the rate of work of the large and the small pumps, respectively.	R, r
Both the small and the large pool pumps are capable of completing their job in the time span of four hours.	2 large and 1 small work for 3 hours to do 1 job.	$4(2R + r) = 1$
The same job can be successfully carried out in the same time frame by one large pump and three small ones.	1 large and 3 small work for 4 hours to do 1 job.	$4(R + 3r) = 1$
The problem asks to calculate the number of hours 4 large and 4 small pumps will need to fill up the swimming pool.	Find time T if 4 large and 4 small are to do one job. Solve for R and r the system of first two equations, then substitute in the third and solve for T to find the time.	$T(4R + 4r) = 1$

Source: Own work.

In the "decoding" or condensation segments of each section in the table, the student, as mentioned, found the heart or gist of their word problem's original text, and created a narrowed-down, powerfully focused guide that, in essence, became their compass in finding the tools needed to acquire the word problem's solution. With this being said, it can be properly inferred that the process of condensation gave the student a practical template for the proper and error-free construction of the numerical and algebraic entities that would pave the way for the answer to the problem's question. In the table, such a construction is identified as "coding" or transcription, and it is, according to our assessment that has just been conducted, arguably the most important stage in a word problem's solution. Moreover and speaking of our assessment, it should be remembered that analysis has been the student's guide in creating their solution's guide and the mentioned entities containing clues for the obtaining of that solution, thus making it possible to conclude that analysis or "source material," as is preferred in the table, is the basis for the word problem-solving convenience and effectiveness brought about by condensation transcription.

Analysis tactic of "What". To apply the analysis tactic of "What" (Landmark et al., 2024), the student must first ask themselves what the word problem's main topic or topics is, and the answer to that would be the following: *The time that it takes a specific number of large pumps and a specific number of small pumps to complete one job.*

Analysis tactic of "What about the What." After this step is complete, the student will apply the condensation transcription tactic of "What about the What" (Comprehension for 4th and 5th Grades), and to carry out this step properly, they are to ask themselves the following questions: 'What is being said about the main topic?'; 'What is the main idea or ideas about the main topic?' In the case of our current word problem of discussion, the answer is the following: *In 4 hours, 2 large pumps and 1 small pump can complete one job; In 4 hours, 1 large pump and 3 small pumps can complete one job; It is unknown how much time it takes 4 large pumps and 4 small pumps to complete one job.*

With the discovery of a word problem's main topic(s) and main idea(s), students are able to make a critical distinction; they are able to understand the kind of word problem they are solving and what its solution process demands. Our sample main topic and main idea discoveries above are supportive of this deduction, for the former's identification of the sample word problem's main topic of time has helped the sample word problem's student solver recognize that they are dealing with a time word problem, and the latter's suggestion for a development of a list of the main topic's main ideas has given the student the awareness that their time word problem involves systems of equations. For mathematics students engaging in word problem-

solving tasks, the knowledge of the category of word problems that they are giving their attention to, which is effectively acquired with the aid of the language-based analysis tactic of "What," (Landmark, 2024) strengthens and solidifies their focus on said word problems' topic-specific scopes, which will, in turn, keep them focused on what they have been taught or need to know for the purpose of obtaining precise and solid solutions. Once students move past the "What" tactic (Landmark, 2024) and implement the language-based, interrogative condensation transcription tactic of "What about the What," (Comprehension for 4th and 5th Grades) they will be able to see the kind of mathematical action their individual word problems' main topics are set and embedded within (e.g., systems of equations calculations), and will find themselves on the right track towards mistake-free word problem solutions and answers. With all that has been explicated and delineated, it is safe to reason that language is not only relevant in mathematics studies, but it can also play a considerable role in mathematics studies' most daunting and often intimidating educational material such as word problem-solving.

Assessment of the Mathematics Mini Essay: Language Through Mathematics

From our careful deliberations of the beneficial outputs of the mathematical decoding and coding procedures, we can note and propose that decoding or condensing considerably stretched-out written mathematical ideas and grounds for typical mathematical activity (i.e., calculations and scientific solutions) and coding or transcription (i.e., the action of assigning and ascribing various relevant scientific entities and figures to the results of said decoding or condensation procedures for the sake of performing and conducting usual mathematical calculations) entail the following: The mechanical creation of a relatively non-detailed, rigid summary of said stretched and written-out mathematical ideas and grounds for calculations; the manual structuration of calculatable and scientifically solvable bodies of cohesive mathematical units and figures. The mechanical and manual natures of the mathematical decoding and coding processes arose from their applications to mathematics learning and their role as the integral, heavily relied-on parts of mathematics learning. In educational mathematics, students learn by either the decoding and coding work of the authors of their classroom material or their very own decoding and coding work on their classroom material. In the former's case, said authors conduct analyses of the specific mathematical subject areas they are adapting into a student classroom resource pack, eventually breaking down these areas into more succinct, concise, and effective bodies of information, and then converting these bodies into their numerical form (Exhibit 3).

The fundamental notion behind linear equations is that a straight line on a coordinate plane can depict the relationship between two variables. These formulas, which take the form ' $y = mx + b$ ', where (m) denotes the slope of the line and (b) the y-intercept, let us simulate a number of real-world situations, like cost-revenue analysis or correlations between distance and time."

- "slope" (m) equals 2.
- 3 is the "y-intercept" (b)

Therefore, the slope (m) of a certain linear equation, such as ($y = 2x + 3$), is 2, meaning that y grows by 2 units for every unit increase in x. The line crosses the y-axis at (0, 3) since the y-intercept (b) is 3.

Exhibit 3. Coded and Decoded Textbook Explanation of Linear Equations. Adapted from (GCFLearnFree.org)

With regards to the latter case wherein students engage in their educators' decoding and coding procedures, we can identify their own exercises of the decoding and coding operations as word problem-solving. Now, what is interesting to note is that the decoding and coding work in students' classroom learning resources, students' word problem-solving, and students' internalizations of said classroom learning resources is reflective of the stages of information coding done by computers' binary coding systems. In all cases of decoding and coding in educational mathematics, the binary system analogs (GCFLearnFree.org) of the stages of decoding and coding are the following: Source Material (Input Information), Analysis (Processing of Input Information), Condensation (Translation of Input Information for Computer's Reading), Transcription (Complete Translation or "Morse" Encryption). From such a comparison, it can be properly inferred that educational mathematical decoding and coding are both machine-like processes. It is also made clear that our mathematics students learn their mathematical concepts with educational mathematical decoding and coding as their study foundations, which means that they learn mathematics on bases that have automatic, mechanical properties, and ultimately become severely disconnected from the lessons that they are investing their study time and effort into. Basically, mathematics pupils study the mathematical lessons administered to them by their class curriculums with the same level of depth that they would be thinking at when they simply type information into a computer and wait for it to generate relevant output.

Mini Essays

Mini essays (National Academies of Sciences, Engineering, and Medicine, "Chapter 4," National Academies) for the testing of mathematical knowledge offer a workable approach. Mini essays for mathematics knowledge assessments are an effective teaching tool that support language proficiency development as well as the consolidation of mathematical concepts. Students are encouraged to communicate complex ideas with clarity and coherence by writing essays that demand them to demonstrate their mastery of mathematical concepts. Students participate in mathematical decoding as they write these essays, distilling complex mathematical ideas into clear and concise material. Students may be asked to discuss the Pythagorean theorem's significance, how it is applied to solve problems in the real world, and evidence supporting its validity in a brief essay dedicated to it. By organizing and logically expressing mathematical ideas in their responses, students not only underline their mastery of mathematics but also hone their language skills. On the other hand, mini essays for mathematics knowledge evaluation provide pupils with the chance to study language through mathematics. Students are to convert numerical ideas into worded explanations by incorporating mathematical topics into language learning assignments like essay writing. For example, using descriptive language is necessary to successfully communicate mathematical concepts in an essay prompt where students must describe the concept of probability in real-world circumstances. By participating in mathematical discourse, students

improve their language skills while simultaneously gaining a deeper comprehension of mathematical concepts. Additionally, because mathematics knowledge evaluation mini essays are multidisciplinary, they encourage cross-curricular connections and a more comprehensive approach to learning. An essay that examines the connection between geometry and architecture, for example, helps students develop their capacity to express complicated ideas in both mathematical and verbal terms while also reinforcing mathematical concepts. As a result, mini essays for the mathematical knowledge evaluation provide students with a dynamic way to study both mathematics and language, promoting interdisciplinary competency and improving general academic performance. Mini essays for mathematics knowledge assessments offer a diverse method of instruction that cuts across conventional disciplinary lines. Students have a rare opportunity to concurrently strengthen their linguistic and mathematics skills through these assignments. Take into consideration, for example, the short essay work (National Academies of Sciences, Engineering, and Medicine, "Chapter 4," National Academies, Exhibit 4) that asks pupils to investigate the topic of functions in mathematics.

Cracking the Secrets of Functions: Analyzing Domain, Range, and Mapping: A Student Mini Essay.

The relationships between sets of inputs and outputs are explained by the fundamental mathematical tools known as functions. One of the basic elements of functions is the concept of domain and range. A function's domain is the set of all possible input values, while its range is the set of all possible output values. Understanding domain and range is a prerequisite to analyzing and interpreting function activity.

Take the function $f(x) = x^2$ as an example. Since the function is defined for any value of x , in this instance, the domain is made up of all real numbers. Since the square of any real integer is non-negative, the function's range is restricted to non-negative real values. We can learn more about a function's characteristics and behavior by looking at its domain and range.

Mapping is another important feature of functions. The process of assigning a distinct element in the range to every element in the domain is referred to as mapping. The unique feature that sets functions apart from other mathematical relationships is the one-to-one correspondence between inputs and outputs. Take the function $g(x) = \sqrt[3]{a}$, for instance. Every non-negative real integer in the domain is mapped by this function to the equivalent non-negative square root in the range. We may gain a better understanding of the structure and behavior of functions by visualizing the mapping between inputs and outputs.

In addition, functions are essential to many disciplines, such as science, engineering, mathematics, and economics. Functions are the building blocks of more intricate mathematical systems in mathematics, such as linear algebra and calculus. Functions are used in science to simulate and examine a wide range of natural events, including the motion of celestial bodies and the behavior of chemical reactions. Functions are used in economics to explain how variables like supply and demand relate to one another. Functions are used in engineering to create and improve processes and systems.

With the help of functions, which are strong mathematical instruments, we may define and examine relationships between variables. We can gain a better knowledge of functions' behavior and applications in a variety of domains by exploring the mathematical nuances of functions, such as domain, range, and mapping.

Exhibit 4. A Student Mini Essay on Domain, Range, and Mapping, and Its Breakdown. Adapted from (National Academies of Sciences, Engineering, and Medicine, "Chapter 4," National Academies)

Breakdown of Sample. The notion of functions in mathematics is well explored in this student's brief essay, which focuses on important ideas including domain, range, and mapping. Math learning through English is demonstrated by the student's ability to convey difficult mathematical concepts to a wider audience using succinct and straightforward language. The essay also shows how learning a language can improve one's ability to understand mathematics. The student not only improves their comprehension of functions but also refines their language skills by using precise vocabulary and logical structure to successfully communicate mathematical concepts by coherently explaining the definitions and properties of domain, range, and mapping.

The essay also demonstrates how language and mathematics are related to one another. The essay writing process requires the learner to solve mathematical problems and express themselves in writing. This strengthens their comprehension of functions and improves their ability to explain mathematical concepts in writing. This brief essay, in summary, demonstrates how math knowledge evaluation tasks can support math learning through English and vice versa. Students gain interdisciplinary competency and improve their performance in both disciplines by combining mathematical principles with language learning challenges, which eventually equips them for success in both academic and real-world contexts.

Students respond to such a writing exercise prompt by delving into the mathematical nuances of functions, including mapping, domain, and range, as well as by engaging in linguistic decoding, which enables them to efficiently convert abstract mathematical ideas into succinct written explanations. As a result of this approach, students get a deeper comprehension of both mathematical principles and linguistic standards by honing their ability to articulate complicated ideas using specialized mathematical language. Mini essays for the mathematics knowledge assessment also give students a chance to investigate how language and mathematics are related in a variety of settings. Students are encouraged to bridge the gap between mathematical symbols and common English, for instance, by writing an essay that examines the relationship between algebraic expressions and written word problems. Students must not only understand the word problem's mathematical substance when crafting their responses, but they must also clearly and concisely express their solutions. This blending of language comprehension and mathematical problem-solving develops critical thinking abilities and a greater understanding of the innate relationships between language and mathematics. Additionally, through written expression in mathematical discourse, students learn how to effectively convey their mathematical thinking, which improves their general academic proficiency and sets them up for success in both the mathematical and linguistic realms.

DISCUSSION

A closer look at condensation transcription reveals its vital function in language and math instruction. Condensation transcription is the process of compacting and reconstructing lexical units into short yet relevant forms. It is necessary for problem solving and successful communication in both mathematics and language learning. Subsequent investigations in this field may explore more deeply into the cognitive processes that underlie condensation transcription in mathematics and language. Learning about how people absorb and use this process could help educators create teaching methods that are more successful.

Effective pedagogical techniques for teaching condensation transcription in language and mathematics classes could be the subject of future studies. Creating educational resources and interventions that specifically teach students how to use condensation transcription techniques in problem-solving activities could be one way to do this.

Subsequent research endeavors may investigate the effects of language-oriented evaluations, such as mini essays, on the mathematics learning results of pupils (National Academies of Sciences, Engineering, and Medicine, "Chapter 4," National Academies). Research on the effects of writing assignments that ask students to express mathematical ideas in writing on their conceptual knowledge and problem-solving abilities over time could be conducted through longitudinal research.

Collaboration between academics in the fields of mathematics and language education may result in the creation of multidisciplinary curriculum materials that incorporate instruction in condensation transcription (Two large and 1 small pumps can fill a swimming pool in 4 hours; Landmark, 2021; North Carolina Department of Public Instruction; Reading Rockets). This could entail developing cross-disciplinary lessons and exercises that motivate students to use condensation transcription methods when solving mathematical and language problems.

CONCLUSION

It is crucial to give educators opportunities for professional development so they can acquire the skills necessary to apply interdisciplinary teaching strategies that include condensation transcription techniques. For language-based solutions to be successfully incorporated into mathematics instruction, educators require assistance and training.

Academics studying language and mathematics education can also implement the *following strategies to improve student communication and problem-solving skills*:

- Including condensation transcription teaching in language and math courses.
- Providing opportunities for educators to receive professional development so they may learn the value of condensation transcribing and how to successfully incorporate it into their teaching methods.
- Encouraging teachers to improve student learning results by implementing condensation transcribing research findings into their teaching techniques.
- Promoting cooperation between math and language teachers to provide multidisciplinary teaching resources and methods that include condensation transcription training.
- Including language-based assessment tasks in mathematics exams, including mini essays, to gauge pupils' written communication skills about mathematical ideas.

Educators can increase students' academic performance in both language and mathematics by implementing condensation transcribing instruction and addressing these guidelines. This will help students become more proficient in multiple disciplines. Furthermore, these initiatives might advance our knowledge of the connection between language and math learning as well as result in the creation of more efficient teaching strategies.

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