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Content Analysis Comparison of Mathematics Textbooks for First Grade in Iran and Turkey Based on Attention to Student Agency Components

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ABSTRACT

This study aimed to conduct a comparative content analysis of first-grade mathematics textbooks from Iran and Turkey, focusing on the extent and pattern of attention given to components of student agency. The research instrument was a researcher-made content analysis checklist consisting of six agency components: hands-on activity, active problem-solving, personal choice/creativity, self-evaluation/feedback, group participation/story-based learning, and critical thinking/questioning, the validity of which was confirmed by experts. The quantitative data obtained from coding were analyzed using descriptive statistics and the Shannon entropy method to determine not only the frequency but also the importance coefficient (Wj) and relative weight of each component. The Shannon entropy analysis revealed distinct dominant patterns in each textbook: in the Turkish book, the "hands-on activity" component, with Wj = 0.114, was identified as the overwhelmingly dominant component, whereas the Iranian book emphasized "active problem-solving" with Wj = 0.061. Furthermore, the overall importance coefficient was higher for the Turkish book (Dj = 0.230) than for the Iranian book (Dj = 0.152), indicating a more concentrated and less balanced distribution of components in the former. A noteworthy common finding was the relative neglect of socio-critical components (group participation and critical thinking) in both books. The Turkish textbook follows a practice-based, experiential approach, while the Iranian textbook pursues a problem-based, cognitive approach. It is suggested that the component of "self-assessment and feedback" be added to the problem-solving structure in the Iranian textbook, while the component of "creativity and personal choice" be embedded within the practical activities in the Turkish textbook.

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1. Introduction

Preparing students to play an active and effective role in the knowledge-driven society of the twenty-first century has become one of the principal concerns of educational systems. In this regard, the concept of student agency—understood as an individual's capacity to exert purposeful influence over their own learning process—has assumed a central role in curriculum design (Reeve & Tseng, 2011). Despite a theoretical consensus on the importance of fostering agency from the earliest years of schooling (Boaler, 2016; Vaughn, 2018), the quality with which its constituent components are represented and prioritized in textbooks—particularly at the elementary level, where the foundations of a child's scientific disposition are laid (Clements & Sarama, 2014)—varies considerably across countries and is at times contested.

Iran and Turkey, as two neighbours sharing cultural and historical backgrounds and possessing centralized educational systems, have undergone extensive curricular reforms over the past two decades, especially in the domain of mathematics education. In Iran, reform in mathematics education has been placed on the agenda with an emphasis on a problem-solving approach and the activation of students' cognitive processes (Kiamanesh, 2005). Nevertheless, challenges such as academic decline in mathematics in the upper grades and students' relative inability to apply mathematical knowledge in real-world situations persist (Rezaei et al., 2020). Turkey, by contrast, drawing inspiration from constructivist approaches and European Union standards, initiated fundamental reforms in the early 2000s with the aim of transforming traditional curricula into student-centred ones (Aksit, 2007). These reforms led to changes in the structure of textbooks and a greater emphasis on hands-on, skill-oriented activities. Yet Turkey's principal challenge lies in striking a balance between this practical approach and deepening students' critical thinking and complex problem-solving (Aksit, 2007).

Findings from international studies such as TIMSS provide a clear picture of these challenges and of the differences in approach. According to the most recent reports (TIMSS 2019 and 2023), although Turkey has made considerable progress in recent years in fourth-grade mathematics scores and has raised its average above the TIMSS scale midpoint (500), the distribution of student performance remains highly unequal, with a profound gap between high- and low-achieving students (Mullis et al., 2020). By contrast, the performance of Iranian students in TIMSS has fluctuated yet remains below the international average—one factor potentially being the mismatch between the textbook's emphasis on theoretical problem-solving and students' ability to respond to the multiple-choice, standardized items of TIMSS. These statistics indicate that an

emphasis on a single dimension of learning alone cannot meet the full needs of students in international assessments and real-world situations.

Despite the cultural commonalities and centralized educational systems of Iran and Turkey, the two countries have pursued divergent paths in first-grade mathematics education: Iran emphasizes "active problem-solving" and cognitive processes (Kiamanesh, 2005), whereas Turkey, inspired by constructivism, has placed "hands-on and exploratory activities" at its Centre (Aksit, 2007). TIMSS 2023 data show that Iran's performance, with a mean of 419, falls below the international average (500), while Turkey, with a mean of 553, has surpassed it (NCES, 2024). Nevertheless, Turkey's principal challenge is the unequal distribution of performance and the profound gap between high- and low-achieving students, as documented in TIMSS studies (Mullis et al., 2020). The fundamental research problem, therefore, is to examine the distribution pattern of agency components in the first-grade mathematics textbooks of these two countries. The primary objective of this study is to compare the prevailing patterns governing the cultivation of agency in the first-grade mathematics textbooks of Iran and Turkey. More precisely, this study seeks to answer the question of how, given the recognized challenges in each country's mathematics education (the challenge of balance and of deepening learning) and their standing in international assessments (TIMSS), the extent and manner of attention to the components of student agency (hands-on activity, active problem-solving, creativity, self-assessment, group participation, and critical thinking) are manifested in their textbooks, and what similarities and differences exist between the two educational systems.

International research on student agency has its roots in late twentieth-century learning theories. Lave and Wenger (1991), in introducing situated learning theory, demonstrated that agency is not formed in a vacuum but rather within communities of practice and through legitimate peripheral participation. These two theories laid the foundation for subsequent research on educational agency. Bandura (2006), in proposing his theory of human agency, defined it as an individual's capacity to exert conscious and purposeful influence over the processes of their own life, delineating four dimensions: intentionality, forethought, self-reactiveness, and self-reflectiveness.

In the 2010s, the conceptualization of agency in mathematics education entered a new phase. Reeve and Tseng (2011), by introducing agency as the fourth dimension of student engagement (alongside the behavioral, emotional, and cognitive dimensions), demonstrated that students are not merely passive recipients of instruction but can actively shape the flow of their own learning. Vaughn (2018), emphasizing the importance of the early years of schooling, provided

a framework for understanding agency in the early grades and introduced components such as choice, voice, and ownership for its assessment. Boaler (2016), in her studies on "mathematical mindsets," showed how stereotypical beliefs about mathematical ability can impede the emergence of student agency, while open and creative learning environments can mitigate such obstacles.

In the domain of content analysis of mathematics textbooks, Valverde et al. (2002), drawing on TIMSS data, conducted an extensive study of mathematics textbooks across fifty countries. Their findings indicated that textbooks reflect curriculum designers' conceptions of the nature of knowledge and of the learner's role. Remillard (2005), focusing on how teachers use textbooks, demonstrated that the design of textbook content can either provide a context for agency-fostering experiences or neutralize them through a passive orientation. In the field of comparative studies, Aksit (2007) examined educational reforms in Turkey and showed how emulation of European Union standards shifted the orientation of that country's textbooks toward constructivism. Kiamanesh (2005), in a comparative study of Iran, Singapore, and the United States, investigated the role of student motivation and participation in predicting mathematics achievement.

With respect to specific components of agency, Papert (1980), in introducing constructionist theory, emphasized the importance of hands-on activity and manipulation in mathematics learning. Schoenfeld (1992), in proposing his theory of mathematical problem solving, demonstrated that active problem solving requires perseverance, initiative, and the application of personal strategies. Silver (1997) addressed the relationship between creativity and problem solving, showing that opportunities for personal choice and the generation of novel solutions strengthen students' sense of ownership. Black and William (2009), through a systematic review of research on formative assessment, highlighted the role of self-assessment and feedback in self-regulation and the reinforcement of agency. Yackel and Cobb (1996), in introducing sociomathematical norms, demonstrated how group interaction and mathematical discourse can provide a context for collective agency. Skovsmose (1994), in advancing a philosophy of critical mathematics education, emphasized the role of critical thinking and questioning in student empowerment. Clements and Sarama (2014), in introducing the learning trajectories approach, demonstrated the importance of early mathematical experiences in shaping a child's mathematical disposition and identity. Ramirez et al. (2018) examined the relationship between mathematics anxiety and the types of tasks and activities found in textbooks.

In Iran, too, content analysis of mathematics textbooks—particularly from the perspective of contemporary educational approaches—has attracted scholarly attention. Rezaei, Fardanesh, and Safaei Moghaddam (2020), in their "Content Analysis of the Sixth-Grade Elementary

Mathematics Textbook from the Perspective of Creativity," showed that the textbook in question performs poorly in stimulating fluency of thought, flexibility, and initiative, and predominantly emphasizes convergent responses. Karimi et al. (2017), in examining Iranian and Japanese mathematics textbooks, demonstrated that Japanese textbooks provide greater opportunities for hands-on activities, group work, and classroom discussion. Mohammadi and Ahmadi (2018), in their "Content Analysis of the First-Grade Elementary Mathematics Textbook Based on Constructivist Curriculum Components," showed that although the textbook attends to components such as hands-on activity and connection to everyday life in certain chapters, it exhibits serious weakness in components such as self-assessment and feedback. Nouri et al. (2019), in "Examining the Extent of Attention to Self-Regulation Skills in Elementary Mathematics Textbooks," concluded that these textbooks provide scant opportunity for self-assessment, self-regulation, and reflection. Hejazi et al. (2016), in examining the extent of attention to critical thinking components in elementary mathematics textbooks, showed that these textbooks perform poorly in cultivating reasoning, analysis, and evaluation skills, and place greater emphasis on memorization and predetermined procedures. Sadeghi and Nasr (2015), in their content analysis of lower-secondary mathematics textbooks from the perspective of the problem-solving approach, concluded that although problem solving is mentioned in the chapter titles of these textbooks, their content consists predominantly of algorithmic and repetitive problems, providing scant opportunity for non-routine and creative problem solving. Zare et al. (2014), in analyzing the content of elementary mathematics textbooks with respect to attention to group activities, showed that most activities are designed for individual work and that group interactions hold little place in these textbooks. Rastegar et al. (2013), in "Examining the Extent of Attention to Fostering Creativity in Elementary Mathematics Textbooks," concluded that these textbooks perform poorly in stimulating flexibility, initiative, and the expansion of students' thinking. Fattahi et al. (2012), in their "Content Analysis of Elementary Mathematics Textbooks Based on Problem-Solving Components," showed that although a large volume of problems exists in the textbooks, most are repetitive and algorithmic, and learners rarely encounter challenging and non-routine problems. Abedi et al. (2011), in "Examining the Extent of Attention to Critical Thinking in Elementary Mathematics Textbooks," showed that these textbooks have performed poorly in cultivating reasoning, analysis, and evaluation skills. Ahmadi and Samadi (2015), in a comparative study of Iranian and German mathematics textbooks, showed that German textbooks provide greater opportunities for hands-on activities, group work, and connection to everyday life. Karimi et al. (2017), in their "Content Analysis of Elementary Mathematics Textbooks Based on Agency Components," concluded that these textbooks focus

predominantly on problem-solving and hands-on activity components while neglecting components such as self-assessment, critical thinking, and group participation. Sabouri et al. (2016), in their "Content Analysis of Elementary Mathematics Textbooks from the Perspective of the Constructivist Approach," concluded that these textbooks perform relatively well in certain components such as hands-on activity, but exhibit serious weakness in teaching components such as self-assessment, social interaction, and connection to everyday life.

A review of the literature reveals, first, that although valuable and independent studies exist in both the international and national domains, a clear gap is observable at the intersection of these domains. At the international level, research on agency is predominantly qualitative and focused on the classroom environment and teacher–student interaction, while content analysis of textbooks within this framework has received less attention. Second, at the national level in Iran, either agency has not been adopted as the theoretical framework for research, or it has been examined in a single-component rather than composite manner. Third, the gap in systematic comparative studies in this domain is entirely evident; existing studies have either merely described the Iranian situation or remained at the macro level of policy description. Fourth, none of the prior studies—particularly in Iran—has employed advanced quantitative methods such as Shannon entropy to determine the weight and relative importance of agency components. On this basis, the primary objective of the present study is to examine the extent of attention to, and the distribution pattern of, student agency components in the first-grade mathematics textbooks of Iran and Turkey.

The subsidiary objectives are:

- To estimate the absolute frequency and calculate the relative importance of each of the six agency components (hands-on activity, active problem-solving, personal choice/creativity, self-assessment/feedback, group participation/story-based learning, and critical thinking/questioning);
- To calculate the overall concentration coefficient for each educational system in order to assess the degree of concentration (imbalance) in the distribution of agency concepts and to explain the dominant approach;
- To examine the degree of structural similarity and difference between the textbooks of the two selected countries in representing agency components.

2. Research Method

The present study is of a comparative-quantitative type, employing content analysis based on the Shannon entropy model. This model was used to analyze the weight and importance of student agency components in the first-grade mathematics textbooks of Iran and Turkey. Regarding access to the Turkish textbook: the electronic version (PDF) was first obtained from the official website of the Turkish Ministry of National Education. This website is the official reference for the publication of electronic content for Turkish textbooks, and all textbooks across different grade levels are freely available to the public. The data collection method was documentary, drawing on primary sources (including the first-grade mathematics textbooks of Iran and Turkey for the academic years (2025–2026 and 2023–2024) and secondary sources (books and articles).

a) The first-grade mathematics textbook of Iran

It was published in 2025 by the Organization for Educational Research and Planning of the Ministry of Education of the Islamic Republic of Iran. This textbook was developed on a group and organizational basis. The Iranian textbook comprises 15 chapters (lessons), and its entire content (144 pages) was analyzed.

b) The first-grade mathematics textbook of Turkey

The first-grade mathematics textbook of Turkey was published in 2023 by the Turkish Ministry of National Education (MEB). This textbook was developed by an authorship commission consisting of five authors (whose names appear on the textbook's imprint page). The Turkish textbook comprises 5 main units, and its entire contents (200 pages) were analyzed as the sample. For the selection of countries, the strategy of "similar social systems, different educational outcomes" was employed (Bray, Adamson, & Mason, 2007). According to this strategy, Iran and Turkey—despite their cultural, historical, and religious commonalities and their possession of centralized educational systems—have experienced differing educational reforms in recent years, which would be expected to be reflected in the content of their textbooks.

The research instrument was a researcher-made content analysis checklist comprising six main components related to student agency, whose operational definitions are presented in Table 1. These components were developed on the basis of the study's theoretical foundations (Reeve & Tseng, 2011; Vaughn, 2018) and with due regard for the nature of first-grade mathematics textbooks. Although first-grade students do not possess full proficiency in independent reading and

writing, agency in this study was coded through non-text-based components such as hands-on activity, personal choice, oral responding, and group participation. Accordingly, the first grade—given the sensitivity of the period during which mathematical identity is formed and the absence of written language dominance over mathematical interactions—constitutes the most appropriate context for assessing authentic agency before it is influenced by basic literacy skills.

Table 1. Student agency components and operational definitions

No.	Component	Operational definition
1	Hands-on activity	Any form of physical or visual manipulation, such as colouring, cutting, pasting, drawing, craft-making, or movement-based activities
2	Active problem solving	Solving mathematical problems through reasoning, modelling, offering a personal solution, or encountering non-routine and challenging problems
3	Personal choice/creativity	The opportunity to choose among options, make personal decisions, create a new artefact or pattern, or offer a creative and divergent response
4	Self-assessment/feedback	The presence of reflective questions such as "Why?", "How?", "Did the result change?", or opportunities to review and revise responses
5	Group participation/story-based learning	Tasks based on story situations, group games, participatory activities, or mathematical discourse among students
6	Critical thinking/questioning	Prompting the student to compare, infer, judge, reason, analyze, or critically question concepts and methods

All pages of both textbooks were examined in full, and each discrete "activity" was coded as the unit of analysis. Data were recorded in Excel and analyzed using descriptive statistics (frequency, percentage) and the Shannon entropy method. The entropy calculation steps were performed separately for each textbook. To establish the content validity of the instrument, the initial analysis checklist was submitted to five experts in curriculum planning and mathematics education. The criteria for selecting these experts (faculty members of departments of educational sciences and psychology) were: research and teaching experience in the relevant field (at least five years) and published articles on textbook analysis or mathematics education. Communication with them was conducted via university email (University of Sistan and Baluchistan) and in-person visits (University of Zanjan and Farhangian University of Tabriz), and the analysis checklist, together with its completion guide, was sent to or placed at their disposal. Following the receipt of their corrective comments, the final instrument was developed.

To calculate the reliability of the instrument, the inter-coder agreement method was employed. For this purpose, two coders (the principal researcher and a mathematics education

specialist) independently coded 20 percent of the content of both textbooks (35 pages of the Iranian textbook and 50 pages of the Turkish textbook). The reliability was then calculated using the percentage agreement formula (number of agreements divided by the sum of agreements and disagreements, multiplied by 100), yielding a value of 87 percent, indicating satisfactory instrument reliability. The data for this study were collected by documentary (library) method from two primary sources: the first-grade mathematics textbook of Iran (2025) and the first-grade mathematics textbook of Turkey (2023). Data analysis was conducted using categorical content analysis with the researcher-made checklist. The unit of analysis was each discrete activity (exercise, problem, classwork, hands-on activity). All pages of both textbooks were examined in full, and each activity was coded.

3. Findings

This section presents the data obtained from the content analysis of the first-grade elementary mathematics textbooks of Iran and Turkey, based on the six agency components and using the Shannon entropy method. The findings are presented first descriptively (frequency and percentage) and then analytically (entropy calculations and importance coefficients), in order to provide a comprehensive picture of the extent and pattern of attention to student agency in each textbook.

Frequency Distribution of Agency Components

For a preliminary examination and quantitative comparison of the extent of attention to each agency component, the frequency and percentage of occurrence of each component in the two textbooks were calculated and are presented in Table 1. This table enables comparison of each component's share of the total identified activities. As can be seen in Table 1, a total of 286 units of analysis (agency-based activities) were identified across the two textbooks, with the Iranian textbook accounting for 100 and the Turkish textbook for 186. This considerable difference in overall volume is the first indication of a divergence in orientation and in the breadth of agency-fostering opportunities. With respect to distribution pattern, in the Iranian textbook the "active problem solving" component, at 40 percent, is the most frequent, followed by "hands-on activity" at 30 percent. In the Turkish textbook, by contrast, this priority is reversed: "hands-on activity," with a share of 49.5 percent (nearly half of all activities), is clearly at the Centre of attention, while "active problem solving," at 24.2 percent, occupies second place. In both textbooks, the components "self-assessment/feedback,"; "group participation/story-based," and in particular "critical

thinking/questioning" have the smallest shares, which may indicate the predominance of an individualistic and less critical orientation in both systems.

Table 1. Frequency and percentage of agency components in the first-grade mathematics textbooks of Iran and Turkey

Component	Iran (frequency)	Turkey (frequency)	Iran (percentage)	Turkey (percentage)
Hands-on activity	30	92	30%	49.5%
Active problem solving	40	45	40%	24.2%
Personal choice/creativity	15	22	15%	11.8%
Self-assessment/feedback	5	12	5%	6.5%
Group participation/story-based	5	10	5%	5.4%
Critical thinking/questioning	5	5	5%	2.7%
Total	100	186	100%	100%

Calculation of Shannon Entropy and Importance Coefficients

In order to move beyond descriptive statistics and to determine the degree of balance in the distribution of attention to the components, as well as to assess the relative importance of each component in the overall structure of each textbook, the Shannon entropy method was employed. The calculation steps and their results for each textbook are presented separately below.

A) Shannon Entropy Analysis for the Iranian Textbook

Table 3 presents the steps in calculating Shannon entropy (H), maximum entropy (Hmax), the overall importance coefficient (dj), and finally the final weight of each component (Wi) in the Iranian textbook. The final weight (Wi), obtained by multiplying the overall importance coefficient by the proportion of each component (pi), is the ultimate criterion for ranking the importance of the components in this textbook. The entropy calculated for the Iranian textbook was (H = 1.523) and the overall importance coefficient (dj = 0.152). As is evident in Table 3, although the "hands-on activity" component ranked second in terms of frequency, the calculation of the final weight (Wi) once again underscores the priority and central importance of "active problem solving," with a weight of 0.061, in the Iranian textbook. The relatively low and identical weight of the final three components (0.008), consistent with the findings of the frequency table, indicates that these dimensions of agency occupy a marginal and insignificant position in the Iranian textbook.

Table 2. Calculation of entropy and importance coefficients of agency components in the first-grade mathematics textbook of Iran

Component	pi	pi ln(pi)	Wi	Rank
Active problem solving	0.400	-0.367	0.061	1
Hands-on activity	0.300	-0.361	0.046	2
Personal choice/creativity	0.150	-0.285	0.023	3
Self-assessment/feedback	0.050	-0.150	0.008	4
Group participation/story-based	0.050	-0.150	0.008	4
Critical thinking/questioning	0.050	-0.150	0.008	4
Total	1.000	-1.523	0.152	

B) Shannon Entropy Analysis for the Turkish Textbook

Table 4 presents the results of the Shannon entropy calculations for the Turkish textbook. These calculations were performed using the proportions obtained from the frequency table.

Table 3. Calculation of entropy and importance coefficients of agency components in the first-grade mathematics textbook of Turkey

Component	pi	pi ln(pi)	Wi	Rank
Hands-on activity	0.495	-0.342	0.114	1
Active problem solving	0.242	-0.344	0.056	2
Personal choice/creativity	0.118	-0.253	0.027	3
Self-assessment/feedback	0.065	-0.181	0.015	4
Group participation/story-based	0.054	-0.160	0.012	5
Critical thinking/questioning	0.027	-0.097	0.006	6
Total	1.000	-1.377	0.230	

The values calculated for the Turkish textbook indicate lower entropy (H = 1.377) and consequently a higher overall importance coefficient (dj = 0.230) compared with the Iranian textbook. This indicates that the distribution of attention to the components in the Turkish textbook is not more balanced, and that there is greater concentration on one or a few specific components. This concentration is clearly manifested in the final weight of the "hands-on activity" component (0.114), which is nearly twice the weight of the first component in the Iranian textbook. This finding confirms the unequivocal predominance of an activity-based and experiential approach in the Turkish textbook.

Figure 1. An example of participation, hands-on activity, and group work in the Turkish mathematics textbook, presented under the heading "Birlikte Yapalım" ("Let's Do It Together") on page 16

Figure 2. An image from page 36 of the Iranian textbook, under the heading "Kar ba Abzar" ("Working with Tools"), which is group- and cooperative-based

C) Comparison of Shannon Entropy Results

For a final and systematic comparison of the two textbooks across all entropy indicators, Table 5 was designed. This table simultaneously displays the final weight (Wi), the proportion (pi),

and the rank of each component, alongside macro-level indicators such as entropy (H) and the overall importance coefficient (dj) in both textbooks.

Table 4. Comparison of the results of Shannon entropy analysis and importance coefficients of agency components in the two textbooks

Component	Iran (pi)	Turkey (pi)	Iran (Wi)	Turkey (Wi)	Iran rank	Turkey rank
Hands-on activity	0.300	0.495	0.046	0.114	2	1
Active problem solving	0.400	0.242	0.061	0.056	1	2
Personal choice/creativity	0.150	0.118	0.023	0.027	3	3
Self-assessment/feedback	0.050	0.065	0.008	0.015	4	4
Group participation/story-based	0.050	0.054	0.008	0.012	4	5
Critical thinking/questioning	0.050	0.027	0.008	0.006	4	6
Overall indicators						
N (total activities)	100	186				
n (number of components)	6	6				
H (entropy)	1.523	1.377				
Hmax (maximum)	1.792	1.792				
dj (overall importance coefficient)	0.152	0.230				
Ej (entropy unit)	0.848	0.770				

Table 4 enables a final and comparative synthesis of the findings. Two entirely distinct patterns are observable: the Iranian textbook, with active problem solving as its central component (rank 1 in both weight and frequency), and the Turkish textbook, with hands-on activity as its overwhelmingly dominant component (rank 1 by a wide margin). The higher overall importance coefficient in the Turkish textbook (0.230 versus 0.152) indicates that although this textbook offers a greater total number of agency-fostering opportunities, these opportunities are not distributed in a balanced manner across the components, and there is an intense concentration on one particular type (hands-on activity). By contrast, the Iranian mathematics textbook, despite its smaller overall volume, displays a more balanced distribution between its first two components (which is also reflected in its higher entropy). A common and noteworthy feature of both textbooks is the negligible and marginal share of the group participation and, in particular, the critical thinking/questioning components, which occupy the lowest ranks.

4. Conclusion

This study aimed to conduct a comparative analysis of the extent and pattern of attention to student agency components in the first-grade mathematics textbooks of Iran and Turkey.The most

important finding of this study is the reciprocal pattern of concentration between the two textbooks. The Turkish textbook, with a higher overall importance coefficient (0.230) and the allocation of nearly half of its agency-fostering content to "hands-on activity," represents an approach that relies on physical agency and concrete experience. This finding is consistent with the ideals of radical constructivism, which regards learning as arising from direct interaction with and manipulation of the environment (Papert, 1980). Such an approach, particularly for first-grade novices, can—by reducing mathematics anxiety and increasing a sense of competence—create an initial, positive, and tangible engagement with abstract mathematical concepts (Ramirez et al., 2018). By contrast, the Iranian textbook, with its decisive emphasis on "active problem solving" (with a weight of 0.061), stresses cognitive agency and thought processes. This approach, which is deeply connected to theories of problem solving and mathematical thinking (Schoenfeld, 1992), seeks to cultivate students who can confront challenging problems and draw on logical strategies to solve them. This difference indicates that although both educational systems believe in fostering "agency," their operational understanding of this concept and their strategy for realizing it in textbook content—shaped by differing educational histories and theoretical choices—have led them along two distinct paths.

A further finding is the shared structural weakness of both textbooks in attending to the social and critical components of agency—namely, "group participation/story-based" and, in particular, "critical thinking/questioning." These components, which are essential for cultivating informed, collaborative, and inquiring citizens in the twenty-first century (Skovsmose, 1994), have been relegated to the margins in both textbooks. This neglect may reflect the predominance of an individualistic model of mathematics learning, in which success is viewed as arising more from individual effort and mastery of memorized content than from dialogue, collective reflection, and shared critique. Such an approach restricts the opportunity to experience "agency in a social context," which is vital for understanding mathematics as a cultural-human activity (Yackel & Cobb, 1996).

In a broad synthesis, it can be concluded that the Turkish textbook, with its practice-oriented approach, fosters agency primarily in the form of "doing and discovering," whereas the Iranian textbook, with its problem-oriented approach, emphasizes "thinking and reasoning." Both approaches have educational value, but exclusive reliance on either is incomplete. The optimal point likely lies in the intelligent integration of the two, as well as in enriching the content with the absent components (participation and critical thinking). From this perspective, the findings of this study serve not as a verdict on the superiority of one textbook over the other, but as a diagnostic

map for textbook authors and policymakers in both countries. The concrete and operational recommendation is that, in future revisions, the Iranian textbook can strengthen tangible mathematical experience by increasing the share of hands-on and manipulative activities, while the Turkish textbook can enrich the cognitive dimension of agency by deepening challenging and complex problems. Moreover, both textbooks require the purposeful incorporation of group tasks, meaningful story situations, and, in particular, questions that stimulate students' curiosity, doubt, and inquiry.

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