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Original Article

Fostering Cognitive Empathy and Gender Sensitivity among Healthcare Students: An Exploratory Study Using a Fictional Male Pregnancy Narrative

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Abstract: [Purpose] This exploratory study investigated a digital storytelling (DST) program featuring a gender-role-reversed fictional scenario in which a male character experiences pregnancy. The objective was to assess its usefulness in fostering healthcare students' understanding of parental perspectives and to explore gender differences in learning. [Participants and Methods] Participants comprised of 162 physical therapy students (81 male, 81 female) who participated in a 90-minute session involving selected video clips and discussions. Students provided free-text responses via worksheets, which were analyzed using text mining techniques to identify key themes and examine gender-related differences. [Results] Four major themes emerged: (1) empathy and perspective-taking toward a partner, (2) acknowledging of the burden of pregnancy and childbirth, (3) awareness of viewing issues as "someone else's problem," and (4) reflection and learning from unrealistic scenarios. Male students more frequently reflected on the burdens of pregnancy, whereas female students—who assumed the non-pregnant role—reported new awareness of the difficulty in empathizing with unfamiliar experiences. [Conclusions] The gender-role-reversed DST scenario encouraged students to reconsider traditional gender roles and reflect on unfamiliar experiences. This approach appears to be a promising educational tool for developing cognitive empathy and gender sensitivity in the context of pediatric rehabilitation.

Keywords: Digital Storytelling, Empathy, Gender Sensitivity

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I. INTRODUCTION

In pediatric rehabilitation, it is essential to build strong relationships not only with the children receiving treatment but also with their parents. Previous research has emphasized that children and parents should be viewed as a single unit of support, and that understanding and consideration for parents significantly influence both treatment effectiveness and the quality of collaboration [1)]. Parents of children with disabilities often experience elevated levels of stress and depression [2)], making sensitive communication that considers their psychological background crucial. Additionally, studies on the professional attitudes required to build trust with parents have indicated that therapists' relational skills may outweigh technical expertise in importance [3)]. Consequently, establishing trust between parents and therapists is a critical prerequisite for successful

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rehabilitation outcomes.

At the heart of this trusting relationship lies empathy, specifically the therapist's commitment to understanding the parent's perspective [4]. In this context, "empathy" refers to cognitive empathy as defined by Davis (1983), involving the intellectual capacity to imaginatively understand another person's situation and experiences [5]. This is distinct from emotional empathy, which involves sharing another's feelings; cognitive empathy enables perspective-taking even for situations one has not personally experienced. Although the importance of empathy in healthcare is well recognized, concerns have been raised about declining empathy levels among healthcare professionals [6]. This highlights the need to foster empathy during healthcare training, particularly to help students develop the capacity to imaginatively adopt a parental perspective. Developing this capacity during training is essential for future clinical practice. However, because most students lack personal parenting experience, fully grasping a parent's perspective can be challenging. Therefore, pediatric rehabilitation curricula require systematic educational approaches aimed at fostering students' capacity to understand a parent's position and feelings through imagination.

Developing the ability to imaginatively understand parental perspectives requires educational strategies that encourage students to engage in perspective-taking beyond their own experiences. Digital storytelling (DST), which involves creating and sharing narratives using digital media, has gained attention as an educational technique for promoting reflection on others' experiences [7, 8]. Previous studies revealed that DST materials focusing on pregnancy and childbirth can help students simulate parental perspectives and enhance engagement in educational programs such as neonatal care training [9, 10]. Such learning experiences are considered important for fostering the foundation of cognitive empathy, which is indispensable for building trusting relationships with patients and families in healthcare practice.

However, conventional DST materials on pregnancy and childbirth are typically presented from a female perspective, which can make it difficult for male students to identify with the experiences depicted. Since men do not biologically experience pregnancy or childbirth, it is inherently difficult for them to fully grasp the associated physical and hormonal changes or to vividly imagine the perspectives and burdens of mothers [11]. Furthermore, societal perceptions often continue to frame pregnancy and childcare as "women's roles" [12–14]. These entrenched gender-role beliefs can create psychological distance for male students, potentially hindering their ability to empathize with female parents. In addition, research has consistently shown that men, on average, exhibit lower levels of empathy compared to women [15–17]. This trend has been consistently observed in recent studies as well [18]. These factors suggest that traditional DST approaches may be less effective in fostering empathy among male students. Therefore, in developing empathy-focused educational interventions, it is important to incorporate gender perspectives into the design of teaching materials and to evaluate their educational utility.

To address the key limitation of conventional DST programs—their limited effectiveness in encouraging male students to actively reflect on the physical and emotional realities of pregnancy and childbirth—we developed an educational intervention featuring a gender-role-reversed fictional scenario in which a male character experiences pregnancy and childbirth. Previous research suggests that viewers are more likely to feel psychologically connected to characters who share demographic traits, such as gender, with themselves [19]. Based on this insight, we anticipated that presenting a male protagonist in the pregnancy role would facilitate greater engagement among male students and promote deeper reflection on the experiences depicted. However, the educational usefulness of gender-role-reversed DST approaches has not yet been systematically evaluated.

Against this background, the purpose of this study was to conduct an exploratory, multifaceted evaluation of an educational intervention using a male-pregnancy DST scenario to deepen students' understanding of parental perspectives and emotions. Specifically, the study aimed to (i) identify the main learning themes and reactions of students participating in the program and (ii) explore differences in responses based on student gender. Pregnancy and childbirth were chosen as the subject matter for fostering empathy because understanding these fundamental parental experiences is critical for building trust in clinical settings. In pediatric care, the parent is also a target of support, and healthcare providers must strive to understand the parent's position and feelings. Pregnancy and childbirth represent an integral starting point of "becoming a parent" for most people, and the ability to imaginatively appreciate the associated physical and psychological changes is a valuable clinical skill for developing strong parent–provider relationships. We argue that employing a fictional scenario with reversed gender roles offers pedagogical value as a tool for cultivating students' perspective-taking abilities.

II. PARTICIPANTS AND METHODS

1. Study Design

This study utilized a cross-sectional, exploratory descriptive design to evaluate student responses to a single-institution educational intervention.

2. Participants

Participants included 162 undergraduate students (81 male, 81 female; mean age 20.2 ± 1.5 years) enrolled in the Department of Physical Therapy at the Narita School of Health Sciences, International University of Health and Welfare, Japan. The intervention was conducted during a regularly scheduled session of the pediatric physical therapy course that was part of the standard curriculum. The study's purpose and procedures were explained to all potential participants, and written informed consent was obtained. Participation was voluntary, and declining to participate did not affect students' course grades or academic standing. The study received ethical approval from the Ethics Committee of the International University of Health and Welfare (Approval No. 24-Im-012).

3. Data Collection

Data were collected during a 90-minute class session incorporated in the pediatric rehabilitation curriculum. The session included the DST materials described below. After the session, participants completed a paper-based worksheet that was collected immediately afterward. The worksheet collected basic demographic information (gender and age) and included a single open-ended question: "What did you learn in today's class? Please answer freely."

4. DST Content and Structure

The DST materials consisted of selected clips from the Japanese television drama He's Expecting (TV Tokyo, 2023), featuring a male protagonist who becomes pregnant. Six clips, each approximately two minutes long, were chosen to depict various psychological and physical aspects of pregnancy and childbirth from a gender-role-reversed perspective (see Table 1 for an overview). The video clips were presented during a scheduled session of the pediatric physical therapy class, permission having been obtained from the television network. Each video clip was an excerpt from the original drama, minimally edited to shorten the duration without altering the intended context or dramatic tone. No special effects or re-editing were applied.

The session was facilitated by the course instructor (the first author), who provided brief explanatory lectures between the video clips. These brief lectures addressed relevant medical and psychosocial topics, including early pregnancy symptoms, physiological changes during pregnancy, and postpartum depression. After viewing each clip, students participated in small-group discussions in which they were encouraged to share any insights, reflections, or emotions evoked by the material.

Table 1. Overview of Selected Drama Clips Used in the DST Program

Scene Title	Description
Discovery of pregnancy	Captures the psychological aspects, such as surprise and anxiety, when the male character discovers that he is pregnant.
Physical changes	Depicts specific physical changes during pregnancy, including morning sickness and fetal movement.
Decision regarding childbirth	Explores the psychological conflict and decision-making process involved in choosing to give birth.
Benefits for women	Portrays the advantages and reactions from the female perspective when a man experiences pregnancy and childbirth.
Holding one's child for the first time	A touching scene depicting the moment a man holds his newborn for the first time after a Cesarean section.
Postpartum challenges	Illustrates workplace issues, such as applying for paternity leave and returning to work after childbirth.

5. Data Processing

All collected free-text responses were analyzed using KH Coder (version 3.02c), a text-mining software developed by Higuchi [20, 21]. First, morphological analysis was conducted to segment the Japanese text into individual words and phrases, with variant forms (e.g., synonyms) standardized. Next, a co-occurrence network analysis was performed to visualize the relationships among frequently occurring words in the responses (Figure 1). To highlight primary word relationships and minimize analytical noise, we set a threshold of 20 or more occurrences per word and extracted the top 50 word pairs based on co-occurrence strength. This threshold was selected pragmatically to enhance the clarity and interpretability of the resulting network.

Subsequently, two researchers (the first and second authors, both experienced in qualitative research and text analysis) independently reviewed the responses in detail, using the co-occurrence network as a reference to inductively identify key themes. Through iterative discussions and consensus-building, the researchers identified core concepts that captured the main characteristics of the students' responses. Although the initial network analysis suggested up to six potential clusters, several terms (e.g., "now," "realize," "childcare," "man," "woman," "learn") did not contribute to coherent thematic categories and were excluded from further analysis. Ultimately, four primary conceptual categories (referred to hereafter as Clusters 1 through 4) were identified. For each cluster, defining keywords and phrases were specified, and coding rules were established to consistently categorize the free-text responses (see Table 2 for cluster themes and coding criteria). For manuscript submission, the third author, a native English speaker proficient in Japanese, translated the outputs of the text-mining analysis, including the co-occurrence network and representative free-text responses.

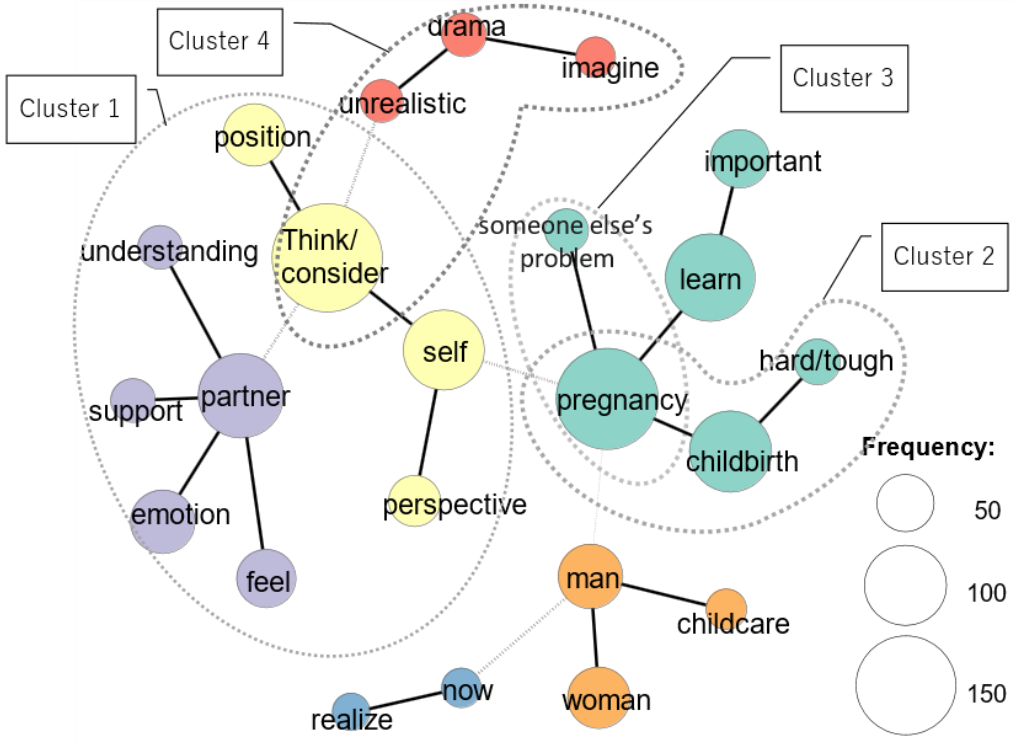

Figure 1. Co-occurrence Network of Frequently Appearing Words in Students' Free-Text Responses

Nodes represent words that appeared frequently in students' responses. Lines indicate strong co-occurrence relationships between words. Four clusters (Clusters 1–4) were identified based on closely connected words, each representing a key conceptual category.

Table 2. Key Conceptual Categories: Definitions and Coding Rules

Code	Definition	Coding Rules
Cluster 1: Empathy and Perspective-Taking Toward a Partner	Descriptions indicating understanding or attempts to understand the feelings, perspectives, and viewpoints of a partner or the opposite sex.	(opposite sex or partner or other person or each other or woman or man) and (feeling or emotion or thought or consideration or perspective or viewpoint or angle or aspect or support)
Cluster 2: Acknowledging of the Burden of Pregnancy and Childbirth	Descriptions recognizing the physical and emotional burdens associated with pregnancy and childbirth, or changes in perception regarding those burdens.	(pregnancy or childbirth) and (hard or tough or morning sickness or difficulty or anxiety or pain or burden or fear or suffering or discomfort or hardship or distress or fatigue)
Cluster 3: Awareness of Viewing Issues as "Someone Else's Problem"	Descriptions recognizing that pregnancy, childbirth, and childcare have often been viewed as someone else's concern or irrelevant to oneself.	(pregnancy or childbirth or child-rearing or childcare or housework) and (someone else's problem or person involeved or lack of awareness or lack of responsibility)
Cluster 4: Reflection and Learning from Unrealistic Scenarios	Descriptions showing personal reflection, awareness, or changes in thinking and values triggered by exposure to fictional or dramatized settings (e.g., dramas, videos).	(unrealistic or drama or video or movie) and (learn or think or realize or notice or understanding or grow or discover or interest or image or imagine)

This table presents the four key conceptual categories derived from the students' written responses. For each category, the definition and the corresponding coding rules are provided to clarify how the themes were identified.

6. Data Analysis

Based on the finalized coding rules, each participant's free-text response was examined to determine whether it aligned with any of the four main conceptual categories (Clusters 1–4). Frequencies were calculated for the entire sample and stratified by gender using KH Coder's cross-tabulation function. Because some responses included multiple insights or perspectives, individual responses were eligible for coding into more than one cluster. Representative responses were selected to illustrate each cluster's thematic characteristics, and results were summarized with a focus on overall learning patterns and notable gender-based differences.

Member checking was not performed as the primary aim of the study was exploratory, focusing on the initial identification of themes based on textual data. However, informal conversations with several participants after the session indicated that the learning content was perceived as impactful and thought-provoking, lending support to the relevance of the extracted themes.

III. RESULTS

1. Overview of Free-Text Data

Free-text responses were collected from all 162 participants. The total word count of the responses was 3,657 words (in Japanese), comprising 607 unique words. Table 3 presents a list of words that appeared at least eight times in the responses.

Table 3. Frequency of Extracted Words Appearing Eight or More Times

Rank	Frequency	Extracted word	Rank	Frequency	Extracted word	Rank	Frequency	Extracted word
1	182	think/consider	14	31	hard/tough	31	16	work
2	159	pregnancy	15	30	support, drama	32	15	negative, see, child, physical
3	127	learn	17	29	understanding	36	14	communication, difference,
4	111	partner	18	28	someone else's problem			things
5	102	childbirth	19	27	unrealistic	39	13	actually, usually
6	100	self	20	25	childcare	41	12	opposite, considerate
7	63	feeling	21	24	imagine	43	11	opinion, again
8	62	man	22	23	experience, now	45	10	reality, slightly,
9	59	position	24	22	viewpoint			responsibility
10	58	woman	25	21	realize	48	9	relationship, stand, good
11	53	feel, important	26	19	different, gender, difficult	51	8	value, natural, change,
13	41	perspective	29	17	have, person			person involved, necessary

This table lists frequently mentioned words from the students' free-text responses following the digital storytelling session, showing those that appeared eight times or more, sorted by frequency.

2. Concept Extraction

Text analysis identified four primary themes (conceptual categories) from the student responses, corresponding to four clusters of related terms (Clusters 1–4), as illustrated in Figure 1 and detailed in Table 2.

Cluster 1 encompassed words related to understanding and considering the partner's perspective (e.g., understanding, think/consider, partner).

Cluster 2 comprised words reflecting the physical and emotional challenges associated with pregnancy and childbirth (e.g., pregnancy, childbirth, hard/tough).

Cluster 3 included words indicating a sense of detachment from pregnancy and childbirth (e.g., someone else's problem, pregnancy).

Cluster 4 comprised words related to reflective thinking triggered by the fictional scenario (e.g., unrealistic, drama, imagine, think/consider).

3. Learning Themes and Gender Differences

Based on the coding, a total of 201 segments were identified across the 162 responses (note: a single response could be classified into multiple categories, resulting in a greater number of coded segments than participants). Table 4 summarizes the frequency of each conceptual category across the entire sample and by gender, along with representative examples of student responses. In summary, Cluster 1 was the most frequently observed theme, followed by Clusters 2 and 4 (which appeared with equal frequency), and then Cluster 3. The distribution of conceptual categories by gender was as follows:

- Cluster 1: identified in 53.1% of all responses (86 of 162). (Females: 55.6% of female students; Males: 50.6% of male students)
- Cluster 2: identified in 27.2% of all responses (44 of 162). (Females: 14.8%; Males: 39.5%)
- Cluster 3: identified in 16.7% of all responses (27 of 162). (Females: 17.3%; Males: 16.1%)
- Cluster 4: identified in 27.2% of all responses (44 of 162). (Females: 25.9%; Males: 28.4%).

Qualitative examination of the responses provided further insight into the nature of each learning theme and how male and female students may have responded differently. Representative examples (with identifiers "f" for female and "m" for male) illustrate these characteristics:

- Cluster 1 (Empathy and Perspective-Taking Toward a Partner): Both male and female students described efforts to adopt the perspective of a partner undergoing pregnancy and childbirth. Many students imagined themselves either as the pregnant individual or the supporting partner (e.g., f_6, f_32, f_61; m_7, m_38). Some students reflected on how to interact with or support a partner by considering the perspective of the opposite gender (e.g., f_15, f_37; m_14, m_23, m_54).
- Cluster 2 (Acknowledging of the Burden of Pregnancy and Childbirth): Students recognized the physical and psychological burdens associated with pregnancy and childbirth, with notable gender differences observed. Female students primarily focused on imagining the emotional burdens from a supportive standpoint (e.g., f_28, f_43, f_58), while male students more often emphasized the physical changes and daily life challenges (e.g., m_16, m_31, m_37, m_74, m_75).
- Cluster 3 (Awareness of Viewing Issues as "Someone Else's Problem"): Students reflected on their previous tendency to perceive pregnancy and childbirth as issues unrelated to themselves, with some gender-based differences. Female students described how assuming the non-pregnant (male) role prompted them to recognize their own tendency to view pregnancy and childbirth as someone else's problem (e.g., f_27, f_42, f_53, f_69, f_72). In contrast, male students reflected on having previously regarded pregnancy and childbirth as distant concerns and noted an increased awareness of the need for personal engagement (e.g., m_47, m_49, m_65, m_73).
- Cluster 4 (Reflection and Learning from Unrealistic Scenarios): Both male and female students engaged in reflection prompted by the highly fictional scenario, contemplating issues that are seldom considered in daily life. Their responses indicated a willingness to reassess their own values and challenge stereotypical assumptions. Some students further noted that engaging with the fictional scenario unexpectedly enhanced their motivation and led to new personal insights (e.g., f_12, f_15, f_24, f_31, f_45; m_20, m_25, m_35, m_39, m_79).

Table 4. Conceptual Categories with Frequencies of Coded Responses and Representative Student Comments by Gender

Number of Coded Responses (n = 201) (From 162 participants)	Selected Free Responses by Gender (Five per Cluster: Female = Upper Row, Male = Lower Row)
Cluster 1: Empathy and Perspective-Taking Toward a Partner Total: 86/162 (53.1%) • Female: 45/81 (55.6%) • Male: 41/81 (50.6%)	(f_6) I had only thought about what it would be like if I were the one who got pregnant, and **never considered how hard it might be for my partner.** (f_15) I was able to **concretely consider how to support my partner** during shared child-rearing responsibilities. (f_32) Imagining myself in someone else's position **helped me broaden my perspective and think more empathetically**. (f_37) By mentally switching roles between genders, I realized I could be **more considerate toward my partner**. (f_61) Considering how I would feel if I were told I was pregnant **gave me some insight into how men might feel.** (m_7) I realized the **importance of putting myself in my partner's shoes and considering their feelings** in daily life. (m_14) Thinking from the perspective of the opposite sex made me recognize **how essential it is to try to understand their viewpoint**. (m_23) Viewing things from a female's perspective helped clarify **what kind of support and care a partner might expect.** (m_38) I feel like I could understand more clearly **how hard pregnancy** is by thinking from my partner's perspective and imagining myself in her position. (m_54) Trying to think like a woman helped me **understand what kind of partner I should strive to be**.
Cluster 2: Acknowledging of the Burden of Pregnancy and Childbirth Total: 44/162 (27.2%) • Female: 12/81 (14.8%) • Male: 32/81 (39.5%)	(f_28) I had always assumed I would be the one giving birth, but imagining myself as the one who relies on a partner made me **realize the anxiety and uncertainty involved in pregnancy from the other party.** (f_35) I learned **how heavy the burden of childbirth can be** when I imagined myself in that position. (f_43) I realized how important it is to know **how to speak to and support a partner suffering during pregnancy**. (f_58) I had always imagined myself as the one going through pregnancy, so **I felt a strong sense of responsibility, anxiety, and fear**. But when I imagined my partner taking on that role instead, **I was surprised to feel some of that emotional burden being lifted**. (f_77) I felt frustrated that in this scenario, it was the man who got to experience pregnancy, including morning sickness, while I, who might actually go through it in real life, **could not fully experience its challenges.** (m_16) I learned that pregnancy **affects work and physical condition**, and that **women endure significant hardship to give birth.** (m_31) I used to think labor pain was the worst part, but I now understand that **things like headaches and nausea can be equally difficult**. (m_37) While I had known that pregnancy was painful, I had **never considered how it affects daily life—this was an eye-opener**. (m_74) I realized how exhausting it must be when **physical and emotional struggles during pregnancy are overlooked** by one's partner. (m_75) I came to understand that **mutual understanding is crucial**, as **pregnancy and parenting are deeply challenging**.
Cluster 3: Awareness of Viewing Issues as "Someone Else's Problem" Total: 27/162 (16.7%) • Female: 14/81 (17.3%) • Male: 13/81 (16.1%)	(f_27) I learned that certain feelings can only be understood **by being the person involved in pregnancy or childbirth**. (f_42) I could relate to the idea that even if the baby has your genes, **it may still feel like someone else's problem when your own body isn't changing**. (f_53) I learned that those who are **not pregnant tend to see pregnancy as someone else's problem**. (f_69) I learned that if you're **not personally involved in pregnancy or childbirth**, it's easy to **see it as someone else's problem**. (f_72) I realized that simply switching the pregnant partner from female to male can make the emotions involved seem **more distant and impersonal.** (m_47) I used to associate pregnancy and childbirth only with celebration, but I realized I had **a lack of awareness about the burden** they place on the person involved. (m_49) The fictional male pregnancy scenario piqued my interest in an issue **I had always seen as distant**. (m_65) I learned the importance of not viewing pregnancy **as someone else's concern**. (m_73) Even if I'm not the one experiencing pregnancy, I realized **I shouldn't treat childbirth or child-rearing as someone else's problem**. (m_77) I learned that treating someone's hardship like it **doesn't matter to me** can be extremely hurtful.
Cluster 4: Reflection and Learning from Unrealistic Scenarios Total: 44/162 (27.2%) • Female: 21/81 (25.9%) • Male: 23/81 (28.4%)	(f_12) Reversing roles in an unrealistic drama allowed me to **objectively reflect on and reevaluate my own assumptions**. (f_15) I discovered that **imagining impossible situations** could lead to **new insights** and even **enjoyment**. (f_24) The active learning through the fictional drama helped me appreciate the importance of **considering my partner's feelings**. (f_31) I learned the **value of viewing issues from multiple perspectives** by engaging with an unrealistic scenario. (f_45) I think such dramas can prompt both men and women to **reflect more deeply** on pregnancy and childbirth. (m_20) I learned that using **unrealistic drama in active learning is valuable**, even for **future clinical practice as a physical therapist**. (m_25) The fictional scenario helped me **think seriously about things I normally wouldn't** and realize how tough pregnancy and childbirth can be. (m_35) Even if the situation isn't real, thinking about it through drama **can promote emotional growth**. (m_39) I used to take pregnancy and childbirth lightly, but seeing it portrayed in the video helped me **realize how serious it is** and **served as a wake-up call**. (m_79) The drama **helped me think from the perspective of someone giving birth**, and I realized how drastically life and the body can change.

Note. This table shows the number and proportion of coded responses for each conceptual category, stratified by gender. A total of 201 coded responses were extracted from the open-ended comments of 162 participants. Percentages are based on the total number of participants (n = 162). English translations of the original Japanese free-text responses are provided. Representative comments (five per cluster) are listed, with female students in the upper row and male students in the lower row.

IV. DISCUSSION

This exploratory study investigated the usefulness of a DST-based educational program featuring a male-pregnancy scenario through an analysis of free-text reflections from physical therapy students. The findings identified four major themes linked to key learning outcomes: Empathy and Perspective-Taking Toward a Partner (Cluster 1), Acknowledging of the Burden of Pregnancy and Childbirth (Cluster 2), Awareness of Viewing Issues as "Someone Else's Problem" (Cluster 3), and Reflection and Learning from Unrealistic Scenarios (Cluster 4). The predominance of Cluster 1 themes across genders suggests that the program effectively encouraged students to adopt a partner's perspective and engage in perspective-taking. In contrast, Clusters 2 and 3 showed distinct patterns between male and female students, indicating that the gender of the student influenced how they interpreted the experience. Cluster 4 showed that, despite the fictional and unrealistic nature of the scenario, students gained practical insights and learning. Overall, the results suggest that this DST-based program is a useful educational tool for fostering empathic understanding and influencing students' perspectives through engagement with the parental experience of pregnancy and childbirth.

The observations related to Cluster 1 suggest that the DST scenario encouraged many students, regardless of gender, to adopt a partner's perspective when thinking about pregnancy and childbirth. By portraying a traditionally female experience through a male character, the narrative setting invited students to shift away from their habitual viewpoints and engage in perspective-taking. This is consistent with the findings of Petty et al. [9, 10], who suggested that digital storytelling based on parental experiences can foster perspective-taking and support the development of empathy in healthcare education. In pediatric rehabilitation, where building trust with parents is vital, fostering cognitive empathy—the capacity to imaginatively understand another's situation—is of particular importance [4]. Furthermore, prior research has disclosed that higher levels of cognitive empathy are associated with more positive supportive behaviors in close relationships; for example, Verhofstadt et al. found that male partners with greater cognitive empathy provided less negative support toward their spouses [22]. Thus, enhancing cognitive empathy during training may contribute to future healthcare providers' ability to engage constructively and empathetically with patients and families.

A particularly striking gender difference emerged in Cluster 2 (Acknowledging of the Burden of Pregnancy and Childbirth), with male students (39.5%) significantly more likely than female students (14.8%) to emphasize this theme. Many male students expressed surprise at or newfound understanding of the physical and emotional difficulties associated with pregnancy. Female students, by contrast, often reflected on the anxiety and sense of responsibility that their male partners might experience by imagining themselves in a supportive role. This gendered pattern of response may be partly explained by the tendency for individuals to feel more psychologically connected to characters who resemble themselves [19]. For male students, the unusual premise of a pregnant male character probably increased the sense of identification and motivated deeper perspective-taking, which contributed to a more concrete understanding of burdens typically borne by women. This suggests that imaginative engagement with reversed gender roles can stimulate reflection and insight that may be difficult to achieve through conventional, one-way instruction.

Cluster 3 (Awareness of Viewing Issues as "Someone Else's Problem") was reflected in responses from both genders, although with subtle differences in focus. Male students primarily discussed their previous failure to view pregnancy and childbirth as personally relevant experiences and acknowledged the need to change this mindset. Female students, by temporarily adopting the perspective of someone unable to

experience pregnancy, gained insight into the difficulty of truly empathizing with an experience one has never undergone. This finding highlights an important point: understanding the male perspective helped female students recognize that fathers can sometimes feel excluded or disconnected from parenting and family support. Paternal marginalization in pediatric care is a well-documented issue [23], and the increased empathy for the male partner's experience developed by female students could translate into a stronger commitment to inclusive family-centered care in their future practice.

The findings related to Cluster 4 (Reflection and Learning from Unrealistic Scenarios) suggest that highly fictionalized educational content can promote meaningful reflection for some students. Several students used the scenario as an opportunity to reconsider issues and social norms that they might not typically question. Some also noted that engaging with the fictional narrative unexpectedly boosted their motivation and led to new personal insights. This is consistent with educational literature suggesting that emotional engagement with fiction, such as literature or drama, can deepen self-reflection and understanding of others [24]. In this study, the unrealistic nature of the scenario did not impede learning; rather, it acted as a catalyst for a subset of students to challenge their preconceived notions and broaden their perspectives. These findings suggest that pedagogical approaches need not rely solely on realistic simulations – fictional narratives may also serve as effective tools for fostering values education and enhancing students' capacity for perspective-taking.

Although the primary aim of the program was to deepen students' understanding of the "parental perspective," an additional observed outcome was that it encouraged students to re-examine their own views on gender roles. By engaging with a scenario deeply rooted in gender-related experiences, students were prompted to reflect on their assumptions about gender and to consider the fluidity of gender roles. Such reflection may contribute to the development of gender sensitivity. Gender sensitivity—the ability of healthcare providers to recognize and address gender-based differences and needs in clinical practice—is increasingly recognized as essential for patient-centered care [25–27]. Educational interventions that challenge fixed gender stereotypes, such as the DST program used in this study, may therefore contribute to cultivating this competency. In pediatric rehabilitation, where effective family support often requires engaging both mothers and fathers, the presence of healthcare providers who are sensitive to gender dynamics is crucial [28]. The gender-role-reversed scenario likely encouraged students to question their preconceived notions about gender, thereby indirectly fostering a more gender-sensitive outlook. Future educational programs could build on this by intentionally incorporating objectives related to both cognitive empathy and gender sensitivity, thereby training healthcare professionals to provide more inclusive family-centered care.

Several limitations of this study should be noted. First, the study assessed only immediate responses to the educational intervention, and its long-term impact on students' attitudes and behaviors remains unknown. Second, participants were limited to physical therapy students from a single university program, potentially limiting the generalizability of the findings to other student populations and educational settings. Third, methodological limitations are inherent to text-mining approaches and linguistic analysis. For example, the Japanese verb kangaeru can be translated as either "think" or "consider" in English, each carrying slightly different nuances. Automated text analysis may struggle to capture such subtle contextual differences, which could affect the interpretation of the qualitative data. In light of these limitations, further research is warranted. Future studies should incorporate follow-up assessments to evaluate whether the observed educational effects persist over time. Expanding the participant pool to include students from other healthcare disciplines or institutions would further assess the generalizability of the program's outcomes. Moreover, employing a mixed-methods approach—combining quantitative text analysis with qualitative methods such as interviews or focus groups—could provide deeper insights into how and why the DST intervention influences student learning. Such efforts would allow for a more comprehensive evaluation of the educational utility of gender-role-reversed DST materials in healthcare education.

In conclusion, this study demonstrated that a digital storytelling intervention using a gender-role-reversed narrative—depicting male pregnancy and childbirth—can serve as a useful educational tool for helping healthcare students imaginatively understand the parental perspective and foster reflective engagement

with others' experiences. Male students gained a deeper appreciation for the physical and emotional burdens of pregnancy, leading them to reconsider previously unexamined assumptions. Female students, by temporarily adopting the non-pregnant partner's role, became more aware of the difficulties involved in empathizing without firsthand experience and developed greater sensitivity toward the father's perspective. The fictional nature of the narrative allowed students to momentarily suspend traditional gender-role expectations and explore unfamiliar experiences. Such interventions hold promise not only for cultivating cognitive empathy but also for promoting gender sensitivity, both of which are essential competencies for providing inclusive and family-centered care in pediatric rehabilitation settings.

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The authors declare that there are no conflicts of interest relevant to the publication of this article.

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