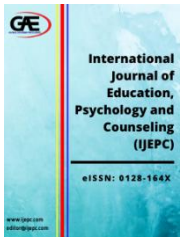
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THERAPEUTIC GAME BASED LEARNING: AN INCLUSIVE EDUCATIONAL APPROACH TO ENHANCING COGNITIVE AND EMOTIONAL WELL BEING AMONG CHILDREN WITH CANCER

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Abstract:

Children diagnosed with cancer may experience interruptions to learning and social participation due to prolonged treatment, hospitalisation, fatigue, and changes in their daily routines. Although Game-Based Learning (GBL) has been associated with learner engagement and academic learning, its use as a supportive educational approach for children with cancer remains insufficiently explored. This study examined changes in selected learning-related and psychosocial indicators following participation in Therapeutic Game-Based Learning (TGBL). An explanatory mixed-methods design was used with 85 children registered with the Friends of Childhood Cancer Association (FOCCAN) who participated in the *Kids Day Out: Math Fun Carnival 2.0* programme. Quantitative data were collected through pre- and post-

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programme questionnaires covering four constructs: Knowledge, Skills, Aspirations, and Attitude Change. Open-ended feedback was collected to provide additional context regarding participants' experiences. Quantitative data were analysed using descriptive statistics and paired-samples t-tests, while qualitative responses were reviewed thematically. The overall mean score increased from 2.21 (SD = 0.53) before the programme to 4.61 (SD = 0.18) afterwards, with a statistically significant difference, $t = -52.685$, $p < .001$. Although the findings indicate a substantial pre–post difference, the one-group design does not establish that TGBL alone caused the observed change. The study provides preliminary evidence of the potential of a community-based, inclusive learning model that combines educational games, social interaction, and supportive learning experiences for children with cancer.

Keyword:

Children with Cancer: Cognitive Well-Being; Community-Based Inclusive Education; Educational Therapy; Emotional Well-Being; Therapeutic Game-Based Learning.

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Introduction

Education is a fundamental right of every child and supports intellectual, social, and emotional development. In line with Sustainable Development Goal 4, inclusive education should be accessible to children regardless of their health status or personal circumstances (United Nations, 2023). Children diagnosed with cancer, however, may experience interrupted schooling because of treatment demands, repeated hospitalisation, fatigue, and reduced opportunities for peer interaction (Krull et al., 2022; Kim et al., 2024). These circumstances can affect continuity of learning, confidence, participation, and social connection. Flexible educational programmes are therefore needed to provide meaningful learning opportunities while recognising the physical and emotional circumstances of children undergoing treatment.

The value of an educational intervention should not be assessed solely in terms of academic achievement. It is also important to examine whether the learning experience supports participation, confidence, motivation, and positive engagement. In this study, the broader idea of Holistic Well Being is discussed through two study dimensions: Cognitive Well-Being and Emotional Well Being. Cognitive Well Being is operationalised through the Knowledge and Skills constructs, whereas Emotional Well Being is discussed through Aspirations and Attitude Change. These constructs are treated as study indicators rather than comprehensive clinical or psychological measures of well being. This distinction is important because a short educational

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programme cannot, by itself, establish the full emotional or psychosocial status of children with cancer.

Game Based Learning (GBL) provides opportunities for active participation, problem-solving, feedback, collaboration, and experiential learning (Wang et al., 2022; Plass et al., 2020). Previous research has reported benefits related to learner engagement and learning outcomes, although much of the existing evidence focuses on mainstream learners or health related serious games. Less is known about community-based educational activities that combine mathematical learning with supportive social and emotional experiences for children with cancer. In this manuscript, Educational Therapy is used as a conceptual description of learning experiences designed to be supportive, engaging, and responsive to learners' emotional needs. It is not presented as a clinical treatment or medically validated therapy.

Although research on game-based learning and inclusive education has expanded, three gaps are relevant to the present study. First, previous GBL research has often prioritised academic achievement, motivation, or engagement, while the relationship between learning activities and broader cognitive and emotional indicators remains less clearly documented. Second, research involving children with cancer has frequently addressed treatment adherence, health knowledge, anxiety, or psychosocial support rather than community-based educational learning. Third, there is limited documentation of inclusive, non-clinical learning programmes delivered through community organisations in the Malaysian context. These gaps justify examining TGBL as a proposed educational approach, while recognising that the present study provides preliminary pre post evidence rather than causal proof.

To respond to these gaps, this study uses the term Therapeutic Game-Based Learning (TGBL) to describe a structured educational experience that combines learning games, social interaction, active participation, positive reinforcement, and emotionally supportive facilitation. In contrast to conventional GBL, which may focus mainly on learning objectives and game mechanics, TGBL in this study places additional emphasis on a safe, inclusive, and supportive environment for children with cancer. Knowledge and Skills are used as indicators of the learning-related dimension, while Aspirations and Attitude Change are used as indicators of the affective and motivational dimension. The study examines changes in these indicators before and after the programme; it does not claim that TGBL alone caused the observed changes.

Literature Review

Game-Based Learning in 21st-Century Education

Game-Based Learning (GBL) has become an increasingly recognised pedagogical approach in 21st-century education because it integrates game elements with educational objectives to enhance student engagement and learning outcomes. Unlike conventional teaching methods, GBL encourages active learning through problem solving, exploration, immediate feedback, and collaborative learning experiences. A meta-analysis by Wang et al. (2022) reported that digital game-based learning had a significant positive effect on students' academic achievement in STEM education. Similarly, Gui et al. (2023) found that well-designed educational games could improve learning outcomes compared with traditional instructional approaches. These findings indicate that GBL can support not only student motivation but also

International Journal of Education, Psychology and Counseling
IJEPC
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the development of essential 21st-century skills, such as communication, collaboration, and critical thinking.

Despite the growing evidence of GBL's effectiveness in education, previous studies have mainly focused on academic achievement and learner engagement within formal educational settings. The relationship between game-based learning and students' cognitive and emotional wellbeing has received less attention. Further research is therefore needed to explore the use of GBL among learners with specific educational and healthcare needs, particularly children with cancer. This may provide a broader understanding of its potential as an inclusive educational approach.

Game-Based Learning for Children with Cancer

Children diagnosed with cancer may experience interruptions to their learning due to prolonged medical treatment, repeated hospitalisation, and reduced social interaction. These challenges can affect not only their academic progress but also their motivation, self-confidence, and psychological wellbeing. In this context, Game-Based Learning (GBL) provides a flexible, engaging, and enjoyable approach that may address the educational needs of children undergoing medical treatment. In a scoping review of serious games in paediatric cancer care, Kim et al. (2024) reported that game-based interventions improved participant engagement, increased healthcare related knowledge, and reduced anxiety during treatment. These findings suggest that games can serve as both educational tools and strategies for supporting the psychosocial well-being of children with cancer.

Recent studies have also highlighted the contribution of serious games to the cognitive and emotional development of paediatric cancer patients. Biró et al. (2025) found that digital games designed for children with cancer enhanced disease related knowledge, encouraged self-directed learning, and supported more positive learning experiences. Similarly, Chai et al. (2022) reported that game-based interventions increased learner engagement and supported psychological adjustment during the treatment process. However, previous studies have primarily focused on health education and treatment management. The use of game-based learning to support both academic learning and emotional wellbeing remains less explored. Therefore, this study proposes Therapeutic Game Based Learning (TGBL) as an integrated educational approach that combines academic learning with emotional support for children with cancer.

Educational Therapy and Emotional Well-Being

Recent educational research suggests that learning effectiveness should be considered beyond academic achievement, with emotional well-being recognised as an important factor influencing learning success. Educational therapy emphasises learning experiences that combine cognitive development with emotional support in safe, enjoyable, and meaningful environments. For children with cancer, emotional well-being is particularly important because prolonged treatment, changes in daily routines, and social isolation may affect their learning motivation and self-confidence. A systematic review by Nazari et al. (2025) found that therapeutic play significantly reduced anxiety, stress, and depression among hospitalised children with cancer. These findings suggest that learning experiences incorporating therapeutic elements may support psychological well-being while encouraging active participation in learning.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 1617-1630

Furthermore, Liu et al. (2025) reported that narrative game-based interventions improved psychological well-being, self-confidence, and social interaction among paediatric cancer patients. Similar findings were reported by Kim et al. (2024), who found that serious games not only improved healthcare-related knowledge but also strengthened coping skills, reduced anxiety, and encouraged active learner participation. However, previous research has often examined psychological support and educational outcomes separately, without explicitly connecting them to educational objectives. This study therefore brings together the concepts of Game-Based Learning, Educational Therapy, and Emotional Well Being to develop Therapeutic Game Based Learning (TGBL) as an integrated educational approach that supports both cognitive and emotional well-being.

Therapeutic Game-Based Learning (TGBL)

Previous studies have shown that Game Based Learning, therapeutic play, and psychosocial interventions can support learning engagement and emotional well-being among children with cancer. However, these approaches have generally been implemented separately according to their specific objectives. While some studies focus on academic achievement, others emphasise psychological support or treatment management. This highlights the need for a more integrated educational framework that combines learning, play, and emotional support.

Drawing on the existing literature, this study defines Therapeutic Game Based Learning (TGBL) as the use of educational games and collaborative activities in a supportive environment to promote learning, participation, and positive emotional experiences. TGBL is proposed as an educational model rather than a clinical intervention. In this framework, Knowledge and Skills represent the learning related dimension, while Aspirations and Attitude Change represent the affective and motivational dimension. These constructs guide the organisation of the questionnaire and the interpretation of the findings. However, they should not be considered direct or comprehensive measures of cognitive or emotional well-being.

Community Based Inclusive Education

Inclusive education extends beyond equal access to schooling by encouraging collaboration among educational institutions, families, community organisations, and society to address the diverse needs of vulnerable groups. It promotes flexible and supportive learning environments in which individuals can participate actively regardless of their health condition or background (UNESCO, 2022).

In this study, Kids Day Out: Math Fun Carnival 2.0, organised in collaboration with the Friends of Childhood Cancer Association (FOCCAN), represents an example of community based inclusive education. The programme combined mathematics learning, educational games, and social interaction in a supportive and enjoyable environment. The involvement of parents, volunteers, and facilitators further contributed to a positive atmosphere that supported participants' emotional well-being. This example illustrates how community based educational programmes can provide opportunities to implement Therapeutic Game-Based Learning (TGBL) beyond the formal classroom setting.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 1617-1630

Research Gap

Community Based Inclusive Education emphasises collaboration among educational institutions, families, and community organisations to create accessible learning opportunities for children with diverse needs (UNESCO, 2022). In the present study, the *Kids Day Out: Math Fun Carnival 2.0* programme, organised in collaboration with FOCCAN, provided a community-based setting where mathematics activities, educational games, and social interaction were combined. The programme is presented as an example of inclusive educational practice rather than evidence that all community-based programmes produce similar outcomes.

The literature highlights three connected gaps. First, research on Game Based Learning (GBL) has commonly focused on academic achievement, motivation, or engagement, with less attention given to the combination of learning related and affective indicators. Second, studies involving children with cancer have often examined clinical care, treatment adherence, health education, or psychosocial support, while fewer studies have explored community based educational programmes. Third, the integration of educational games, supportive interaction, and inclusive community participation remains insufficiently documented in the Malaysian context. In response to these gaps, this study proposes Therapeutic Game-Based Learning (TGBL) as a practical educational approach and examines changes in four questionnaire constructs: Knowledge, Skills, Aspirations, and Attitude Change. These constructs are used as study indicators and should not be interpreted as comprehensive measures of clinical cognitive or emotional well-being. The findings provide preliminary pre post evidence rather than causal evidence of the effects of TGBL.

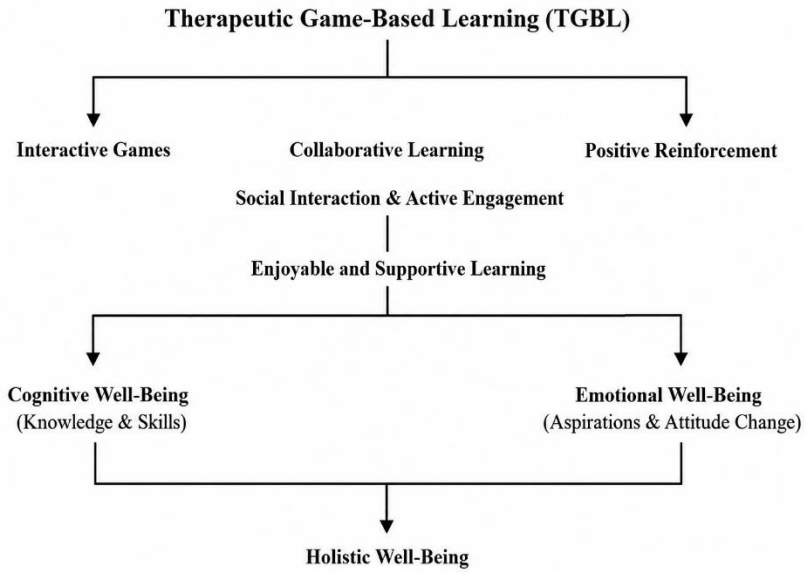


Figure 1: Conceptual Framework of Therapeutic Game-Based Learning (TGBL)

Figure 1 presents the proposed conceptual framework. It should be interpreted as a conceptual explanation of how the programme components may be connected to the study indicators, rather than as a tested causal model. The framework guided the selection of activities and the interpretation of the pre post findings.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 1617-1630

Methodology

This study adopted an explanatory mixed methods design. The quantitative component used a one-group pre post format to examine changes in questionnaire scores before and after the programme. The qualitative component consisted of open-ended feedback from participants and/or their parents or guardians. Qualitative responses were intended to add context to the numerical results by identifying participants' descriptions of engagement, learning experiences, confidence, and feelings during the programme. The integration was therefore interpretive: qualitative comments were used to help explain possible patterns in the quantitative findings, rather than to establish causal effects.

Research Participants

The study involved 85 children diagnosed with cancer who were registered with FOCCAN and participated in the Kids Day Out: Math Fun Carnival 2.0 programme. Participants were recruited through purposive sampling from the registered programme population. For younger participants, parents or guardians assisted with questionnaire completion where necessary. Because the participants were drawn from one registered community group and were not randomly selected, the findings should be interpreted within this specific programme context and should not be generalised to all children with cancer.

Research Instrument

The research instrument consisted of 12 questionnaire items developed with reference to the study objectives and relevant literature. The items were organised into four constructs: Knowledge, Skills, Aspirations, and Attitude Change. Each item used a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Knowledge and Skills were treated as indicators of the learning-related dimension, while Aspirations and Attitude Change were treated as indicators of the affective and motivational dimension. The instrument's internal consistency was examined using Cronbach's alpha. However, internal consistency alone does not establish content validity, construct validity, or clinical validity; evidence concerning expert review, pilot testing, or formal validation should be added if it was conducted.

Within the proposed conceptual framework, Knowledge and Skills represented Cognitive Well Being, whereas Aspirations and Attitude Change represented Emotional Well Being. The internal consistency of the instrument was assessed using Cronbach's alpha coefficient, which is widely recognised as an appropriate measure of reliability for multi-item questionnaires (Nunnally & Bernstein, 1994). A Cronbach's alpha value of 0.70 or above indicates acceptable internal consistency and confirms that the instrument is suitable for research purposes.

Data Collection Procedure

The study employed a one-group pre–post design to examine changes in participants' questionnaire responses following the TGBL programme. Quantitative data was collected before and after the programme using a questionnaire covering four constructs: Knowledge, Skills, Aspirations, and Attitude Change. Descriptive statistics were used to summarise the participants' responses, while a paired-samples t-test was conducted to examine the difference between the pre-test and post-test scores. Qualitative feedback was collected to provide additional context regarding participants' experiences during the programme.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 1617-1630

In addition, participants and their parents or guardians were invited to provide open ended feedback regarding their learning experiences throughout the programme. These qualitative responses offered valuable insights into participants' engagement, perceptions, and emotional well-being, thereby complementing the quantitative findings.

Data Analysis

The paired-samples t-test showed a statistically significant difference between the pre-test and post-test scores, $t(84) = -52.685$, $p < .001$. The overall mean score increased from 2.21 (SD = 0.53) before the programme to 4.61 (SD = 0.18) after the programme, representing a mean increase of 2.40 points. Although the results indicate a substantial difference in participants' responses, the one-group pre–post design does not establish that the programme alone caused the observed change.

Figure 2 illustrates the overall methodological framework, including research design, participants, research instrument, data collection procedure, and data analysis.

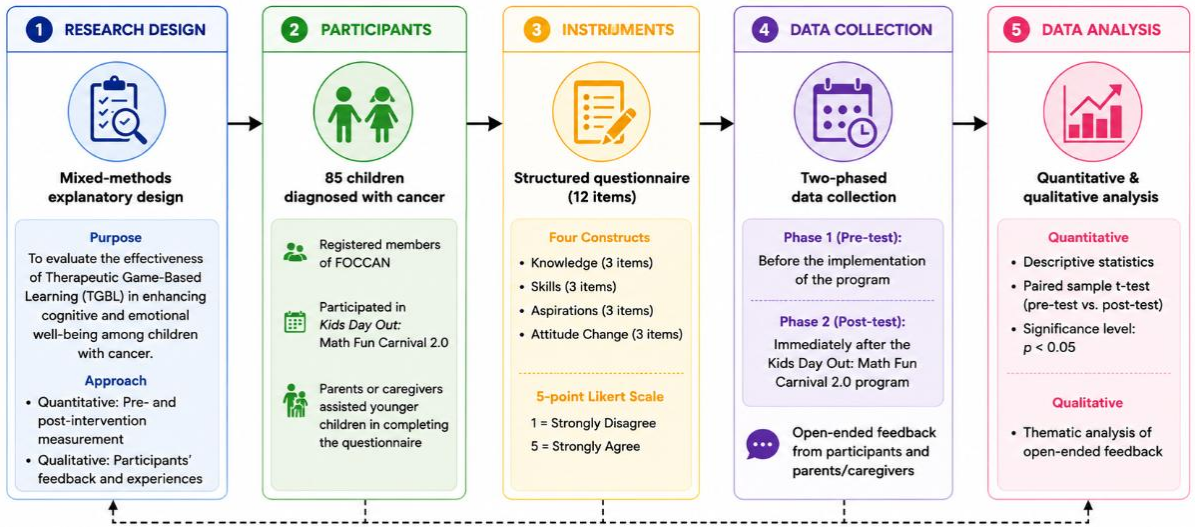


Figure 2: Methodology Flowchart of Study

Intervention Description and Mixed-Methods Integration

The Therapeutic Game-Based Learning (TGBL) programme was implemented through *Kids Day Out: Math Fun Carnival 2.0* at Dewan Kompleks Masyarakat Penyayang, Pulau Pinang. The half day programme was facilitated by lecturers and volunteers and included six educational game activities: SNAP EDU, TeKnow, GeoGram, Matchstick Puzzle, Magic Numeric, and Tangram. The activities encouraged hands-on learning, problem-solving, interaction, and active participation in a supportive learning environment.

Data was collected before and after the programme using a questionnaire measuring four constructs: Knowledge, Skills, Aspirations, and Attitude Change. Qualitative feedback was also obtained from participants and parents to provide additional insight into their learning experiences, teamwork and interaction, motivation or aspirations, and attitudes towards

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 1617-1630

learning. The quantitative data were analysed using descriptive statistics and paired samples t-tests, while the qualitative feedback was reviewed according to the identified areas of interest. One participant expressed enthusiasm about the programme, stating, "I was very excited about this programme because it helped me improve my learning skills." This response reflects the Learning Experience theme and provides contextual information about the participant's perception of the learning activities. The qualitative feedback complemented the quantitative findings by offering additional insight into participants' experiences during the programme.

The findings were interpreted as observed changes in participants' responses before and after the programme. As the study employed a one-group pre-post design without a control group, the results do not establish that TGBL alone caused the observed changes. The programme is recommended for continuation in the future to provide children with cancer with ongoing opportunities for inclusive and engaging learning experiences.

Results

Reliability Analysis

A reliability analysis was performed to assess the internal consistency of the research instrument. The instrument consisted of four constructs, namely Knowledge, Skills, Aspirations, and Attitude Change which represented the dimensions of Cognitive Well Being and Emotional Well Being. As shown in **Table 1**, the Cronbach's alpha coefficients ranged from 0.842 to 0.879 across the four constructs, while the overall reliability coefficient was 0.887. These values exceeded the recommended minimum threshold of 0.70 (Nunnally & Bernstein, 1994), indicating satisfactory internal consistency and confirming that the instrument was reliable for measuring the intended constructs and appropriate for subsequent statistical analyses.

Table 1: Reliability Analysis of Research Instrument

Construct	*Number of Items*	*Cronbach's Alpha*	*Interpretation*
Knowledge	3	0.842	Good
Skills	3	0.864	Good
Aspirations	3	0.879	Good
Attitude Change	3	0.851	Good
Overall Instrument	12	0.887	Good Reliability

Pre-test and Post-test Results

Table 2 presents the preprogramme and post programme mean scores. All four constructs showed higher mean scores after the programme. Knowledge increased from 2.20 (SD = 0.54) to 4.63 (SD = 0.19), Skills from 2.18 (SD = 0.56) to 4.70 (SD = 0.17), Aspirations from 2.17 (SD = 0.51) to 4.59 (SD = 0.18), and Attitude Change from 2.27 (SD = 0.50) to 4.56 (SD = 0.19). The overall mean increased from 2.21 (SD = 0.53) to 4.61 (SD = 0.18), a difference of 2.40 points. These descriptive changes indicate a favourable shift in participants' responses after the programme, but they do not demonstrate that TGBL alone produced the change.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 1617-1630

For the Cognitive Well Being dimension, the mean score for Knowledge increased from 2.20 (SD = 0.54) before the intervention to 4.63 (SD = 0.19) after the intervention. Similarly, the mean score for Skills improved from 2.18 (SD = 0.56) to 4.70 (SD = 0.17). With respect to Emotional Well Being, the mean score for Aspirations increased from 2.17 (SD = 0.51) to 4.59 (SD = 0.18), while Attitude Change improved from 2.27 (SD = 0.50) to 4.56 (SD = 0.19).

The overall mean score increased from 2.21 (SD = 0.53) before the programme to 4.61 (SD = 0.18) after the programme. Increases were observed across all four questionnaire constructs: Knowledge, Skills, Aspirations, and Attitude Change. These findings indicate a favourable change in participants' responses following the programme. However, the four constructs should be interpreted as study indicators rather than comprehensive measures of cognitive or emotional well-being. The findings therefore provide preliminary evidence of an association between participation in the programme and the observed pre–post changes, without establishing a causal effect.

Table 2: Pre-test and Post-test Mean Scores for Each Construct (N = 85)

Construct	*Pre-test Mean*	*SD*	*Post-test Mean*	*SD*	*Mean Difference*
Knowledge	2.20	0.54	4.63	0.19	2.43
Skills	2.18	0.56	4.70	0.17	2.52
Aspirations	2.17	0.51	4.59	0.18	2.42
Attitude Change	2.27	0.50	4.56	0.19	2.29
Overall	2.21	0.53	4.61	0.18	2.40

Paired-Samples t-Test Results

A paired samples t-test was used to examine the difference between the overall pre-programme and post-programme scores. The mean difference was −2.40 when calculated as pre-test minus post-test, with $t = -52.685$ and $p < .001$. The corresponding approximate paired-samples effect size was Cohen's $dz \approx 5.72$, calculated from the reported t value and sample size. Because the study did not include a control group, the result should be interpreted as evidence of a statistically significant pre post difference rather than definitive evidence of an intervention effect.

Table 3: Paired Sample t-Test Results for Overall TGBL Intervention (N = 85)

Variable	*Pre-test Mean (SD)*	*Post-test Mean (SD)*	*Mean Difference*	*t-value*	*p-value*
Overall Cognitive and Emotional Well Being	2.21 (0.53)	4.61 (0.18)	-2.40	-52.685	< 0.001*

The paired-samples t-test indicated a statistically significant difference between the pre-programme and post-programme scores, $t = -52.685$, $p < 0.001$. The result shows that participants' questionnaire scores were higher after the programme. It does not, however, establish that TGBL was the sole cause of the change. The finding should therefore be considered preliminary and interpreted alongside the programme context, the measurement limitations, and the qualitative evidence.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 64 (September 2026) PP. 1617-1630

Discussion

Cognitive Well Being

The Knowledge and Skills scores were higher after the programme. This pattern is consistent with the possibility that interactive mathematical games, peer interaction, and hands-on activities supported participants' learning experiences. However, the questionnaire measured perceived or self-reported responses rather than objective achievement tests. The findings should therefore be described as an observed improvement in learning related indicators, not as definitive evidence that TGBL improved cognitive well-being in a clinical or comprehensive sense.

These findings are consistent with those reported by Wang et al. (2022), who concluded that Game Based Learning (GBL) significantly improves academic achievement, learner motivation, and engagement in STEM education. Similarly, Gui et al. (2023) found that educational games designed with clearly defined learning objectives enhance learning effectiveness more successfully than conventional instructional approaches. While previous studies primarily examined the contribution of GBL to academic performance, the present study extends the existing literature by demonstrating that Therapeutic Game Based Learning (TGBL) not only supports knowledge acquisition and skill development but also contributes to the enhancement of Cognitive Well Being among children with cancer.

Emotional Well-Being

The findings showed increases in the Knowledge and Skills constructs, suggesting favourable changes in participants' responses to the learning related items. Similarly, increases in Aspirations and Attitude Change indicate positive changes in the affective and motivational responses measured by the questionnaire. These findings are consistent with the supportive and interactive learning environment provided during the programme. However, the results should not be interpreted as direct evidence of improved clinical cognitive or emotional well-being, as the constructs were used as study indicators rather than validated clinical measures.

These findings are consistent with the study conducted by Kim et al. (2024), which reported that serious games improve learner engagement, psychological well-being, and educational experiences among children with cancer. Likewise, Nazari et al. (2025) demonstrated that therapeutic play effectively reduces stress and anxiety, while Liu et al. (2025) found that narrative-based game interventions significantly enhance psychological well-being and social interaction among paediatric cancer patients. Collectively, these findings suggest that Therapeutic Game Based Learning (TGBL) extends beyond its role as an instructional strategy by simultaneously promoting learners' emotional resilience and positive learning experiences.

Therapeutic Game-Based Learning (TGBL)

The contribution of this study is the proposal of TGBL as a community based educational approach that brings together learning games, social interaction, active participation, and supportive facilitation. The pre post results show a consistent increase across the four questionnaire constructs, providing preliminary evidence that the programme was associated with favourable participant responses. The findings do not establish a causal intervention

effect, and the proposed model requires further testing using validated instruments, larger samples, and comparison groups.

The increase across Knowledge, Skills, Aspirations, and Attitude Change is consistent with the study's conceptual framework. However, these constructs are study indicators rather than comprehensive measures of cognitive and emotional well-being. The results should therefore be interpreted as changes in participants' questionnaire responses following the programme, rather than as proof of broad or lasting improvements in well-being.

The study adds a community-based example of how educational games may be organised for children with cancer in collaboration with a support organisation. Its practical contribution lies in describing an inclusive learning setting that combines mathematical activities with interaction and encouragement. Further research is needed to determine whether the approach is feasible across settings and whether similar outcomes are observed over time or in comparison with other educational activities.

Limitations

Several limitations should be considered when interpreting the findings. First, the study was conducted within a single community programme involving children registered with FOCCAN; therefore, the findings may not be generalisable to other populations or settings. Second, purposive sampling and the absence of a control or comparison group limit causal interpretation. Third, the pre post interval was short, and the study did not examine whether the observed changes were sustained over time. Fourth, the questionnaire constructs were developed for the purposes of the study and should not be treated as comprehensive or clinically validated measures of cognitive or emotional well-being. Finally, the qualitative findings can only be reported fully after the actual responses, coding process, and themes have been documented.

Conclusion

This study provides preliminary evidence of a favourable pre post change in four questionnaire constructs following participation in a community-based game learning programme. The findings support the feasibility of combining educational games, social interaction, and supportive facilitation for children with cancer. They should not be interpreted as proof that TGBL alone caused improvements in cognitive or emotional wellbeing, particularly because the study used a one-group design and indirect indicators.

The principal contribution is the proposal of TGBL as a practical, inclusive educational approach for community programmes involving children with special healthcare needs. The study highlights the potential value of integrating learning objectives with supportive interaction. Future studies should strengthen the evidence base through validated measures, clearly documented intervention procedures, longer follow-up periods, and control or comparison groups.

Overall, the findings suggest that learning activities which combine play, social interaction, and encouragement may provide meaningful educational experiences for children with cancer. The proposed TGBL framework should be regarded as an initial model for further investigation

rather than a validated therapeutic intervention. Its educational and psychosocial implications require confirmation through more rigorous and longitudinal research.

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Ethics Statement: Verbal permission was obtained from the Friends of Childhood Cancer Association (FOCCAN) to conduct the programme and collect research data. Verbally informed consent was obtained from the parents or legal guardians of the participating children before data collection, and child assent was obtained from the participants. Participation was voluntary. Participant information was managed using coded data to protect privacy and confidentiality. The collected data was used for academic research purposes, and no personally identifiable information was disclosed in the reporting of the findings.

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