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BOOSTING STUDENT MOTIVATION: AN APPLICATION OF A GAMES & ENVIRONMENTAL EDUCATION TECHNOLOGY MODEL IN HYDROCARBON AND PETROLEUM STUDIES

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ABSTRACT

This study investigates the impact of the Teams Games Tournament (TGT) learning model, which integrates environmental education, on the motivation of 11th-grade students at Public Senior High School within Jakarta, Indonesia, specifically focusing on hydrocarbon compounds and petroleum topics. This study applied a Posttest Only Control Group Design using the True Experimental Design method and a quantitative approach. The research involved 35 students from 11th-grade MIA 5 as the control group and 35 students from 11th-grade MIA 2 as the experimental group. Data collection involved a 60-item questionnaire, and statistical analysis utilized a t-test at α=0.05. The results illuminate a substantial difference in learning motivation between the experimental and control groups, with the control group averaging a motivation score of 71.63%. In comparison, the experimental group achieved a higher score of 78.83%. Hypothesis testing through the t-test demonstrates that the calculated t-value (3.9565) surpasses the critical t-value (1.9955), providing compelling evidence of the positive impact of the Teams Games Tournament model on students' learning motivation. In summary, this research underscores the significance of the integrated TGT learning model, enriched with environmental education, in fostering heightened learning motivation among 11th-grade students, particularly in the context of hydrocarbon compounds and petroleum studies at Public Senior High School 42 Jakarta.

Keywords: Teams Games Tournament (TGT); Learning Model; Environmental Education Integration; Learning Motivation; Educational Impact

1. INTRODUCTION

Education is central to human life, shaping character and human resources quality. This concept is reflected in the Republic of Indonesia Law No. 20 of 2003 concerning the National Education System, which emphasizes education as a conscious and planned effort to create a conducive learning environment and learning processes [1][2][3]. The aim is to enable students to actively develop their potential, including spiritual and religious strength, self-control, personality, intelligence, and noble character, as well as the skills necessary for community, national, and state life.

This perspective is supported by government regulations, as outlined in Republic of Indonesia Government Regulation No. 32 of 2013. Article 19 of this regulation emphasizes that the learning process in educational institutions should be interactive, inspirational, enjoyable, challenging, and motivating for students to participate actively. Furthermore, the learning process should provide ample space for practice, creativity, and independence in alignment with students' talents, interests, and physical and psychological development [4].

In this context, teachers must design lesson plans to ensure students understand the material and create an enjoyable learning atmosphere [5][6][7]. A pleasurable learning experience allows students to develop their activities and creativity through interaction and learning experiences. Thus, education becomes more than a means to transfer knowledge; it becomes a tool to shape students' character, motivation, and abilities in facing life's challenges.

The perennial challenge in chemistry education is intricately tied to the prevailing perception that the subject is inherently complex, leading to suboptimal academic achievements. A pivotal contributing factor to this challenge is students' inherent difficulty in establishing meaningful connections between the macroscopic phenomena observable in their everyday lives and the intricate, microscopic intricacies that underlie chemical concepts [8][9]. Students' lack of engagement in chemistry lessons is often related to their inability to see real connections

between abstract chemical concepts and applications in everyday life [10][11][12]. These findings indicate the need for innovative learning approaches to strengthen students' motivation in understanding complex chemical concepts.

Student involvement in chemistry learning is greatly influenced by learning activities that are interesting and relevant to everyday life. This shows the need for a learning approach that connects chemistry concepts with real-life contexts to increase student interest and motivation [13][14][15].This disconnect between the observable macroscopic world and the abstract microscopic realm poses a significant hurdle for learners. The tangible, real-world applications of chemical principles often seem elusive, impeding students' ability to grasp and internalize the fundamental concepts. Consequently, this struggle to bridge the macroscopic and microscopic dimensions of chemistry becomes a critical focal point for educators and researchers seeking to enhance the effectiveness of chemistry pedagogy. Addressing this foundational challenge is imperative for fostering a deeper understanding and appreciation of the subject among students, ultimately aiming to facilitate academic performance in chemistry education.

Detailed observations conducted at Public Senior High School 42 Jakarta shed light on students face in their chemistry learning journey. A prevailing issue emerges as students frequently articulate their struggles in comprehending chemistry lessons, attributing their difficulties to a perceived monotony in the teaching style. The palpable monotony creates an environment where students grapple with boredom and drowsiness during class sessions.

This unfortunate monotony poses a formidable barrier, detrimental to the student's overall engagement in the learning process. The pervasive sense of boredom seeps into their cognitive and affective domains, causing a discernible decline in attention, interest, and motivation levels. This collective decline in the vital components of effective learning complicates fulfilling the overarching goals outlined in chemistry education [16].

As a consequence of this observed dynamic, it becomes apparent that addressing the perceived monotony in teaching styles is a crucial intervention point. Recognizing the intricate interplay between instructional methods and students' engagement, educators can explore innovative pedagogical approaches that infuse dynamism into the learning environment. Such interventions aim to alleviate boredom and reignite students' curiosity, fostering a more conducive atmosphere for achieving the multifaceted objectives of chemistry education.

This research zeroes in on a targeted cohort of students at Public Senior High School 42 Jakarta who exhibit a notable deficiency in motivation in learning chemistry. Recognizing the imperative need to address this motivational gap, the study strategically incorporates cooperative learning methodologies, specifically emphasizing the implementation of the Teams Games Tournament method.

Cooperative learning is the cornerstone of this intervention, a pedagogical approach designed to foster student collaborative engagement. This method deviates from traditional teaching models by organizing students into small, interactive groups. Within these groups, students actively collaborate, pooling their collective efforts to comprehend and internalize complex academic content [17].

The Teams Games Tournament method, a dynamic facet of cooperative learning, adds a competitive yet inclusive layer to the collaborative process. Developed by David DeVries and Keith Edward in 1972 at Johns Hopkins University, this methodology infuses an element of friendly competition into the learning environment. Students work together towards a shared understanding of academic content and engage in a spirited competition, enhancing the learning experience.

The Teams Games Tournament, initially developed by David DeVries and Keith Edward in 1972 at Johns Hopkins University, takes center stage in this teaching method. In Teams Games Tournament, students compete with members of other teams to achieve the highest score. The competition occurs between teams at tournament tables, with question variations to ensure fair competition. Winners at each tournament table contribute the same

points to their team, providing equal opportunities for students of various achievement levels. The team with the best results is eligible for recognition and awards [18].

Based on previous research, students' learning motivation in chemistry falls within the moderate category, as indicated by the average pre-research motivation questionnaire results of 51.15% [19]. Chemistry education is often perceived as less appealing to students, primarily due to the involvement of concepts that cannot be directly observed. To enhance motivation, a playful learning approach becomes crucial. The Teams Games Tournament teaching model, which engages all students without differentiation, incorporating elements of play and reinforcement, is considered highly relevant [20].

Using game-based learning models, such as the Teams Games Tournament method, can effectively increase student motivation and involvement in learning [21][22][23]. These findings provide a strong basis for this research to evaluate the impact of integrating the Teams Games Tournament model with environmental education on student motivation in hydrocarbon and petroleum studies.

Moreover, establishing a robust connection between instructional material and real-world occurrences is a potent and innovative strategy to invigorate students' interest and motivation. By seamlessly weaving tangible connections between abstract chemical concepts and the practicalities of everyday life, instructional content transcends theoretical boundaries and takes on a palpable relevance that resonates with students.

This strategic linkage aims to bridge the gap between the seemingly abstract nature of chemical concepts and their concrete manifestations in daily experiences. The intentional integration of real-life situations into the instructional framework creates a dynamic learning environment wherein students can readily identify and appreciate the applicability of chemistry in their immediate surroundings.

As students observe the direct correlations between theoretical knowledge and tangible experiences, the instructional material transforms into a powerful catalyst for engagement. The contextualization of chemical concepts within familiar contexts renders the content more relatable and sparks curiosity and enthusiasm among students. This multifaceted approach aligns with the diverse ways students absorb and internalize information, fostering a deeper connection and understanding of the subject matter.

Despite recognizing the challenges in chemistry education, particularly in understanding complex chemical concepts like hydrocarbon compounds and petroleum, there remains a research gap in identifying and implementing innovative pedagogical approaches to address the motivation gap among high school students effectively. While previous studies have acknowledged the importance of engaging and relevant learning activities in enhancing student motivation in chemistry education [10][11][12], there is limited research focusing on integrating cooperative learning methodologies, such as the Teams Games Tournament teaching model, with environmental education to specifically target and improve student motivation in studying hydrocarbon compounds and petroleum.

This study aims to fill this research gap by evaluating how integrating the Teams Games Tournament teaching model with environmental education influences students' learning motivation in hydrocarbon compounds and petroleum. Through this investigation, we seek to contribute insights into innovative teaching approaches that can effectively address the motivation challenges in chemistry education, particularly in complex chemical concepts. The study aims to contribute to the broader conversation on refining teaching methodologies for improved educational outcomes in chemistry education by identifying the positive impact of the Teams Games Tournament model in this area.

Moreover, while this research is conducted at Public Senior High School 42 Jakarta, it is important to acknowledge that the generalizability of findings to other educational settings may have limitations. However, the insights gained from this focused investigation can serve as a valuable starting point for broader discussions and future research endeavors in innovative pedagogical approaches in chemistry education.

2. METHODS

In establishing the methodological framework for this study, a thorough examination of prior research has guided the selection and refinement of the research design. The True Experimental Design approach, characterized by its robust quantitative foundation, draws inspiration from seminal studies [24][25], ensuring established methodologies are incorporated into the current investigation. The meticulous selection of 35 eleventh-grade science students from Public Senior High School 42 Jakarta aligns with the principles of Cluster Random Sampling for its efficacy in obtaining representative samples [26].

The research subjects are strategically divided into the control group (XI MIA 5) and the experimental group (XI MIA 2). This classification adheres to the methodological choices made in renowned studies [27][28], providing a solid basis for comparative analysis. The methodological decisions surrounding the selection of subjects and the formation of groups are influenced by a synthesis of best practices outlined in the literature, ensuring the study's adherence to established standards.

A critical element in the research design is measuring students' learning motivation. The deployment of a motivational test consisting of 60 statements mirrors methodologies [29][30], contributing to the validity and reliability of the chosen instrument. The Likert scale questionnaire enriches the assessment process by offering participants a nuanced range of response alternatives [31][32]. This methodological alignment with prior research contributes to the comprehensive exploration of motivational dynamics.

The emphasis on the research instrument, particularly the motivational test, is informed by prior validation practices [33][34]. This careful validation process ensures the precision required to assess students' motivation accurately. The instrument's design, encompassing vital aspects of learning motivation, is a deliberate nod to the methodological advancements enhancing the research's capacity to capture the intricate dimensions of motivational experiences [35][36].

Implementing the Teams Games Tournament teaching model in the experimental group and the conventional instruction in the control group draws inspiration from the successes documented in studies [17][37]. This methodological alignment positions the current study within a broader context of innovative instructional approaches, allowing for meaningful comparisons. The post-intervention data collection is a strategic step that positions the research for an in-depth analysis of the impact of instructional models on learning motivation [24][38].

The choice of the t-test for data analysis at a significance level of $\alpha=0.05$ is a methodological decision reinforced by the statistical rigor advocated in studies [39][40]. This established statistical tool, implemented consistent with prior research, enhances the reliability of the study's findings. The application of the t-test facilitates a nuanced exploration of statistical differences in learning motivation between the experimental and control groups, echoing the methodological rigor [41][42].

The ethical dimension of this study is a cornerstone, underscoring the commitment to conducting research with integrity and sensitivity. This commitment is manifested in the meticulous steps taken to secure ethical approval from the relevant committee and to obtain permission from the educational institution, Public Senior High School 42 Jakarta. The ethical framework ensures that the participating students' rights, well-being, and confidentiality are rigorously protected throughout the research process. This reflects a conscientious approach to research, upholding the principles of respect, beneficence, and justice in educational inquiry.

3. RESULTS AND DISCUSSION

Based on the conducted research, the learning motivation data of the experimental class is presented in Figure 1 as follows:

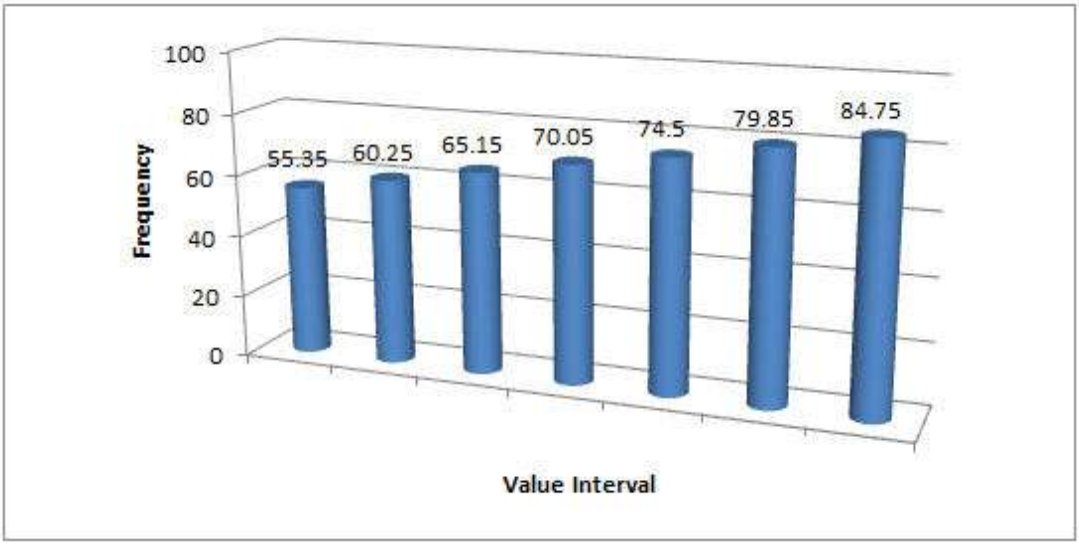

Figure 1: Frequency Distribution of Post-test Scores for the Control Group

Meanwhile, the learning motivation data of the experimental group students are presented in Figure 2. as follows:

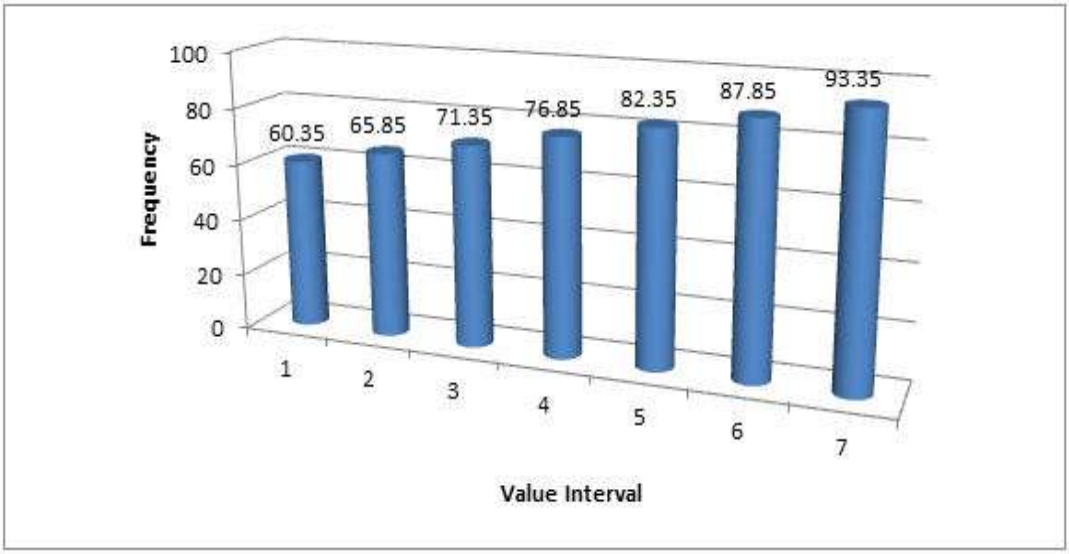

Figure 2: Frequency Distribution of Post-test Scores in the Experimental Group

All data on the learning motivation of the control group and experimental group from the student learning motivation questionnaire yielded the following results:

Table 1: Motivation learning data of control and experimental group students

Description	Class	
	Control	Experiment
n	35	35
Minimum value	55.4	60.4
Maximum value	84.6	93.1
Average	**71.63**	**78.38**

The data presented in Table 1 sheds light on the learning motivation scores obtained from both the experimental class, where the Teams Games Tournament (TGT) instructional model was implemented, and the control class, which utilized traditional teaching methods. Upon analyzing this data, a distinct pattern emerges, indicating the significant impact of the TGT instructional model on learning motivation within the experimental class compared to the control class. Students in the experimental class demonstrated notably higher levels of learning motivation, suggesting that TGT's innovative pedagogical approach played a pivotal role in fostering increased engagement and interest in the learning process.

This discrepancy in learning motivation is further underscored by the difference in average scores between the two classes. The control class yielded an average learning motivation score of 71.63, whereas the experimental class exhibited a substantially higher average score of 78.38. This variance in averages highlights the effectiveness of the TGT instructional model in eliciting heightened motivation among students, thereby surpassing the levels observed in the traditional teaching environment.

To validate these observations rigorously, a statistical analysis using a t-test was conducted to assess the significance of the difference in learning motivation scores between the two classes. The calculated t-value of 3.9565 exceeded the critical t-value for a sample size of 35 at a significance level of α=0.05, providing robust statistical evidence supporting the conclusion that the TGT instructional model engendered a significant divergence in learning motivation compared to traditional teaching methods.

The findings from this analysis underscore the efficacy of innovative pedagogical approaches, such as the TGT instructional model, in enhancing student motivation and engagement in the learning process. The observed increase in learning motivation among students in the experimental class signifies the potential of TGT to create a dynamic and stimulating learning environment that fosters active participation and enthusiasm for learning. This highlights the importance of incorporating innovative teaching methodologies to optimize student outcomes and promote a positive learning experience.

The inference drawn from the statistical analysis emphasizes a significant dissimilarity between the control class, characterized by conventional teaching methods, and the experimental class immersed in the innovative Teams Games Tournament instructional model. This distinction is particularly pronounced in the context of hydrocarbon compounds integrated with environmental education, echoing the broader educational discourse.

The resonance of these findings with earlier research [43] reinforces the argument that cooperative learning models, particularly exemplified by the Teams Games Tournament (TGT) approach, play a pivotal role in addressing student boredom, which is often associated with conventional lecture-based teaching methods. By synthesizing the current data with previous research findings, this analysis highlights the consistent efficacy of cooperative learning frameworks in promoting student engagement and motivation within the classroom setting.

This data synthesis corroborates the effectiveness of cooperative learning models and underscores their contextual alignment with contemporary educational needs. The observed impact of TGT on student motivation aligns with broader pedagogical trends emphasizing active student participation and collaborative learning environments. As such, these findings offer valuable insights for educators grappling with engagement challenges in traditional lecture-based classrooms.

Moreover, the efficacy of cooperative learning frameworks, as demonstrated by the TGT approach, extends beyond mitigating student boredom. By fostering collaborative interactions and shared learning experiences, these models contribute to a more dynamic and interactive educational environment. This, in turn, enhances the overall educational experience by promoting deeper student engagement and facilitating meaningful learning outcomes. Adopting the Teams Games Tournament (TGT) instructional model introduces a dynamic learning environment wherein student participation is not merely encouraged but also deemed essential for the overall success of the learning process. Within this cooperative framework, students, regardless of their varying levels of

comprehension within a group, are prompted to contribute actively. This approach cultivates a sense of collective responsibility, necessitating students to operate as a unified team during learning activities.

The TGT model acts as a catalyst, motivating students to eschew passive involvement in learning, which could otherwise impede the effective execution of educational activities. This cooperative structure incentivizes students to engage meaningfully with the material, leveraging their strengths and knowledge to support the collective learning objectives. This active participation enhances students' comprehension and retention of the subject matter and fosters crucial collaborative skills essential for real-world applications.

Moreover, the TGT model instills a spirit of healthy competition among students, further amplifying their motivation to excel academically. The structured format of team-based competition encourages students to strive for excellence while fostering a supportive learning environment where peers collaborate and celebrate each other's successes. This blend of competition and collaboration within the TGT framework enhances student engagement and cultivates a positive classroom culture centered around mutual respect and shared learning goals.

The TGT instructional model transforms the traditional classroom dynamic by promoting active student participation, fostering collaborative learning experiences, and igniting a sense of academic drive through structured competition. This approach empowers students to take ownership of their learning journey, driving their motivation and investment in the educational process.

The instructional design of the Teams Games Tournament (TGT) method underscores the importance of sustained engagement, aiming to mitigate the potential drawbacks associated with passive learning. Within this framework, the TGT model recognizes the paramountcy of active cognitive involvement, reflecting the foundational principle that genuine learning thrives on continuous mental participation [44].

By placing a premium on active thinking, the TGT model echoes the overarching philosophy that learning is a dynamic process fueled by the stimulation of critical thought. This emphasis on active cognitive engagement resonates with contemporary pedagogical paradigms prioritizing active learning strategies as catalysts for fostering effective and enduring knowledge acquisition.

Moreover, the TGT instructional design underscores the role of collaborative learning in enhancing cognitive engagement. By fostering collaborative problem-solving and knowledge-sharing within a team-based setting, the TGT model encourages students to construct their understanding of the subject matter actively. This collaborative dynamic deepens students' comprehension and cultivates essential interpersonal skills, such as communication, teamwork, and conflict resolution, which are integral for success in academic and professional domains.

Furthermore, the TGT model leverages structured competition to heighten student motivation and engagement. By introducing a competitive yet inclusive environment where students strive to outperform their peers while supporting each other's learning, the TGT method creates a dynamic and stimulating learning atmosphere. This competitive aspect of the TGT model motivates students to participate actively and fosters a sense of accountability and ownership over their learning outcomes.

The TGT instructional design embodies a holistic approach to fostering sustained engagement and active participation in the learning process. Integrating elements of collaboration, competition, and active cognitive involvement, the TGT model provides a multifaceted framework for promoting deep learning and meaningful student engagement.

The cooperative learning approach facilitated by the Teams Games Tournament (TGT) model has proven its effectiveness in enhancing student engagement. Central to this instructional methodology is a group-oriented framework that encourages students to collaborate in sharing knowledge and actively participating within their respective teams. This collaborative dynamic engages students in discussions and interactions with their teachers, leading to heightened motivation.

As the gaming process unfolds within the TGT framework, students are encouraged to communicate and engage in group dialogues. These interactions ignite enthusiasm and foster a deeper engagement with the material. Moreover, the element of competition inherent in the TGT model, where students strive to achieve the highest scores, acts as a positive motivator. The sense of accomplishment derived from successfully navigating the gaming framework boosts students' morale. It instills a sense of healthy competition, driving them to participate actively and excel in their learning endeavors [45].

The cooperative structure inherent in the Teams Games Tournament (TGT) model fosters a synergistic atmosphere, leveraging group members' collective intelligence and efforts. Through collaborative problem-solving and shared exploration of the subject matter, students not only deepen their understanding but also contribute to the overall knowledge pool of the group. This participatory dynamic cultivates a sense of shared accomplishment, creating a positive learning environment where students actively engage as contributors to the collective learning experience. The success achieved in the gaming element further underscores the notion that incorporating competitive elements can serve as potent motivators in the learning process [45].

Furthermore, the TGT model instills a sense of responsibility within each student toward their respective groups. It promotes teamwork during learning activities, fostering an active learning environment characterized by exercises, discussions, and games among students and teachers [46]. Students' inherent enjoyment from active involvement in various learning activities, such as class presentations, group discussions, and games, motivates all group members to strive for the highest points in tournaments, showcasing their group's success [47].

The TGT model introduces an element of enjoyment by transforming quizzes into games or tournaments. With TGT, students embrace the tournament atmosphere as they compete with equally skilled groups. This aspect makes the TGT instructional model feel more equitable than traditional forms of competition in learning, adding an enjoyable and competitive dimension that motivates students to study chemistry with enthusiasm [48].

In the Teams Games Tournament model, each student assumes a distinct role within their group, fostering teamwork throughout the learning activities. This collaborative approach establishes an active learning environment wherein students engage in various exercises, discussions, and games. The heightened participation of students during the learning process contributes to creating an enjoyable atmosphere, motivating them to participate in-class presentations, group discussions, and tournaments actively participate in class presentations, group discussions, and tournaments. The collective efforts of all students are directed toward accumulating the highest points during tournaments, serving as a tangible measure of the group’s success [46][47].

The Teams Games Tournament instructional model injects an element of enjoyment into chemistry education by redefining quizzes as games or tournaments. The element of fair competition, involving groups with comparable abilities, renders this model more attractive than traditional learning approaches. The enjoyable and competitive nature intrinsic to Teams Games Tournament potentiates students’ motivation to engage with and learn chemistry with enthusiasm [48].

Furthermore, the Teams Games Tournament model encourages a sense of camaraderie among students within each group. As students collaborate on problem-solving and collectively explore the subject matter, they not only enhance their understanding but also contribute to the overall knowledge pool of the group. This collaborative dynamic reinforces a shared sense of accomplishment, fostering a positive learning environment where students actively contribute to the collective learning experience. The success achieved in the gaming component further affirms the notion that well-structured competitive elements can serve as powerful motivators within the learning process [45].

Integrating environmental education into the curriculum positively affects student engagement and interest. The content becomes more relatable and intriguing by directly connecting the learning material and students’ daily lives. This linkage stimulates students’ heightened curiosity, significantly boosting their enthusiasm for learning.

Actively involving students in the learning activities further reinforces their interest, enhancing their learning motivation [49].

This research investigates the tangible effects of integrating the Teams Games Tournament instructional model on students' learning motivation. The results reveal that students actively engage in every phase of this learning approach demonstrate heightened motivation levels. Unlike passive observers, these students are fully immersed and actively involved in the learning journey. This underscores the importance of dynamic and interactive learning methodologies in cultivating enduring motivation among students.

4. CONCLUSION

This study presents significant findings regarding the impact of the Teams Games Tournament (TGT) integrated with environmental education on the learning motivation of students in the XI MIA 2 and XI MIA 5 classes at Public Senior High School 42 Jakarta. Data analysis shows that the TGT instructional model positively influences students' learning motivation in the context of chemistry education. The average learning motivation scores for students in the experimental class (78.38) show a noteworthy increase compared to the control class (71.63). These results reflect the success of TGT in creating a learning environment that motivates students to participate and engage in the learning process actively. The improved learning motivation is recognized as a crucial factor in achieving the goals of chemistry education. Hypothesis testing using the t-test produces findings consistent with the analysis of average scores. The significant value of the t-test (3.9565) surpasses the tabulated t-value (1.9955), indicating a highly significant difference in learning motivation between the experimental and control classes. In other words, implementing the TGT model effectively enhances students' learning motivation. This conclusion supports the assertion that the TGT instructional model, particularly when integrated with environmental education, provides a positive impact that stimulates students' interest and learning enthusiasm. This research contributes to enriching the literature on chemistry education strategies that can enhance the learning motivation of high school students.

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