Physical Education, Health and Social Sciences

https://journal-of-social-education.org

E-ISSN: 2958-5996

P-ISSN: 2958-5988

Effect of Genius Hour Teaching Strategy on Cognitive Engagement of Prospective Teachers

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DOI: https://doi.org/10.63163/jpehss.v3i3.596

Abstract

In response to the growing demand for student-centered and inquiry-driven pedagogies in teacher education, this study investigates the effect of the **Genius Hour teaching strategy** on the **cognitive engagement** of prospective teachers enrolled in a School Management course. Grounded in constructivist learning theory and Self-Determination Theory, the research explores how learner autonomy, choice, and real-world application influence students' mental effort, strategic learning, and intellectual persistence. A **true experimental pre-test/post-test control group design** was employed with 88 B.Ed. (Hons) Elementary students at the University of Kotli, Azad Jammu and Kashmir. Participants were randomly assigned to either an **experimental group** (n = 44), which received instruction through the Genius Hour strategy, or a **control group** (n = 44), taught using traditional lecture-based methods. Cognitive engagement was measured using a validated self-report scale administered before and after the instructional intervention. The results revealed a **statistically significant increase** in cognitive engagement among students in the Genius Hour group ($p < .001$, Cohen's $d = 1.33$), while no significant change was observed in the control group ($p = .891$). Additionally, a between-group comparison confirmed that students taught through the Genius Hour strategy demonstrated significantly higher post-test cognitive engagement than those in the traditional group ($p < .001$, Cohen's $d = 1.52$). These findings provide strong empirical support for the integration of **Genius Hour into teacher education programs**, highlighting its potential to foster deep intellectual engagement, metacognition, and critical thinking among future educators. The study contributes to the limited body of literature on inquiry-based instruction in teacher training in Pakistan and offers evidence-based recommendations for curriculum planners and teacher educators seeking to promote cognitive engagement through innovative pedagogical models.

Keywords: Genius Hour, cognitive engagement, teacher education, inquiry-based learning, constructivist pedagogy, prospective teachers,

Introduction

In the era of educational transformation, the demand for teaching strategies that foster learner autonomy, creativity, and deep cognitive engagement has become more pressing than ever (Juliani, 2015). As educational systems globally shift from traditional, teacher-centered instruction to more dynamic, student-centered approaches, the need for pedagogical models that cultivate critical thinking, strategic learning, and reflective inquiry continues to grow. One such model is the Genius Hour teaching strategy an inquiry-based instructional approach that empowers students to explore self-selected topics, conduct independent research, and present their findings in meaningful and innovative ways (Spencer, 2022; Wettrick, 2014).

Originally inspired by Google's "20% time" initiative, Genius Hour has been adapted into educational contexts to support student agency, intrinsic motivation, and deep learning (Juliani, 2015). It challenges the traditional paradigms of passive learning by transforming students into active constructors of knowledge, thereby developing metacognitive skills, critical reasoning, and intellectual persistence key components of cognitive engagement (Schraw et al., 1998). The instructional philosophy behind Genius Hour aligns closely with constructivist learning theories, which emphasize experience-based, inquiry-driven learning and the co-construction of knowledge (Savery & Duffy, 1995).

Emerging empirical research affirms the effectiveness of Genius Hour in enhancing students' engagement and cognitive involvement. For instance, LeGeros et al. and Downes (2022) found that participation in Genius Projects enabled students to demonstrate higher levels of focus, problem-solving, and self-regulated learning. Terauchi (2022) also observed improved independent learning behaviors and reflective thinking in university students engaging in 20% time projects. Similarly, Wettrick (2014) and Ruday & Caprino (2020) emphasized that Genius Hour fosters self-direction and intellectual curiosity hallmarks of cognitive engagement. These findings indicate that when students are granted autonomy to explore meaningful topics within a structured learning environment, their mental investment and academic resilience significantly improve.

Within the teacher education context of Azad Jammu and Kashmir, however, instructional practices remain predominantly lecture-driven, focusing on content coverage and theoretical transmission. This approach offers limited opportunities for prospective teachers to engage in inquiry-based, cognitively demanding learning experiences (Naveed & Mehmood, 2020). As a result, many teacher candidates struggle to develop the critical thinking and reflective learning dispositions needed to implement active pedagogies in future classrooms. The introduction of Genius Hour into teacher education programs could serve as a transformative pedagogical shift, allowing prospective teachers to experience and internalize the cognitive demands of student-led inquiry. As Downes and Figg (2019) noted, teacher candidates who engaged in Genius Hour reported enhanced inquiry skills, deeper reflection, and increased creative confidence in their instructional planning.

In this study, cognitive engagement is conceptualized as the degree to which students are mentally invested, strategically learning, and intellectually persistent in their academic work (Fredricks et al., 2004; Greene, 2015). While cognitive engagement can manifest in various forms from self-regulation to deep processing of information researchers typically assess it through student self-reports, focusing on effort, metacognition, and willingness to tackle complex tasks. According to Schunk and Mullen (2012), cognitive engagement is not only a predictor of academic success but also a marker of long-term learning retention and adaptive expertise.

The Self-Determination Theory (SDT) and Achievement Goal Theory both underscore the importance of instructional design in cultivating cognitive engagement. According to Ryan and Deci (2000), cognitive engagement thrives when learners experience autonomy, competence, and relatedness in their learning environments. Elliot and Church (1997) further explain that mastery-oriented goals fostered through interest-driven, self-directed tasks promote sustained cognitive investment. Genius Hour, by enabling learners to pursue personally meaningful inquiries, aligns with these motivational theories and supports the development of deep, goal-directed engagement.

Despite its global relevance, limited empirical research has explored the effect of Genius Hour on cognitive engagement in teacher education settings in Pakistan, especially within content-intensive courses like School Management. Given the rising emphasis on

reflective, student-centered instruction in global teacher education reform, there is a pressing need to examine how innovative pedagogies like Genius Hour shape the cognitive learning behaviours of future educators.

Therefore, this study aims to empirically investigate the effect of the Genius Hour teaching strategy on the cognitive engagement of B.Ed. (Hons) Elementary students enrolled in a School Management course at the University of Kotli, AJ&K. Utilizing a true experimental, pre-test/post-test control group design, the study compares changes in cognitive engagement among students taught via Genius Hour and those taught using traditional lecture-based instruction. By addressing this gap, the research contributes to the growing body of literature on Genius Hour and offers evidence-based insights for improving engagement-oriented practices in teacher education programs across Azad Jammu and Kashmir.

Ultimately, the findings of this study are expected to inform policy, curriculum planning, and teaching strategies that aim to foster cognitive engagement, metacognition, and inquiry-based learning in future classrooms. By analysing and comparing the outcomes of both Genius Hour and traditional instruction, the study offers a meaningful framework to guide teacher education reforms in Pakistan. In doing so, it serves as a practical roadmap for educators, teacher trainers, and academic leaders committed to nurturing cognitively engaged, reflective, and future-ready teachers.

Objective of the Study

The objectives of the study were:

1. To determine the effect of the Genius Hour teaching strategy on the cognitive engagement of prospective teachers.
2. To compare cognitive engagement of prospective teachers in control and experimental group.

Hypotheses of the Study

H_{o1}: There is no significant effect of the Genius Hour teaching strategy on the cognitive engagement of prospective teachers.

H_{o2}: There is no significant effect of traditional teaching strategy on cognitive engagement of prospective teachers.

H_{o3}: There is no significance difference in the mean scores of cognitive engagements of prospective teachers taught through Genius Hour teaching strategy and traditional teaching strategy.

Literature Review

Cognitive engagement is widely recognized as a key factor in meaningful learning, particularly in higher education and teacher preparation programs. It involves the mental effort, deep information processing, use of learning strategies, and persistence students demonstrate in the learning process (Fredricks et al., 2004). Engaged students actively seek to understand concepts, apply knowledge to new situations, and reflect critically on their learning (Greene, 2015).

Genius Hour, originally inspired by Google's "20% time," promotes inquiry-driven, passion-based learning where students pursue self-directed projects. This model aligns with the principles of Self-Determination Theory (Deci & Ryan, 2000), which posits that learners become more motivated and engaged when their basic psychological needs for autonomy, competence, and relatedness are satisfied.

According to Reeve (2012), autonomy-supportive teaching practices like those inherent in Genius Hour foster greater levels of intrinsic motivation and deeper cognitive

engagement. Juliani (2015) and Ruday & Caprino (2020) suggest that Genius Hour encourages exploration, innovation, and intellectual risk-taking, which are central to cognitive engagement.

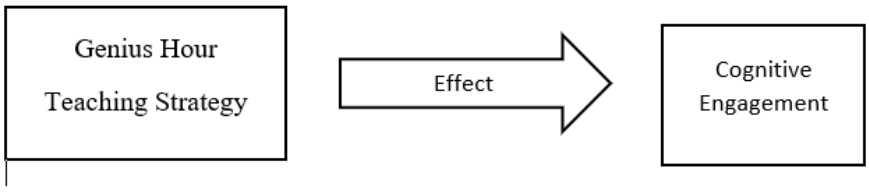
A study by Bond and Bedenlier (2019) demonstrated that inquiry-based and technology-enhanced learning environments positively affect student engagement by encouraging cognitive challenge and personal investment. Similarly, Hiver et al. (2021) emphasized the importance of learner agency in cognitive engagement, finding that students who are empowered to make academic decisions show higher levels of critical thinking and task persistence.

In a classroom-based experiment, Terauchi (2022) found that integrating Genius Hour into a university-level English class improved students' independent learning behaviors, reflective thinking, and problem-solving abilities. These findings echo the conclusions of Zorzi et al. (2020), who argued that project-based learning, particularly when personalized, leads to sustained cognitive engagement and academic growth.

Despite these promising findings, research on Genius Hour's impact in teacher education contexts remains limited. Most existing studies have focused on school-aged learners or general higher education settings. Although widely studied in school contexts, its application in teacher education has not been thoroughly investigated, presenting a gap this study seeks to fill. Therefore, this study addresses a significant gap by exploring the Genius Hour teaching strategy effect on cognitive engagement among prospective teachers enrolled in a school management course.

Research Design and Method

The study employed a **quantitative (true experimental)** research design using a **pre-test/post-test control group design** to investigate the effect of the Genius Hour teaching strategy on the cognitive engagement of prospective teachers. The experiment involved two intact groups: an **experimental group,** which was taught using the Genius Hour strategy, and a **control group,** which received instruction through traditional lecture-based methods.



Population and Sample

The population comprised all prospective teachers enrolled in the **B.Ed. (Hons) Elementary program** at the University of Kotli, Azad Jammu and Kashmir, during the **Fall 2024** semester. These students were taking the **School Management course,** making them the target population for evaluating the impact of instructional strategies on cognitive engagement. The final sample consisted of **88 prospective teachers,** all in the 8th semester, and enrolled in the aforementioned course. Using a **true experimental design,** participants were randomly assigned to two groups of equal size based on their pre-test scores to ensure initial equivalence:

- An **experimental group** (n = 44), taught using the Genius Hour teaching strategy
- A **control group** (n = 44), taught using the traditional lecture method

Random assignment helped maintain **internal validity** by ensuring comparability between the groups in terms of prior cognitive engagement and learning exposure.

Research Instruments

To measure cognitive engagement, the researcher developed and validated a **Study Engagement Scale** tailored to the context of the School Management course. The scale focused on three key dimensions of cognitive engagement:

- Mental effort and focus
- Strategic learning and problem-solving
- Persistence and intellectual curiosity

The instrument consisted of **Likert-scale items** (5-point scale: Strongly Disagree to Strongly Agree), covering indicators aligned with established frameworks for measuring cognitive engagement (e.g., Fredricks et al., 2004; Greene, 2015).

The same scale was administered to both groups as a **pre-test** and **post-test,** enabling an accurate comparison of changes in cognitive engagement levels resulting from the instructional intervention. To ensure **content validity**, the scale was reviewed by **subject matter experts in educational psychology and teacher education**, and pilot-tested for reliability. The internal consistency (Cronbach's alpha) of the cognitive engagement subscale was found to be **0.82,** indicating strong reliability.

Results

In this section, the data collected from the participants was analyzed to determine the effect of the Genius Hour teaching strategy on the cognitive engagement of prospective teachers. The results of the pre-test and post-test scores were subjected to statistical analysis to evaluate the impact of the instructional intervention on students' mental investment, strategic learning, and reflective thinking.

Descriptive and inferential statistics were applied to compare the cognitive engagement levels of the experimental group (taught using the Genius Hour strategy) and the control group (taught using traditional methods). The analysis aimed to test the hypothesis regarding whether the Genius Hour strategy produced a significant difference in cognitive engagement among prospective teachers.

The findings of this analysis covering within-group comparisons, between-group differences, and effect sizes are presented in tabular form and interpreted in light of the study's objectives. These results offer important insights into the effectiveness of innovative, student-centered instruction in fostering deeper cognitive engagement in teacher education settings.

Table 1

Effect of Genius Hour Teaching Strategy on Cognitive Engagement

Test Type	N	M	SD	t	Df	p	Cohen's d
Pre vs Post (GH)	44	27.13 vs 33.84	4.981 vs 5.214	9.576	43	< .001	1.33

The data presented in the table 1 indicated a statistically significant improvement in cognitive engagement among prospective teachers in the Genius Hour (GH) group from pre-test to post-test. The mean score increased from **27.13** to **33.84,** with standard deviations of **4.981** and **5.214** respectively. The paired-sample t-test yielded a **t-value of 9.576** with **43**

degrees of freedom, and the result was statistically significant at **p < .001.** Moreover, the **Cohen's d value of 1.33** indicates a **large effect size**, according to conventional benchmarks (Cohen, 1988). This suggests that the observed increase in cognitive engagement was not only statistically significant but also educationally meaningful. The results strongly support the effectiveness of the Genius Hour teaching strategy in enhancing the cognitive engagement of prospective teachers, highlighting its potential for deeper mental investment, strategic learning, and critical thinking in teacher education programs.

Table 2

Effect of Traditional Teaching Strategy on Cognitive Engagement

Test Type	N	M	SD	t	Df	p	Cohen's d
Pre vs Post (Traditional)	44	27.11 vs 27.20	4.899 vs 4.990	0.138	43	.891	0.02

The table 2 shows the cognitive engagement scores of prospective teachers in the Traditional (control) group before and after the intervention. The mean scores changed only slightly from 27.11 (pre-test) to 27.20 (post-test), with standard deviations of 4.899 and 4.990, respectively. The paired-sample t-test resulted in a t-value of 0.138, with 43 degrees of freedom, and a p-value of .891, indicating that the difference is not statistically significant. The Cohen's d value of 0.02 reflects a negligible effect size, suggesting no meaningful improvement in cognitive engagement as a result of traditional instruction. These results imply that the traditional lecture-based teaching strategy did not enhance the cognitive engagement of prospective teachers. This further highlight the limitations of conventional methods in promoting deep mental effort, strategic learning, and reflective thinking.

Table 3

Comparison of Post-Test Scores Between Experimental and Control Groups

Group	N	M	SD	t	Df	p	Cohen's d
GH vs Traditional	44 each	33.84 vs 27.20	5.214 vs 4.990	7.149	86	< .001	1.52

The table 3 compares the post-test cognitive engagement scores between the Genius Hour (GH) group and the Traditional teaching group. The GH group had a significantly higher mean score of 33.84 compared to 27.20 for the traditional group, with standard deviations of 5.214 and 4.990, respectively. An independent-samples t-test revealed a t-value of 7.149 with 86 degrees of freedom, and the difference was statistically significant at p < .001. The Cohen's d value of 1.52 indicates a very large effect size, demonstrating that the difference between the two groups is not only statistically significant but also practically meaningful. These findings strongly suggest that the Genius Hour teaching strategy is substantially more effective than traditional methods in promoting cognitive engagement among prospective teachers. The results reinforce the value of student-centered, inquiry-based approaches in fostering deeper intellectual involvement and critical thinking in teacher education.

Findings

Table 1 shows a significant increase in cognitive engagement in the Genius Hour group from pre-test to post-test, with a large effect size (d = 1.33). Table 2 shows no meaningful change in the traditional group, with a negligible effect size (d = 0.02). Table 3 highlights a significant post-test difference between the two groups, favoring the Genius Hour strategy with a very large effect size (d = 1.52). These findings confirm that Genius Hour is more effective than traditional teaching in promoting cognitive engagement among prospective teachers.

Discussion

The study aimed to evaluate the effect of the Genius Hour teaching strategy on the cognitive engagement of prospective teachers enrolled in the School Management course. To address this, three hypotheses were tested, with a focus on comparing the impact of Genius Hour versus traditional teaching methods.

Hypothesis 1 (Ho_1) posited that the Genius Hour teaching strategy has no significant effect on cognitive engagement. The results shown in Table 1 reveal a significant improvement in cognitive engagement from pre-test ($M = 27.13$, $SD = 4.981$) to post-test ($M = 33.84$, $SD = 5.214$) in the experimental group, with a t-value of 9.576 and $p < .001$. The calculated Cohen's $d = 1.33$ indicates a large effect size, demonstrating that Genius Hour significantly enhances learners' mental investment, strategic thinking, and intellectual effort. This leads to the rejection of Ho_1 and confirms that Genius Hour positively impacts cognitive engagement.

These findings are consistent with previous research that supports the effectiveness of project-based, inquiry-driven, and student-centered instruction in promoting deeper engagement and learning (Juliani, 2015; Reeve, 2012). Genius Hour's focus on autonomy, self-direction, and real-world problem-solving aligns with the principles of Self-Determination Theory (Deci & Ryan, 2000), which emphasize the psychological needs of autonomy, competence, and relatedness in fostering meaningful learning.

Hypothesis 2 (Ho_2) examined whether traditional teaching methods alone would impact cognitive engagement. As reported in Table 2, the change from pre-test ($M = 27.11$, $SD = 4.899$) to post-test ($M = 27.20$, $SD = 4.990$) in the control group was statistically non-significant ($t = 0.138$, $p = .891$), with an almost negligible effect size (Cohen's $d = 0.02$). This suggests that while traditional teaching may help maintain baseline engagement, it does not significantly enhance cognitive investment or higher-order thinking. These results align with studies that argue lecture-based methods are limited in their ability to stimulate students' deeper engagement, creativity, or reflective learning (Bond & Bedenlier, 2019; Hiver et al., 2021).

To further examine the difference in instructional impact, Hypothesis 3 (Ho_3) tested whether there is a significant difference in post-test cognitive engagement between the Genius Hour and traditional groups. As shown in Table 3, the Genius Hour group ($M = 33.84$, $SD = 5.214$) significantly outperformed the traditional group ($M = 27.20$, $SD = 4.990$), with a t-value of 7.149, $p < .001$, and a very large effect size (Cohen's $d = 1.52$). This clear difference validates that Genius Hour fosters substantially higher levels of cognitive engagement compared to conventional teaching approaches.

The findings are consistent with Fredricks et al. (2004) and Greene (2015), who emphasized that students exhibit higher cognitive engagement when learning environments promote autonomy, choice, and relevance. Furthermore, as highlighted by LeGeros et al. (2022), the Genius Hour model enables learners to develop competencies such as critical thinking, metacognition, and self-directed inquiry. The results also align with Spencer et al. (2020), who found that students involved in Genius Hour projects show increased research literacy, creativity, and problem-solving hallmarks of cognitive engagement.

In the context of teacher education, such outcomes are particularly significant. Future educators need to experience and model cognitively engaging instructional strategies. By allowing prospective teachers to immerse themselves in inquiry-based projects, Genius Hour supports the development of pedagogical dispositions aligned with 21st-century teaching demands.

Collectively, the results provide strong empirical support for integrating the Genius Hour teaching strategy into teacher education programs, particularly for enhancing cognitive engagement in conceptually demanding and reflective courses. The strategy's emphasis on autonomy, exploration, and student agency positions it as a transformative model that goes beyond content delivery to cultivate deep, sustained intellectual engagement among future teachers.

Conclusion

While the existing body of literature has widely examined the effectiveness of student-centered instructional strategies such as project-based learning, flipped classrooms, and inquiry-based approaches in enhancing student engagement, relatively fewer empirical studies have focused specifically on the implementation of Genius Hour within teacher education programs particularly regarding cognitive engagement. This study addresses that gap by examining the impact of the Genius Hour teaching strategy on the cognitive engagement of prospective teachers enrolled in a School Management course. By employing a pre-test/post-test control group design, the study found strong empirical evidence that Genius Hour had a profound and statistically significant impact on students' cognitive engagement levels.

Both within-group and between-group comparisons revealed substantial gains in post-test scores for the experimental group exposed to the Genius Hour approach. These participants not only demonstrated higher levels of intellectual effort, strategic learning, and reflective thinking, but also engaged more deeply with content in ways that promoted autonomy and critical inquiry. This supports the argument that inquiry-based, student-driven instruction fosters higher-order thinking, metacognitive awareness, and authentic learning, consistent with constructivist learning theory (Ryan & Deci, 2000; Dörnyei, 2001). The structure of Genius Hour centered on learner autonomy, self-direction, and reflection enabled students to take ownership of their cognitive processes in meaningful and personalized ways.

From a theoretical standpoint, this research contributes to the growing body of literature by empirically validating the application of Genius Hour as a strategy for enhancing cognitive engagement in teacher education, a domain where its impact has remained underexplored. The findings highlight the relevance of integrating such innovative pedagogical approaches into teacher training, especially in courses like School Management that demand both conceptual understanding and critical application.

On a practical level, the study offers valuable implications for curriculum developers, teacher educators, and policy makers. The success of Genius Hour suggests that teacher education programs should incorporate structured, student-led inquiry experiences that promote mental effort, problem-solving, and independent learning. Implementing Genius Hour can help cultivate reflective, cognitively engaged, and pedagogically skilled educators, who are better prepared to foster similar engagement-rich environments in their future classrooms.

Despite its strengths, this study acknowledges certain limitations. The sample was limited to a single course and institution, which may affect the generalizability of the findings. Future research should explore the cross-disciplinary and long-term effects of Genius Hour on cognitive engagement, and investigate additional related outcomes such as academic self-regulation, instructional creativity, or reflective teaching practices.

In conclusion, the study provides compelling evidence that the Genius Hour teaching strategy is a powerful model for enhancing cognitive engagement in teacher education. By promoting autonomy, inquiry, and deep intellectual involvement, Genius Hour not only

supports meaningful learning but also prepares prospective teachers to become innovative, critical, and reflective practitioners, capable of thriving in complex and dynamic educational settings.

Recommendations

- Teacher education programs may integrate Genius Hour to promote cognitive engagement and deeper learning.
- Future research may explore long-term effects of Genius Hour on cognitive engagement across diverse disciplines and student populations.

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