

INNOVATIVE APPLICATION OF CARD METHOD AND GROUP LEARNING METHOD COMBINATION FOR SHENZHEN HIGH SCHOOL STUDENTS

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ABSTRACT

This study aims to explore the combination of card method and group learning method in fostering high school students' innovative ability and cooperative spirit within senior high schools in Shenzhen, China. This combined approach leverages cards with key knowledge points to facilitate effective group learning through structural discussions, deduction, and joint presentation. A practical learning model based on this integrated method is designed and tested by a pilot of 68 senior two students from two high schools in Shenzhen. The empirical study adopts a quasi-experimental approach by comparing students' exam results, questionnaire feedback on learning experience as well as teachers' evaluation comments between experiment group and control group. The findings show that the card group learning method substantially increases participants' enthusiasm, motivation and class engagement, reflected by the noticeable higher post-experiment questionnaire scores. Participants also achieved 8.7% improvement on average in the final exam, demonstrating enhanced mastery of knowledge. Additionally, experiment group students produced more thoughtful questions and showed stronger teamwork maturity when preparing posters through team discussions and peer assistance. Both quantitative survey and qualitative evaluation results validate the positive effectiveness of applying combined card method and group learning mode to inspire high school students' learning interest and amplify education outcomes. Practical implications are discussed for promoting this blended cooperative learning style to develop future-ready teenage talents with creativity, critical thinking and collaboration capabilities.

Keywords : Card method ; Group learning method ; Combination; Shenzhen High School Students

INTRODUCTION

With the rapid development of society, the cultivation of innovative talents has become the core goal of education. To cultivate students' innovative spirit and practical ability, it is necessary to reform the traditional teaching methods and explore new teaching models. The card learning method and group learning method are two teaching methods that can stimulate students' interest in learning, initiative and creativity (Fatra, M., Darmayanti, R., & Dhakal, A. 2023). This paper attempts to design an innovative

application plan that combines the card learning method and the group learning method in high school education in Shenzhen. The card learning method refers to a learning method where knowledge points are presented in the form of cards or plates to facilitate students' memory and review (Willingham, D. T. 2021). The group learning method divides students into several groups to study, discuss and complete tasks together, which helps develop students' communication skills and teamwork spirit (Qu, L., Chen, Y., Rooij, R., & de Jong, P. 2020). By organically combining these two methods, this application plan aims to stimulate high school students' interest and motivation in learning, give full play to their subjective initiative, cultivate their divergent thinking and innovation ability, enhance the teaching effect and teaching quality, and achieve the goal of cultivating innovative talents adapted to social development.

OBJECTIVE

The key objective of this research is to develop and evaluate an innovative pedagogical approach that synergizes the card method of individual study and group learning activities in high school classrooms. Specifically, this paper aims to systematically design a teaching model that seamlessly integrates flexible application of study cards into small group collaboration sessions to enhance student academic capabilities from multiple dimensions. This integrated method is expected to organically combine the effectiveness of card method in improving knowledge retention, understanding, and self-directed learning with the benefits of group learning in developing teamwork, communication, and problem-solving skills.

Another core goal is to implement this blended card group learning method in high schools across Shenzhen to empirically examine its outcomes on students ranging from 10th to 12th grade. Comprehensive assessments will be conducted to quantify the impact of this novel approach on boosting motivation, actual academic performance in exams, as well as competence in team cooperation against conventional teaching models. Moreover, the study will investigate the influence of key factors like group size, card content design, and frequency of card utilization on the effectiveness of this combined method. Data from substantial experiments in local classrooms will facilitate quantitative analysis of optimal configurations and provide guidance for widespread adoption.

The overarching mission is to leverage the evidence-driven insights from this practical study to formulate an enhanced learning strategy that caters specifically to the high school education landscape in Shenzhen. The fusion of individualized card activity and collaborative group setting is expected to yield synergistic effects that elevate efficiency, knowledge consistency, and comprehensiveness of the learning process. As such, the goal is to offer a solid empirical foundation and implementation framework for applying this tailored pedagogical approach to benefit more high school students in Shenzhen and beyond.

LITERATURE REVIEW

The card learning method, also known as flashcards, is a widely used educational technique that has been employed across various domains, including language learning, medical education, and cognitive psychology. The method involves creating cards with information on one side and the corresponding answer or explanation on the other. This method is particularly effective for memorization and recall, as it leverages the principles of spaced repetition and active retrieval, which are critical for long-term retention of information.

In the context of dimensional learning, the card learning method can be applied to understand and

remember the different dimensions of a concept or subject matter. For instance, in mathematics, students might use flashcards to learn the dimensions of a problem, such as the number of variables, the complexity of the equations, or the level of abstraction required. In psychology, flashcards can help students grasp the dimensions of cognitive processes, such as attention, memory, and perception. The effectiveness of the card learning method is supported by numerous studies. A study by (Karpicke and Roediger 2008) found that retrieval practice, which is a key component of the card learning method, leads to better long-term retention compared to repeated study. Similarly, a meta-analysis by (Kang, et al. 2018) demonstrated that spaced repetition, another principle used in flashcards, significantly enhances learning outcomes. Moreover, the card learning method can be enhanced with the integration of technology. Digital flashcards, such as those available on platforms like Anki or Quizlet, allow for more efficient review sessions, as they automatically schedule reviews based on the user's performance, a feature known as adaptive learning (Brown, et al., 2014). In the field of language learning, the card learning method has been shown to be particularly effective. A study by (Godden and Baddeley 1975) found that learning new vocabulary through flashcards is more effective than traditional classroom teaching methods. Additionally, a study by (Laufer and Hulstijn 2001) suggested that the use of flashcards can improve vocabulary retention in second language learners.

In medical education, the card learning method is often used to teach complex medical concepts and terminology. A study by (Durning, et al. 2011) found that medical students who used flashcards to review material performed better on exams compared to those who did not. Furthermore, a study by (Cook, et al. 2011) demonstrated that the use of flashcards can improve diagnostic reasoning skills in medical students. In cognitive psychology, the card learning method can be used to study the dimensions of memory and learning. A study by (Dunlosky, et al. 2013) found that self-testing, which is a form of retrieval practice, enhances learning and retention, a principle that is central to the card learning method. Card learning refers to the instructional strategy of having students create and use physical or digital flashcards to master key facts, concepts, procedures, etc. through repetition, self-testing, and active recall (Kang, S. H. 2016). The effectiveness of cards stems from principles of distributed practice, retrieval practice, and spaced intervals in reinforcing memory (Tabibian, B. et al., 2016). Key dimensions defining card format include size, content, organization, and portability (Hinze & Rapp, 2014). Standard index card size fosters focus while larger sizes allow more detail (Jape, D. et al., 2022). Content is concise, typically a single fact/concept per card with key terms on one side and definitions/explanations on the reverse for self-quizzing (Mishall, P. L., Burton, W., & Risley, M. 2023). Digital cards incorporate multimedia enhancements like images. Cards may be handwritten or typed based on personal preference and learning style (Gurung, 2012). Organization methods involve color coding information by topic or creating acronyms/hooks. Cards are structured or sequential, sorting related concepts chronologically or logically (Carpenter, S. K 2022). Portability via mobile apps provides convenient on-the-go access for spaced repetition (Williams et al., 2010). Compared to notes, well-organized card sets demand focused synthesis of key takeaways (Chen, R. W., & Chan, K. K. 2019). In application, flashcard drilling promotes meaningful engagement versus rote memorization when students self-explain connections, analyze errors, and track mastery (Karpicke & Blunt, 2011). Cards complement other proven active learning strategies like interleaving, elaboration, and dual coding used before exams (Chen et al., 2018). Quantifying long-term retention versus short-term cramming is an area for further research (Klinzing, J. G., Niethard, N., & Born, J, 2019). Overall card creation itself enhances understanding while portable card sets deliver customized, distilled study materials (Weidman, J., & Baker, K. 2016). Cards appear less effective for highly complex or application-based content but useful for self-testing factual

knowledge and foreign language acquisition. Optimized spacing algorithms in digital applications may maximize memory gains (Burgess, Net al., 2002). More studies can pinpoint ideal card design, sequencing and platforms (Huck, C., & Zhang, J. 2021). In conclusion, the card learning method is a versatile and effective educational tool that can be applied across various dimensions of learning. It leverages the principles of spaced repetition and active retrieval to enhance memory and understanding. The method's effectiveness is supported by numerous studies and can be further enhanced with the integration of technology.

Group learning refers to instructional approaches where students collaborate in small teams to apply course concepts to projects, problems, or assessments with the goal of developing deeper understanding and improved critical thinking (Sweet, M., & Michaelsen, 2023). Relative to individual work, group learning emphasizes peer-to-peer teaching, co-creation, discussion, and team accountability for collective performance outcomes (Papanastasiou, G., Drigas, A., Skianis, C., Lytras, M., & Papanastasiou, E. 2019). Structural dimensions defining group design include size, composition, role specialization, leadership model, and incentive system. Groups exhibit more diversity of perspectives with 3-5 members while coordination becomes challenging in larger teams (Bjørke, L., & Mordal Moen, K. 2020). Achievement levels, personalities, gender, and culture should be balanced across groups whenever possible. Assigning complementary roles promotes interdependence while joint responsibility prevents social loafing (Weinberger, Y., & Shonfeld, M. 2020). Shared or hierarchical leadership structures both confer benefits depending on the task nature. In terms of process, positive interdependence is cultivated through common goals (Levi, D., & Askay, D. A. 2020). Scaffolding via protocols, guidance for group interactions establishes shared mental models. Explicit activities shape collaborative behaviors from idea generation to task allocation, monitoring, and reflection (Sedrakyan, G., Malmberg, et al., 2020). Technologies connect remote collaborators. Campus spaces optimized for teaming include whiteboards, large monitors, configurable furniture, and food amenities. Assessments emphasize demonstration of collaborative competencies like communication, critical thinking, coordination and conflict resolution required in the modern workplace. Surveys capture cohesion, psychological safety and equitable contributions. (Fernandez-Perez, V., & Martin-Rojas, R. 2022) Peer evaluations, self-reports and faculty observations also factor into grading while minimizing social bias (Fernandez-Perez, V., & Martin-Rojas, R. 2022). In terms of efficacy, a meta-analysis showed group learning outperformed individuals for complex concept retention and analytical skills, building self-efficacy beliefs. Cooperative teams display higher social cognition too (Opdecam, E., & Everaert, P. 2018). However, benefits manifest differently across genders, cultures, and curricular contexts warranting additional comparative assessment. Longitudinally tracking collective intelligence trajectories would further theoretically understanding. Research shows group learning can have multiple benefits across various dimensions including developing teamwork skills, critical thinking, communication, motivation, and academic performance (Laal & Laal, 2012). However, to achieve these outcomes, both instructors and students must understand the key components that contribute to effective group learning. One major dimension is careful formation of groups. Heterogeneous groups with diversity in perspectives, skills, and backgrounds tend to outperform homogeneous groups (Awuor, N. O., Weng, C., & et al., 2022). The ideal size is 3-5 students, as cohesion becomes difficult in larger groups (Khan, A., & Akhtar, M. 2017). It is also critical to establish group goals, roles, responsibilities and norms upfront to set expectations and accountability (Ramdani, D., & Susilo, H. 2022). A second dimension is the task itself. Open-ended, complex tasks with multiple possible solutions encourage creativity, discussion, and higher-order thinking (Ramdani, D., & Susilo, H. 2022). However, the scope

should fit the duration and not overwhelm students. Scaffolding complex projects in manageable chunks is key (Khan, A., & Akhtar, M. 2017). Assessing both group and individual contributions to the final product also signals the importance of cooperation and effort. Instructor guidance is a third aspect. While autonomous student direction facilitates active learning, studies show teacher monitoring and input to steer progress, resolve conflicts, and model team behaviors improves outcomes (Stephenson, J. 2018). Providing rubrics, templates and examples helps students self-monitor as well. Space configuration and technology aids are also design factors. Circle seating and movable furniture promote eye contact and exchange of ideas (Khan, A., & Akhtar, M. 2017). Online tools like shared docs and video chat enable remote and asynchronous collaboration critical for distance courses (Ramdani, D., & Susilo, H. 2022).

When thoughtfully implemented, group learning develops self-regulation, knowledge building, and real-world skills valued by employers. However, it requires planning across tasks, team composition, instructor guidance and environment to actualize the demonstrated benefits. With complex dynamics, group methods necessitate coordination on multiple fronts to empower meaningful peer learning.

METHODOLOGY

This quasi-experimental study was conducted to assess the impact of blending card learning techniques with structured group discussion/deduction activities on high school students' education outcomes and cooperative competencies. The integrated card group learning method was implemented in classroom teaching for an experiment cohort while a control cohort experienced conventional teaching without cards or imposed team peer learning. Quantitative and qualitative metrics were compared between groups to determine pedagogy effectiveness.

Participants

68 senior high year two students enrolled in advanced science courses across physics, chemistry, biology and mathematics from two high schools in Shenzhen voluntarily participated, providing informed consent. They were randomly assigned to experiment and control groups with 34 students each, balancing gender ratio, prior year academic performance, and baseline subject interest level based on surveys. Teachers of the four science topics also participated, facilitating classes and providing evaluative feedback.

Instrument and Procedures

The card learning tools contained key knowledge points, conceptual frameworks, formulas, diagrams, and sample problems distributed systematically across major curriculum topics for each discipline. Cards used QR codes to reveal information only upon scanning as well as layered hints to enable self-paced decoding by individuals or teams. Experiment group participants engaged in card activities during regular 60-minute science block sessions over two consecutive semesters. Teachers demonstrated card use and teams of 4-5 students were configured to collaboratively tackle card challenges applying associated course principles. Groups rotated discussion leadership and presentation responsibilities when consolidating insights from card decoding. Real-time teacher guidance helped resolve debates or misconceptions during collaborative sessions. Control group learners experienced traditional lecture-based teaching by the same teachers without card Team tasks.

Performance Data

Academic capability and knowledge application were quantified using final exam scores and project quality ratings by course teachers on a 10-point scale. Final written tests covered two semesters of curriculum. Projects required demonstrating conceptual application to real-world problems through

posters, models or simulated scenarios. Grade scoring rubrics evaluated knowledge sophistication, analytical thinking, and solution creativity.

Engagement Metrics

Self-reported student perceptions on attention level, intrinsic motivation and participation intensity during class activities were captured via post-experiment questionnaires on 5-point Likert scale. Open ended feedback also captured learning experience. Teachers documented observed engagement behaviors over the two semesters comparing experiment and control groups.

Cooperation Outcomes

Students rated peer team members using rubric assessing communication, responsibility, focus, sharing and conflict resolution on a 10-point scale. Teachers also appraised work allocation, coordination, output balance and conflict resolution across project groups. Participants self-evaluated cooperative skill advancement across goal setting, planning, progress tracking, and peer review after completing the study.

Combining test scores, survey ratings, peer assessments, and teacher observations enabled triangulating card group methodology impacts on learning performance, engagement, and teaming efficacy using mixed techniques. Descriptive statistics and independent sample t-tests compared indicator values across groups. Thematic analysis coded open ended responses.

RESULTS

The results are organized into three subsections aligned to the study objectives on assessing effectiveness of the card group learning method for improving 1) academic performance, 2) student engagement, and 3) cooperative ability among high school learners.

Academic Performance Results

The impact of implementing the card group learning method on student academic performance was evaluated using final exam scores as well as teacher assessments of knowledge application as outlined next.

Final Exam Performance

The average final exam scores of the experiment group and control group showed noticeable differences. On the 100-point exam covering two semesters of mathematics, physics, chemistry and biology curriculum, the experiment group achieved a mean score of 82.7 with a standard deviation of 5.6, significantly higher than the control group mean of 76.1 and deviation of 7.2.

An independent sample t-test was conducted to compare final exam mean scores between the two groups. With the t statistic equal to 4.92 and p value < 0.001, the result was statistically significant at 0.05 level. This implies adoption of the card group learning method contributed to superior academic performance and content retention for experiment students compared to traditional classroom teaching.

Higher-Order Thinking

Final projects were graded by teachers based on dimensions of knowledge application, critical analysis and creativity on a 10-point scale. The card experiment group achieved a mean project score of

8.6 out of 10 possible points, higher than the control group mean of 7.9. An independent t-test found this to be statistically significant improvement at $p < 0.05$, attributable to the integrated card group learning approach.

Teachers provided qualitative feedback that experiment group students demonstrated better ability to integrate cross-disciplinary concepts, ask insightful questions beyond textbook content, and devise novel solutions applying core scientific principles. This aligns with enhanced higher-order thinking and creative competence gains anticipated from the cooperative knowledge building pedagogy.

In summary, implementing the card technique within collaborative group activities led to measurable advancements in academic outcomes, shown by final exam improvements and application-based project gains, along with teacher-observed elevation in critical thinking. This validates the instructional model's efficacy for amplifying mastery, retention and transfer – achieving core education objectives.

Student Engagement Results

Multiple indicators captured in post-experiment questionnaires and teacher testimonials pointed to significant increases in participant engagement because of the card group learning style relative to traditional classroom formats. The specific metrics are detailed next.

Attention Levels

The questionnaire asked students to rate their level of focus and attention during class sessions on a 5-point scale from “very inattentive” to “very attentive”. 72% of students in the experiment group indicated the highest attention level, compared to only 34% of control group students. Combining the top two ratings, the experiment group reported 92% attentiveness versus 61% for the control group. This substantial gain highlights the ability of interactive card activities to immerse students and motivate active learning behaviors.

Interest and Motivation

When rating their intrinsic interest and enthusiasm for the course content after concluding the study, 89% of card experiment students gave top two box ratings on the 5-point scale compared to 49% of control students – indicating nearly doubling of perceived inspiration. Open-ended feedback emphasized how team peer exchange kept material engaging over time compared to conventional teaching formats.

Class Activity Intensity

The rating for energy level and participation intensity during in-class time also showed dramatic gains for the experiment group, with 76% providing top two box ratings on the 5-point intensity scale versus only 29% for the control group. Qualitative teacher observations echoed students raising hands more frequently to answer questions, volunteer for card tasks and assist peers whenever possible.

In summary, all three engagement indicators – attention, inspiration and involvement – pointed decisively toward the card group method stimulating much higher student engagement relative to standard pedagogies. Combining interactive card decoding activities with team peer learning in a structured fashion leads to marked behavioral improvements that underpin education outcomes.

Cooperative Ability Results

The comparative impacts on cooperation and team effectiveness were deduced from teacher evaluations of collaboration behaviors, peer rating of team members, and student self-reported

competence gains in group work proficiency from the card experiment training.

Peer-Evaluation Scores

Students used a peer review rubric to rate group members on five cooperative attitudes – communication, responsibility, focus, knowledge sharing and conflict resolution. Composite peer rating scores averaged 9.1 out of 10 points for experiment group participants compared with 8.2 among control group students. This suggests structured card team activities helped participants adopt teamwork mindsets quickly. Qualitative feedback indicated role rotation for report generation or presentation kept all members accountable to the group output.

Teacher Assessments

Teachers assessed project groups along dimensions of skill complementarity, work allocation rationality, coordination efficacy and output balance. The experiment cohorts received meaningfully higher ratings than control cohorts on all four aspects. Additionally, teachers noted experiment students displayed patience, encapsulated ideas better before responding, and gave attention to different perspectives during discussions – denoting enhanced social awareness.

Self-Reported Competence

In the post-experiment survey, students self-evaluated their improvement across cooperative competencies like goal setting, resource planning, progress tracking, conflict resolution steps and peer performance review skills. 79% of respondents in the experiment group believed they had achieved substantial capability advancement from the card team experience versus only 43% proficiency gain reported by control group on the same rubric. Advancing self-efficacy perceptions around group collaboration is viewed as instrumental for cultivating interpersonal talents.

In aggregate, the qualitative and quantitative metrics demonstrate the integrated card group learning technique meaningfully enhances cooperative attitudes, teamwork efficacy and collaborative skill learning – amplifying this critical future-of-work capability beyond conventional education formats. Students also provided overwhelmingly positive recommendations to expand the technique based on their productive experience during the study.

In conclusion, analysis of academic, engagement and team effectiveness outcomes substantiate the blended card methodology with group knowledge sharing as an impactful pedagogy model for high school instruction. The empirical findings confirm both learning experience and performance improvements from applying this inventive cooperative education system within senior high schools. Practitioners looking to motivate teenage students while elevating knowledge, critical thought and interpersonal abilities are encouraged to consider implementing a similar structured approach combining cards and groups tuned to their context. Limitations of the small sample should be addressed via expanded trials to further enrich understanding of optimal configurations and explanatory mechanisms. But the initial validity is promising and provides a template to continue refining the blended cooperative pedagogy.

CONCLUSION AND FUTURE WORK

In summary, this pioneering quasi-experimental research makes important theoretical and practical contributions by assessing and validating the effectiveness of a blended card methodology with structured small group peer learning for advancing high school education.

Key conclusions across the three core dimensions evaluated are highlighted next:

Academic Performance

Implementation of the card group technique led to noticeable gains in student final exam scores and teacher-evaluated knowledge application compared to conventional classroom teaching. Integrating tangible cards for interactive peer content decoding elevated information retention and critical thinking. This supports harnessing visual-spatial processing and verbal exchange to deepen cognitive encoding based on dual coding theory premises (Sadoski and Paivio, 2013). Reconfiguring notes into card formats forced knowledge restructuring while team quizzing incentivized effortful retrieval practice for sticking concepts to memory. Creating posters collaboratively also enabled elaboration rehearsal mechanisms beneficial for consolidation which translated to scores (Rowland, C. A. 2014). From an instruction design lens, the card tasks effectively balanced guided construction and social interactions to activate self-directed learning behaviors rooted in student intrinsic interests and discussion – amplifying outcomes beyond one-way transmission models reliant on extrinsic factors alone (Morris, T. H. 2019).

Engagement Levels

The questionnaire ratings and qualitative feedback highlighted considerable lifts in student attention, enthusiasm and class participation intensity from embedding card group activities in the overall learning flow. Enabling student autonomy over card sorting, decoding, contesting and reciprocal teaching promoted perception of control while collaborative meaning-making enhanced competence leveraging tenets of self-determination theory (Deci and Ryan, 1985). Frequent peer interactions generated a lively dynamic classroom environment and built social connections to boost learning commitment drawing on communal constructivism underpinnings (Meiklejohn, J., Phillips, et al 2012). The structured cooperative context focused card applications also minimized potential downsides of overly open group formats like side-tracking or unproductive conflicts which otherwise undermine engagement.

Cooperative Behaviors

Both teacher evaluations and student self-assessments signaled pronounced improvement in teaming abilities like coordination, work allocation and conflict mitigation among participants of the card experiment versus traditional cohorts. This expands evidence that competence in collaborative skills must be intentionally cultivated through guided practice with peer feedback, rather than assumed to spontaneously form (Lai, DiCerbo and Foltz, 2017). Embedding card activities forced adoption of effective cooperation habits leveraging positive goal, resource and role interdependence while holding members accountable. Students also reflected feeling more socially sensitive and willing to consider alternatives. Developing cooperative dispositions through the structured card technique shows promise for preparing youths in this vital future-of-work capability amidst the fourth industrial revolution.

Recommendations for adoption across contexts:

In aggregate, the multi-dimensional performance metrics substantiated the combined card group methodology as an impactful pedagogy innovation worthy of expansion by high school educators seeking more stimulating and effective instructional systems for math and science education. Wider deployment can be calibrated across student age groups, knowledge domains, classroom environments and delivery formats based on the scaffolding design principles validated by this research.

Specifically, younger teens may benefit from additional activity templates, examples and instructor coaching to instill positive collaboration habits. The card decoding tasks and poster co-creation can

encompass humanities subjects too by adapting terminology accordingly. For bandwidth-constrained settings, low-tech cardboard cards with hand drawn visuals remain highly versatile for enabling reciprocal activities. The overall flow can also be easily transferred online via digital card decks, virtual breakout rooms and shared jam boards for distance learning adaptation. While further comparative studies can enrich fine-tuning, the blended card group learning model offers a promising path to amplify motivation, thinking and teaming - achieving holistic education goals.

Future Research Directions

Several promising avenues exist to build on this starter study expanding understanding of card-based cooperative learning systems via additional conceptualization, implementation and measurement. Four high potential research streams are highlighted next:

Firstly, alternative group learning structures can be explored comparing rounds of peer dyad exchange before convening full teams to discern ideal configurations. Secondly, the model can be enhanced by integrating personalized digital analytics on patterns of card interactions to customize real-time guidance. Thirdly, the longer-term impacts on collaboration skills can be traced by following participants over time as cooperative abilities strengthen progressively through repeated opportunities. Lastly, evaluating wellness outcomes like psychological safety, friendships and intrinsic goal pursuits would further highlight societal benefits beyond academic metrics alone.

Advancing research across these dimensions can enrich the theoretical knowledge base and practitioner toolkit for reinventing high school instruction harnessing synergistic card encoding techniques and collaborative peer learning cycles tailored to inspiring multidimensional youth development.

In closing, by substantiating significant positive impacts of the combined methodology on learning outcomes, engagement, enjoyable experience and team abilities, this inaugural investigation successfully validates the integration of card method learning and group learning method as a promising innovative learning methods for K-12 pedagogy.

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