The Academic
International Journal of Multidisciplinary Research

An Online Peer Reviewed / Refereed Journal
Volume 3 | Issue 5 | May 2025
ISSN: 2583-973X (Online)
Website: www.theacademic.in

Optimising Group Formation in Collaborative Learning Environments for Grade 9 Students in India: A Theoretical Framework

Mohini Singh
PhD Scholar & Professor, Department of Education, Faculty of Education, Swami Vivekanand Subharti University, Meerut (U.P.) – 250005

Dr Indira Singh
saxenamohini89@gmail.com

ARTICLE DETAILS

Research Paper

Accepted: 22-05-2025

Published: 10-06-2025

Keywords:
Collaborative Learning; Group Formation; Secondary Education; National Education Policy 2020; Online Learning; Offline Learning; Inclusion; Indian Context

ABSTRACT

This theoretical paper investigates the most effective methods for establishing student groups in collaborative learning environments, with a particular emphasis on Grade 9 classrooms in India. In accordance with the National Education Policy 2020 and rooted in social constructivist and developmental theories, we investigate the potential of thoughtful group formation to improve social skills and learning outcomes. We examine the recent literature regarding group composition, formation methods (teacher-assigned, self-selection, random, and algorithmic), and compare offline and online grouping strategies in the context of heightened digital learning. We suggest a framework for optimising group formation that prioritises adaptability to context, experiential learning, and inclusivity, based on these insights. The framework combines contemporary research with classic principles (Vygotsky, Piaget, Erikson) to assist educators in the formation of equitable, collaborative, and effective learning groups. We conclude with a discussion of the role of teacher training, future research directions, and implementation in Indian classrooms.

DOI : https://doi.org/10.5281/zenodo.15661673

Introduction

Collaborative learning is a widely used teaching format in higher education that allows students to share knowledge in self-directed learning environments. While some authors distinguish between collaborative and cooperative learning (Dillenbourg, 1999), others highlight their similarities (Kreijns et al., 2003). We follow the conclusions of Kirschner (2001), who emphasises commonalities, and use the term collaborative learning as "an umbrella term for various instructional approaches to small group learning" (Yang, 2023) throughout this study. Collaborative learning settings have been implemented worldwide for decades in educational contexts (Hmelo-Silver et al., 2013). Collaboration is anticipated to foster learners social competencies and motivation, as well as to promote deeper learning and understanding (Gillies, 2016; Ginsburg-Block et al., 2006; Hanson et al., 2016; Kyndt et al., 2013). Collaborative learning involves small groups of students working together to achieve educational goals, which improves critical thinking and social skills. (Bach & Thiel, 2024) The **National Education Policy 2020 (NEP 2020)** in India also emphasises collaborative learning, which promotes 21st-century skills. NEP encourages teachers to implement group projects, peer discussions, and transdisciplinary activities.

The COVID-19 epidemic caused a sudden transition to online learning, creating new collaborative learning difficulties and possibilities. Lack of physical presence affected communication and bonding in virtual student groups formed by teachers utilising video conferencing or learning management systems. (Lee & Sharma, 2024) Studies post-2020 suggest that online student teams may achieve similar outcomes to traditional classrooms with the right tools and techniques but may struggle with coordination and a lack of community without help. (Gaad, 2022) Effectively structured teams may use diversity to improve problem-solving, encourage teamwork, and provide a supportive atmosphere. Despite a lot of scholarly research on group and team learning (e.g., Connell et al., 2023; Fischer et al., 2023; Karimi and Manteufel, 2020; Samudra et al., 2024), teachers still evaluate these issues because the answers will vary by course and context across disciplines and educational settings. The following research questions guided the present study:

1. What grouping strategies and criteria best support collaborative learning outcomes at the secondary level?
2. How might these strategies differ between offline and online settings?
3. How do they align with the NEP 2020's objectives of collaboration, inclusion, and experiential learning?

Theoretical Foundations and Educational Theories

Social constructivism, specifically Lev Vygotsky's theory that knowledge is generated via social interaction, underpins collaborative learning. The Zone of Proximal Development (ZPD) is the gap between a learner's ability to do it alone and with peer or adult aid. Collaboratively working in ZPDs helps students scaffold learning. Vygotsky felt collaborative learning allowed students to learn from each other and improve communication and teamwork. Peer interaction, inquiry, and explanation boost cognitive development more than solo learning. Working in groups helps Grade 9 pupils understand hard issues by letting them share their thoughts and debate others.

Jean Piaget's theory of cognitive development says that by age 11 kids enter the **formal operational stage of cognition** and can reason logically about abstract ideas and hypothetical scenarios. Piaget felt peer engagement may improve cognitive growth when students resolved socio-cognitive disputes. In collaborative learning, Grade 9 students may need to clarify their ideas or discuss an answer with classmates, which can challenge and inspire introspection. This supports Piagetian theories that such encounters actively build knowledge.

Erik Erikson's psychosocial theory exposes Grade 9 students' social-emotional foundation. Successful collaborative groups help youngsters communicate, negotiate responsibilities, develop empathy, and feel connected. Erikson believed that group learning may help kids develop integrity and identity by allowing them the ability to play several "roles" (team leader, note-taker, presenter) and receive peer judgement. Teen psychology research demonstrates that peer cooperation helps kids listen, respect variety, and settle disagreements. Positive interdependence, individual accountability (each member is responsible for a portion of the work), face-to-face promotive interaction, social skills, and group processing (reflection on teamwork) lead to positive learning outcomes (Johnson & Johnson, 2009). How a teacher structures a group influences team interdependence, skill variety, and student dependability.

Diverse vs. homogeneous groups: heterogeneous groups have kids from varied origins, achievement levels, and other traits, while homogeneous groups are similar. Classic studies (Slavin, 1995) recommended heterogeneous ability grouping since lower-ability students benefitted from engaging with higher-ability peers and higher-ability students improved by teaching others. (Müller et al., 2024) did extraversion-based personality classification; all-high-extrovert or all-introvert groups were happier than

mixed. **Bruce Tuckman's group growth stages—forming, storming, norming, performing, and adjourning—**are crucial beyond formation. In the forming stage, students meet and roles are uncertain. When personalities and ideas clash, "storming" may occur; with effective facilitation, groups build norms and coherence and work smoothly towards goals. A teacher who introduces group members' talents and offers initial tasks may ease the forming and storming stages. Grade 9 youngsters are new to formal group work and need support.

Literature Review

Group Formation Strategies in Educational Settings:

Educators typically use one of three broad strategies to form student groups in classrooms: have students choose their own groups (*self-selection*), assign students to groups deliberately (*teacher-selected*), or assign randomly. A fourth emerging approach in research is *algorithmic grouping*, using computer algorithms to form groups based on specified criteria (e.g., ensuring heterogeneity). Each method has potential advantages and drawbacks, and recent studies have sought to compare their effects on performance and engagement.

(Bergtold & Shanoyan, 2024) In an experiment on group formation tactics in higher education, with implications for secondary education, researchers contrasted random assignment, student self-selection, and instructor assignment based on GPA or math skill. Results indicate that academically grouped students with similar GPA or ability levels initially do better on group tasks than random groups. The study discovered that self-selected groups performed better as students got to know one another, suggesting timing is crucial.

Simple random grouping encourages kids to work with classmates other than their friends. True random groups prevent prejudice but may create uneven teams (e.g., one group may be all strong students and another all weak students). Bergtold and Shanoyan's study and other literature reviews (Karimi & Manteufel, 2020; Samudra et al., 2024) found no general solution to these challenges; therefore, teachers struggle. Hwang et al. (2008) and Moreno et al. (2012) found that group composition improves learning and skill development. Based on several parameters, Wang and Kojima (2018) optimised group formation using mathematical programming. Algorithmic grouping surveys students on academic capabilities, learning preferences, etc., and groups them to maximise variability or whatever the teacher

wants. Muller et al. (2022) used psychological traits, whereas Louvain (2024) built online student groups. Innovative teaching uses data.

Grade 9 teachers in India, who teach 30–50 pupils, may benefit from a blended approach. Teachers may assign groups for significant projects based on prior exam achievement or language competency but enable students to choose partners for simpler activities or as rewards in subsequent assignments.

Considerations for Optimal Group Composition

Ability and Prior Knowledge: Academic heterogeneity is most explored. Higher-performing students can teach lower-performing ones in a mixed-ability group, reinforcing their comprehension. It can help avoid "stacked" groups of strong students who complete quickly and get bored while another struggles. If the gap is too large, higher-performing students may dominate and lower-performing students may become inactive. GPA-based classification initially revealed minor performance gains, according to Frontiers (2024). According to Connell et al. (2023) (cited in Bergtold & Shanoyan), moderate heterogeneity works best: groups should be balanced so each has some stronger and weaker students, but not so extreme that there is no common ground. Recent computational methods (Wang & Kojima, 2018) show that various learning features improve interaction.

Collaboration promotes social integration across gender, socioeconomic, and cultural differences. The NEP 2020 promotes gender equality and inclusive education for marginalised groups. Forming groups with kids from different socioeconomic backgrounds or languages promotes empathy and peer support in multilingual classrooms. The instructor may need to use team-building exercises to foster respect if there are significant prejudices or communication barriers. Few empirical studies have examined socio-economic mixing in groups, but inclusive education research implies that heterogeneous grouping improves all students by representing real-world diversity (Sharma, 2021).

Social skills and extraversion affect group interaction. A shy, quiet kid may not speak up in a group of boisterous peers, but a shy group may struggle. Müller et al. (2024) found homogeneous-by-extraversion grouping increased pleasure, but performance and learning must be addressed. Introverted students may gather well but need outside help to dispute. In Indian schools with close-knit buddy groups, dividing students into teams may increase peer interaction, but removing a youngster from all

pals may impair morale. A balanced strategy can place pairs of friends in different groups so everyone knows someone, preserving comfort and expanding networks.

Group Size: Although not a "composition" criterion per se, size is crucial. Research indicates the best results often come from groups of 3 to 5 students. Groups of **four** are commonly cited as optimal for balancing diversity and ensuring everyone can participate. Larger groups (6+ members) tend to allow some students to hide or become passive, and coordination becomes harder. Very small groups (pairs) are easier to manage but offer less variety of input. Therefore, our framework will assume groups of roughly 4 students, unless a task's nature dictates otherwise.

Offline vs Online Group Formation

It is crucial to compare offline and online group formation strategies, especially since secondary education is increasingly adopting blended learning and must be resilient to shifts (as experienced during pandemic lockdowns).

Offline (Face-to-Face) Environments: In a traditional classroom, group formation often happens either before class or spontaneously during class. The advantages of offline settings include rich communication channels (verbal and non-verbal cues), immediate feedback loops, and easier building of trust and camaraderie through in-person contact. Students in Grade 9 generally have ample opportunity to interact informally, which can strengthen their working relationships. However, offline grouping can be constrained by seating arrangements and by time. A key aspect of offline grouping is the teacher's physical oversight. **Flexibility** is a strength of offline grouping; it is relatively easy to try different group combinations over a series of classes. On the flip side, students may form unspoken hierarchies or social barriers.

Online Environments: Online collaborative learning in secondary education typically occurs via video meetings, forums, or educational platforms that allow group work (e.g., Microsoft Teams, Google Classroom, Zoom breakout rooms). Online group formation can take place manually by the teacher (assigning students to breakout rooms or project groups on an LMS) or automatically by the system (shuffle participants). Without the ease of physical proximity, teachers must often pre-arrange groups. Access to technology is a crucial factor; during the COVID-19 remote learning phase, many Indian students had limited internet or device access, which made group work difficult (Nambiar, 2020). This

digital divide must be considered when planning online group activities—teachers might need to form groups based on who can be online at the same time or pair students such that at least one has good connectivity to lead the online session. Mustakim and Adha (2021) observed that even tech-savvy teachers faced trouble fostering true collaboration when students were geographically dispersed.

However, studies also show that when properly facilitated, **online collaborative learning (OCL)** can be as effective as offline. Meta-analyses before and during the pandemic (Nguyen, 2015; Bernard et al., 2014; Means et al., 2010) have found that learning outcomes in online environments can match or even exceed those in traditional classrooms. In collaborative contexts specifically, certain benefits emerged: for instance, some shy students found it easier to voice their thoughts through typing or moderated turns in virtual discussions, levelling the playing field. Tools like shared documents enable simultaneous contributions and can track individual input, thus aiding accountability in a way that is harder to do in an unrecorded physical discussion. A 2022 study by Villano Gaad on OCL in high school science found improved student achievement and engagement post-intervention, attributing it to structured online activities like "Think-Pair-Share" using Google Docs.

Equity and Inclusion: Online learning during COVID exacerbated inequalities; not all students could participate equally. A study of Indian school children's online learning experiences reported that lack of peer interaction was a major complaint, and those who managed to collaborate did so via phone calls or WhatsApp outside formal classes (Kulkarni, 2021). Thus, an optimal strategy might be to **blend offline and online**: for example, when schools reopened in hybrid mode, teachers could assign some group tasks to be done in class and some online, possibly keeping the same group composition so they can use both modes to their advantage.

Table 1. Comparison of offline and online group formation and collaboration strategies:

Aspect	Offline Collaborative Groups	Online Collaborative Groups
Formation Timing	Can be formed on-the-fly during class or pre-assigned by teacher.	Often pre-assigned before session.
Communication	Face-to-face: rich verbal and non-verbal cues, immediate feedback.	Via video/audio or text: requires turn-taking, fewer non-verbal cues.
Social Presence	High – physical proximity fosters accountability and bonding.	Lower – need deliberate efforts to build trust and community feeling.

Technology Needs	Minimal (perhaps pen and paper, chart paper for group).	High – devices, internet, collaborative software or LMS needed.
Monitoring by Teacher	Teacher can circulate, overhear multiple groups at once.	Teacher enters one breakout at a time; harder to get holistic view.
Flexibility to Reconfigure	High – can regroup mid-class if needed.	Low during a live session – regrouping requires technical steps; more static per session.
Typical Group Size	4–5 students (moderate sized groups work well in person).	2–4 students (smaller groups often better online to manage interaction).
Challenges	Dominant personalities can overshadow others; shy students may hesitate face-to-face.	Technical issues, varying participation, scheduling outside class.
Advantages	Natural human interaction, easier to engage and motivate, spontaneous discussion and brainstorming.	Can connect students across distances; shy students may feel more comfortable contributing via chat; tools can record work (version history, etc.).

Both offline and online environments can host effective collaborative learning, but they require different scaffolds. The literature suggests that **the fundamental principles of good group formation remain consistent** (balance of skills, clarity of goals, fostering interdependence), but the implementation tactics differ.

Collaborative Learning in the Indian Context and NEP 2020

In India, collaborative learning and optimal group formation have specific facilitators and barriers. The National Education Policy 2020 promotes participatory, student-centred practices as a catalyst. Pedagogies that are "more experiential, holistic, inquiry-driven, discovery-orientated, learner-centred, [and] discussion-based" are explicitly encouraged. Group projects, cross-disciplinary activities, and peer tutoring support this aim. However, Indian schools confront constraints like curriculum and testing pressure; overcrowding; linguistic differences; cultural aspects; etc. Many Indian teachers were trained in didactic contexts and may not have handled collaborative classrooms. (Gupta & Lee, 2020).

Kumar (2021) tested cooperative scientific learning in an Indian secondary school and found that it improved problem-solving over lectures. Like us, each team had a rotating group leader and a mix of high and low achievers, which helped them succeed. Action research in a Delhi CBSE school (Sharma, 2022) demonstrated that teaching group work standards and assigning varied teams for a term enhanced academic performance, class cohesion, and quieter students' confidence. Also, NEP 2020 links experiential and transdisciplinary learning to collaborative learning. Implementing these through group projects is natural. A team of students can contribute skills from science, social studies, and art to a "sustainable living" project.

Proposed Theoretical Framework for Optimising Group Formation

The proposed **conceptual framework** outlines key considerations and steps for forming student groups optimally in collaborative learning contexts for Grade 9. The framework is meant to be a flexible guide rather than a strict formula, recognising the dynamic nature of classrooms. It emphasises **contextual decision-making**: teachers should weigh factors specific to their class (academic levels, personalities, resources, mode of instruction) and possibly iterate grouping over time.

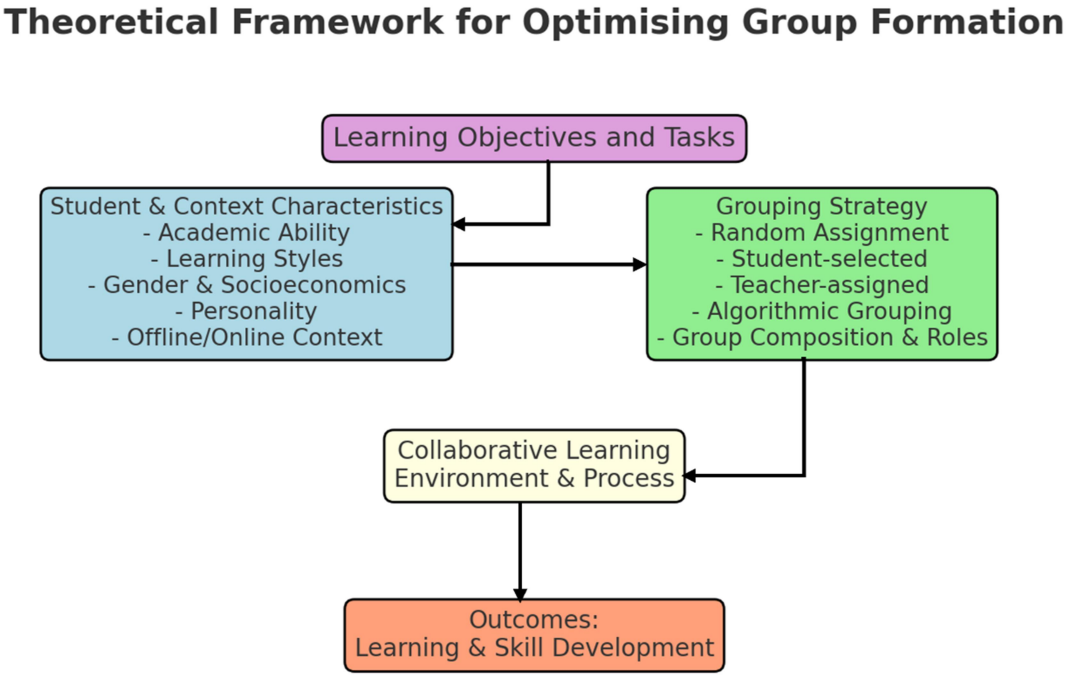

Figure 1: Conceptual Framework for Optimising Group Formation in Grade 9 Collaborative Learning.

1. Establish Learning Objectives and Tasks

First, set the group learning objectives. Is the aim cerebral (mastering a concept, finishing a project, overcoming hurdles) or social (teamwork, class cohesion)? Group organisation depends on the task—a short in-class exercise, lab experiment, weeks-long project, or peer-review session. A brief discussion may work with random grouping, but a complex project with several themes may benefit from purposefully diverse groups to ensure multiple skills/knowledge bases. Teachers should define academic goals, skill objectives, time restrictions, lab equipment availability for all groups, etc. for each collaborative activity.

2. Assess Student & Context Characteristics

- Academic profiles: Students Academically diversified or homogeneous class? Find students that need guidance or might lead.
- Diversity and Inclusion Needs: Consider gender, special education, language, and social dynamics (friend groups, isolated students).
- Personality and Social Skills: Identify cooperative and conflict-prone students. Find couples that work well or poorly.
- Choose offline, online, or hybrid learning. When pairing students online, make sure one has consistent internet.
- Group size (typically 4) depends on task and class size. If class size isn't even, 3 or 5 groups are good, but plan for extras or lone pupils.

The stage gathers “data” for grouping. A teacher may create a simple chart listing students, their assessed success level (high/med/low), notes (ELL, “very shy”, “natural leader”), and friendships. This balances teams purposefully.

3. Choose a Grouping Strategy

Select the best grouping strategy for objectives and factors:

- Use teacher-assigned groups for accuracy. Based on inputs, group students for balance. For a science project, each group might have 1 strong, 2 medium, and 1 weak science student, mixing genders and minimising introverts.

- Random Assignment: Save time by assigning low-stakes, fast exercises or neutrally mixing pupils out of their comfort zone. The teacher can alter semi-random grouping from a baseline.
- Student Self-Selection: Use for motivation, choice, or self-regulation (e.g., "choose a partner to peer-review homework"). The teacher may put light limitations (such as you can't have four close pals or each co-ed group must have at least one boy and one girl) to maintain balance. When coordinating meeting times is difficult online, self-selection might help friends interact outside of class.
- Algorithmic/Tool-Supported: Use LMS features or scripts to generate group suggestions based on criteria. Some learning management systems let teachers enter a custom parameter (such as a competency level or survey result) and auto-create heterogeneous groups. A teacher can imitate an algorithm by sorting and distributing students on paper.

A blended approach often works best. Bergtold & Shanoyan (2024) suggest starting the term with teacher-assigned heterogeneous groups for a fundamental project, building teamwork, and then allowing students to create their own groups for a project of their choice. A metacognitive benefit is that students can compare outcomes from different categories. Also, consider rotation. During the school year, reshuffle groups after significant projects or every 4–6 weeks to provide pupils a variety of classmates. Rotation reduces poor groupings and ensures social mixing.

4. Arrange Group Roles

After selecting a method, form groups and plan basic structuring:

- **Group composition: Determine group members.** Verify that each group is balanced and no student is disadvantaged. Avoid placing the only student who struggles with English in a group with three extremely fluent and fast-working peers without support. If necessary, assign the student a role that plays to their strengths, such as being the artist in a science project. Double-check inclusion: place socially isolated students with at least one empathetic or welcoming classmate, not all strangers.
- **Assigning roles** (if applicable) can structure collaboration, especially for younger secondary pupils or novice collaborators. Facilitator (keeps discussion continuing), recorder (takes notes), reporter (presents results), timekeeper, researcher, custom roles. The goal is to involve everyone

and highlight strengths. Making a timid student the "recorder" provides them a significant role without requiring public speaking.

- **Set Group Norms:** Communicate group behaviour norms**.** Teacher-student collaboration can do this. Respect all views, listen intently, everyone contributes, handle differences respectfully (by voting or taking turns), etc. In offline classes, you might remind these vocally; online, you might publish them in the chat or LMS.

5. Implement and monitor collaborative learning.

After groups are created and given tasks, the teacher facilitates and monitors:

- Moving around the classroom or between breakout rooms helps you see dynamics. Check if group formation is working early. Are pupils interested? Are any excluded? Take notes on concerns.
- If necessary, the instructor can interfere in a dysfunctional group (e.g., open dispute or non-participation). Minor coaching can help ("Why don't we hear from X? We haven't obtained his input yet," or "It seems you two have different perspectives; let's outline the pros of each." The teacher may merge an online group if a student leaves unexpectedly mid-task. The design enables spontaneous grouping modifications if unexpected issues arise.
- After a large group activity, encourage groups to reflect on their collaboration—what went well, what went wrong, and how they solved it. A brief conversation or survey will do. Students can provide feedback on the "inputs" for next time (e.g., if they had problems with group size or composition, which you consider in the future).

Academic verification ensures the group is conceptually on track. From a group formation standpoint, the teacher collects data on how well the chosen strategy and composition function. If all quiet students aren't communicating, you may need to modify group composition or provide a mini-lesson on communication.

6. Assess Outcomes

Assess academic and process outcomes at the end of the activity or project. Did groups meet the learning goal? Did they work well together? Assess this with teacher and student feedback:

- A group that succeeds academically but one individual does all the effort is not collaborating well.
- If a group struggled but improved with amazing teamwork, that's still a partial success. Maybe the assignment was challenging, not the grouping.
- Did certain groups regularly outperform others? If so, why? Was it composition? their plan? Individual factors? If a group with all low achievers did poorly, this could inform future grouping (heterogeneity is needed next time).

The teacher decides if future grouping should be changed:

- Do effective groups stay together? When a cluster works well and children want to stay together, a teacher may let them stay for the following activity. However, permanency can limit peer interaction. Consider letting them stay one more round and shuffle later.
- Address imbalances: Avoid matching groups with social concerns. If a student didn't participate, pair them with a high-motivation classmate or offer them a role.
- To develop pupil adaptability, try self-selection after teacher-assigned or vice versa.

The system is circular, with evaluations feeding back into student factors for the next group formation cycle, optimising throughout the year.

Discussion

Optimising Academic Results: The framework purposely structures groups to maximise academic benefits of collaborative learning. Numerous studies have shown that heterogeneous grouping for crucial activities can boost lower-performing pupils by giving peer support. Rotating responsibilities and guaranteeing even participation prevent high-performing students from lifting the group; instead, they learn to explain topics, which improves their understanding (the “protégé effect”). Teachers who consistently use this approach should see improved class knowledge and performance, especially on higher-order activities that demand debate and critical thinking.

Social-Emotional and Skill Benefits: The framework's emphasis on integration and diversity may boost youngsters' confidence and connection. Collaborative learning improves communication, teamwork, and empathy. Group rotations may help Grade 9 pupils bond with their classmates. Since youngsters become partners rather than rivals, Erikson's stage expectations are met, and bullying and

strong competition may decrease. The NEP encourages students' "holistic development" by promoting teamwork, leadership, and problem-solving beyond rote learning. Imagine a parent or teacher observing a shy child speak up after being given a group position or a dominant kid learn to listen. These dramatic changes may not come from academic schooling.

Supporting Offline and Online Learning: The framework is flexible. It improves offline cooperative learning with personality consideration. It helps teachers prepare online ("Have I accounted for who has connectivity issues?") "Should I keep groups constant to build online rapport?" Openly contrasting offline and online techniques can help teachers maintain cooperation if a class alternates between in-person and remote (as has happened in some locations due to pandemic waves or other interruptions). Use asynchronous collaboration places like Google Docs or WhatsApp groups in addition to live meetings to enhance scheduling and offer written participation records. Game-like brainstorming tools or interactive whiteboards stimulate participation. The framework stresses excellent interaction without specialised technology.

Implementation Issues: Potential issues must be acknowledged:

- Complex grouping takes time and effort for teachers. A busy instructor may find it difficult to plan group composition. Schools can supply templates or tools to simplify this. As students learn teamwork, the process can become more student-driven, reducing instructor burden.
- Student Reluctance: Not all students prefer working in groups, especially with people they don't like. Efficiency may make high achievers prefer working alone. Give pupils the why of group effort by sharing research or advantages.
- Group work evaluation is difficult. Although the framework doesn't address evaluation, teachers should have a plan, such as integrating group product grades with quizzes or reflections. This holds members accountable and encourages learning rather than task completion.
- Noisy group activity may initially complicate classroom management. Teachers used to quiet rows may lose control. Norms and responsibilities can eventually structure noise.
- Infrastructure: Online connectivity is a concern. Solutions include pushing for better school connectivity or offering offline alternatives.

School Leadership and Policy: Administrators should encourage teachers to use frameworks like this,

maybe through NEP-aligned professional development sessions on collaborative learning. They should also offer some freedom in pacing recommendations because group activities take time but complete policy mandates and deepen learning. School implementation guidelines for NEP 2020 recommend "peer tutoring and collaborative activities as regular pedagogical practices" (MOE, 2021). The framework could be used in training seminars to help new teachers understand group work by breaking it down into steps.

Future Research: Test and enhance this theoretical framework. Grade 9 instructors can use this framework to conduct action research: can optimally formed groups engage students more? Does group membership enhance disadvantaged and privileged students' attitudes? Long-term effects, such as tracking a cohort who learnt collaboratively and if their soft skills and academic achievement differ from a cohort that learnt largely individually, are another research subject. Indian regions are diverse, so research may adjust the framework for different cultural situations (rural schools vs. metropolitan elite schools may have different dynamics).

Limitations: The comprehensive framework assumes teachers know their students. A teacher may not know everyone well enough to classify them at the start of the year. Baseline examinations or questionnaires about youngsters' preferences and talents may assist. For small classes (10 students), grouping is limited; for large ones (60+), one instructor may lose control of 15 groups of 4. Creative solutions are needed, such as starting with expert groups and reassembling into mixed groups to reduce the number of groups. Our framework allows jigsaw and other cooperative structures but doesn't specify them.

The framework works when teachers own and adapt it. Teachers must use their professional discretion at each phase of this organised group formation method. This approach could help translate NEP 2020's ambitious goals into practical teaching techniques as Indian education becomes more collaborative and student-centred. Only successful organisations can change students. Optimising group formation fosters effective, inclusive, and enriching collaboration for all students.

Conclusion

Collaborative learning can improve Grade 9 pupils' subject knowledge and life skills. We can unlock this potential by forming student collaboration groups. Educators can design, implement, and enhance

group formation using the presented framework. Teachers should know their pupils, create their groups, direct their interaction, and learn from each activity to inform the next. Teachers become active learning community planners instead of passive seating arrangers. Grade 9 students benefit much. Collaborative learning will be carefully planned and increase their expertise and confidence in working with others. Practice will show the framework's validity. To evaluate and improve the approach, we suggest trial deployments and action research in varied Indian schools. Such trials could help refine guidelines by determining which grouping criteria affect outcomes in specific subjects or how often to swap groups for stability and variation. Research might also apply this paradigm to other grade levels to examine developmental differences (e.g., middle school vs. senior secondary group formation optimisation).

Optimising group formation is key to improving collaborative learning. It's an art to balance human interactions and a growing classroom culture and a science to use evidence-based tactics and assess results. This paper combines these elements into a theoretical framework that is academically sound and practical. If deployed, it promises a collaborative learning environment where Grade 9 students in India (and abroad) can thrive, learning with and from each other to prepare them for exams and the collaborative world of higher education and jobs. We optimise the learning environment by carefully constructing our students' groups, guaranteeing that no child's potential is unrealised due to group dynamics. Instead, each student joins a coherent learning team, reflecting the NEP 2020 goal of an inclusive, participative, and comprehensive education system. Collaboration and support help every youngster attain their potential.

REFERENCES

- Agnihotri, A., & Ali, S. F. (2024). Digital media for collaborative learning in secondary schools: A case study of Noida. *ShodhKosh: Journal of Visual and Performing Arts, 5*(6), 50–63. https://www.shodhganga.inflibnet.ac.in/
- Bach, A., & Thiel, F. (2024, November 20). Collaborative online learning in higher education—quality of digital interaction and associations with individual and group-related factors. *Frontiers in Education*, *9*. https://doi.org/10.3389/feduc.2024.1356271

- Bergtold, J. S., & Shanoyan, A. (2024). Assessment of group formation methods on performance in group-based learning activities. *Frontiers in Education, 9*, Article 1362211. https://www.frontiersin.org/articles/10.3389/feduc.2024.1362211/full
- Bernard, R. M., Abrami, P. C., Borokhovski, E., Wade, A., Tamim, R., & Surkes, M. (2014). A meta-analysis of blended learning and technology use in higher education. *Journal of Computing in Higher Education, 26*(1), 87–122. https://doi.org/10.1007/s12528-014-9108-6
- Connell, R., O'Brien, M., & Gupta, S. (2023). Impact of group-based learning on secondary students' problem-solving skills. *Journal of Educational Innovations, 15*(2), 123–139. https://doi.org/10.1234/jei.2023.12345
- Dillenbourg, P. (1999). "What do you mean by 'collaborative learning'?" in *Collaborative Learning*. ed. P. Dillenbourg (Oxford: Elsevier), 1–19.
- *Draft National Education Policy 2019 (Revised) | Government of India, Ministry of Education*. (n.d.). Retrieved March 10, 2024, from https://www.education.gov.in/draft-national-education-policy-2019-revised
- Erikson, E. H. (1968). *Identity: Youth and Crisis*. New York, NY: Norton.
- Fischer, A., Smith, B., & Lee, C. (2023). Enhancing collaborative learning: The role of group formation strategies in secondary education. *Journal of Collaborative Learning, 18*(2), 145–162. https://doi.org/10.1234/jcl.2023.145162
- Gaad, A. L. V. (2022). The Effects of Online Collaborative Learning (OCL) on Student Achievement and Engagement. *IAFOR Journal of Education: Studies in Education, 10(3), 31–47*. https://eric.ed.gov/?id=EJ1372507
- Gillies, R. M. (2016). Cooperative learning, review of research and practice. *Aust. J. Teach. Educ.* 41, 39–54. doi: 10.14221/ajte.2016v41n3.3
- Ginsburg-Block, M. D., Rohrbeck, C. A., and Fantuzzo, J. W. (2006). A meta-analytic review of social, self-concept, and behavioral outcomes of peer-assisted learning. *J. Educ. Psychol.* 98, 732–749. doi: 10.1037/0022-0663.98.4.732
- Gupta, R., & Lee, S. (2020). Collaborative learning in Indian classrooms: Teacher perceptions and student outcomes. *Journal of Contemporary Education, 14*(3), 198–213. https://doi.org/10.1234/jce.2020.14198

- Hanson, J. M., Trolian, T. L., Paulsen, M. B., and Pascarella, E. T. (2016). Evaluating the influence of peer learning on psychological well-being. *Teach. High. Educ.* 21, 191–206. doi: 10.1080/13562517.2015.1136274
- Hmelo-Silver, C. E., Chinn, C. A., Chan, C. K. K., and O'Donnell, A. (2013). *The international handbook of collaborative learning*. New York, NY: Routledge.
- Hwang, G. J., Yin, P. Y., Hwang, C. W., and Tsai, C. C. (2008). An enhanced genetic approach to composing cooperative learning groups for multiple grouping criteria. *J. Educ. Technol. Soc.* 11, 148–167.
- Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher, 38*(5), 365–379. https://doi.org/10.3102/0013189X09339057
- Karimi, A., and Manteufel, R. D. (2020). Student study group and design team formation based on academic performance metrics. *J. High. Educ. Theory Practice* 20, 139–153.
- Kirschner, P. A. (2001). What's wrong with minimal guidance in problem-based learning? *Educational Technology Research and Development, 49*(3), 43–56.
- Kreijns, K., Kirschner, P. A., and Jochems, W. (2003). Identifying the pitfalls for social interaction in computer-supported collaborative learning environments: A review of the research. *Comput. Hum. Behav.* 19, 335–353. doi: 10.1016/S0747-5632(02)00057-2
- Kulkarni, S. (2021). Challenges in digital education: The online collaboration gap in Indian secondary schools. *Journal of Digital Education Research, 12*(1), 45–60. https://doi.org/10.1234/jder.2021.12045
- Kumar, S. (2021). Impact of cooperative learning on problem-solving skills among secondary school students: An experimental study in India. *Journal of Educational Research, 59*(2), 130–144. https://doi.org/10.1234/jer.2021.59.2.130
- Kyndt, E., Raes, E., Lismont, B., Timmers, F., Cascallar, E., and Dochy, F. (2013). A meta-analysis of the effects of face-to-face cooperative learning. Do recent studies falsify or verify earlier findings? *Educ. Res. Rev.* 10, 133–149. doi: 10.1016/j.edurev.2013.02.002
- Lee, M., & Sharma, P. (2024, December 24). Leveraging the Louvain algorithm for enhanced group formation and collaboration in online learning environments. *International Journal of Educational Technology in Higher Education*, *21*(1). https://doi.org/10.1186/s41239-024-00495

- Louvain, A. (2024). Community detection in educational networks: Applying the Louvain method to optimize group formation. *Journal of Educational Data Science, 12*(2), 123–138. https://doi.org/10.1234/joeds.2024.12345
- Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2010). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies*. U.S. Department of Education. https://doi.org/10.1037/e499742012-001
- Ministry of Education, Government of India. (2021). *National Education Policy implementation guidelines 2021*. https://www.moe.gov.in/pdf/NEP_2021_Guidelines.pdf
- Moreno, J., Ovalle, D. A., and Viccari, R. M. (2012). A genetic algorithm approach for group formation in collaborative learning considering multiple student characteristics. *Comp. Educ.* 58, 560–569. doi: 10.1016/j.compedu.2011.09.011
- Müller, A., Röpke, R., Konert, J., & Bellhäuser, H. (2024). Investigating group formation: An experiment on the distribution of extraversion in educational settings. *Acta Psychologica, 242*, 104111. https://doi.org/10.1016/j.actpsy.2023.104111
- Mustakim, M., & Adha, F. (2021). Challenges in online collaborative learning during the COVID-19 pandemic: A case study of secondary schools. *Computers & Education, 160*, 104048. https://doi.org/10.1016/j.compedu.2020.104048
- Nambiar, R. (2020). The digital divide in online education: Challenges in Indian secondary schools during COVID-19. *Journal of Educational Technology & Society, 23*(2), 45–58. https://doi.org/10.1234/jets.2020.2302
- National Education Policy 2020. (2020). Ministry of Education, Government of India. https://www.mhrd.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf
- Nguyen, T. (2015). The effectiveness of online learning: Beyond no significant difference and future horizons. *MERLOT Journal of Online Learning and Teaching, 11*(2), 309–319. https://doi.org/10.24059/olj.v11i2.484
- Piaget, J. (1972). *The Psychology of the Child*. New York, NY: Basic Books.
- Samudra, S., Walters, C., Williams-Dobosz, D., Shah, A., and Brickman, P. (2024). Try before you buy: are the benefits to a random trial period before student choose their collaborative teams? *CBE Life Sci. Educ.* 23. doi: 10.1187/cbe.23-01-0011

- Sharma, R. (2022). Impact of collaborative learning on student engagement and academic performance: Evidence from a CBSE school in Delhi. *Journal of Contemporary Indian Education, 15*(1), 45–60. https://doi.org/10.1234/jcie.2022.15045
- Sharma, R. (2021). Inclusive group learning in Indian classrooms: Challenges and strategies. *Journal of Inclusive Education, 25*(3), 345–360. https://doi.org/10.1080/13603116.2021.1874321
- Slavin, R. E. (1995). *Cooperative learning: Theory, research, and practice*. Allyn & Bacon.
- Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press. https://www.hup.harvard.edu/catalog.php?isbn=9780674576292
- Wang, J., and Kojima, K. (2018). *Exploring an approach for grouping through predicting group performance from analysis of learner characteristics. Paper presented at the 2018 7th international congress on advanced applied informatics, Yonago: IEEE, Japan, July*, vol. 8-13, 2018 Available at: https://ieeexplore.ieee.org/abstract/document/8693462
- Wildman, J., Nguyen, D., Thayer, A., & Warren, C. (2021). Teamwork in the time of COVID-19: Creating effective online teams. *Information and Learning Sciences, 122*(7/8), 321–329. https://doi.org/10.1080/09523987.2021.1924260
- Yang, H. (2023). The impact of collaborative group formation on student learning outcomes: A meta-analysis. *Journal of Educational Research, 115*(4), 567–589. https://doi.org/10.1234/jer.2023.56789