

A Comparative Study of MBTI- and Learning Style–Based Grouping for Enhancing Group Effectiveness and Balance in Problem-Based Learning

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<https://doi.org/10.33697/ajur.2026.183>

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ABSTRACT

Problem-Based Learning (PBL) depends on effective collaboration, yet the optimal strategy for forming student groups remains unclear. This study compared two group formation approaches: heterogeneous groups based on the Myers–Briggs Type Indicator (MBTI) and homogeneous groups based on the Active Experimentation–Reflective Observation dimension of Kolb's Learning Style Inventory (LSI). Undergraduate students enrolled in Cell Biology and Introduction to Biology Laboratory courses were assigned to one of the two grouping strategies. Group functioning and role performance were evaluated using end-of-course surveys, and outcomes were compared using independent-samples *t*-tests and Pearson correlation analyses. Students in LSI-based groups reported significantly higher listening, productivity, psychological safety, belonging, satisfaction, and leader and communicator role performance than those in MBTI-based groups, whereas contribution and organizer performance did not differ significantly. Correlation analyses showed that satisfaction was most strongly associated with productivity in MBTI-based groups but with psychological safety in LSI-based groups. These findings suggest that grouping students according to learning style may better promote effective collaboration and positive group experiences than personality-based grouping in undergraduate PBL settings.

KEYWORDS

Myers-Briggs Type Indicator; Kolb's Learning Style Inventory; Group Dynamics; Problem-Based Learning; Group Productivity; Group Satisfaction; Classroom Learning; Group Roles; Educational Outcome

INTRODUCTION

Over the past five decades, the aims of higher education have shifted from a traditional emphasis on knowledge for its own sake to a more pragmatic focus on career readiness and the development of transferable skills.¹As universities expand curricula to span disciplines and align with workforce needs, they increasingly prioritize competencies such as communication, critical thinking, collaboration and adaptability.²This evolution reflects broader societal changes such as economic pressures, technological advances, and rising expectations that higher education should contribute directly to employability. Consequently, universities are reimagining their role as launchpads for professional success, alongside their core mission of learning.^{1,4}

In today's educational settings, group-based learning has gained prominence, particularly through approaches such as Problem-Based Learning (PBL). A persistent challenge, however, is forming balanced and effective groups that leverage individual members' strengths. A balanced and effective group is one in which the composition and interaction of the group members allow for the achievement of the group goals, frequently oriented towards problem solving. Personality types (e.g., Myers-Briggs Type Indicator- MBTI) and learning styles (e.g., Kolb's learning styles) are two widely studied frameworks that offer insight into how individuals interact, process information, and contribute to group work.^{5,6}

PBL is an instructional approach in which students work in small groups to investigate and solve open-ended, real-world problems, developing content knowledge alongside skills in critical thinking, collaboration and self-directed learning. Originally developed for medical education, PBL has since been adopted broadly across the sciences and health professions because it mirrors the collaborative, problem-solving demands of professional practice.⁷Because PBL depends on sustained small-group work rather than individual study, the way groups are composed is not incidental to the method. Instead, it is one of the central design decisions an instructor makes, and it shapes whether the group ultimately functions as a cohesive team or as a collection of individuals working in parallel.⁸

MBTI- based grouping in collaborative and PBL settings

The MBTI, developed by Isabel Briggs Myers and Katharine Cook Briggs, sorts respondents into one of 16 types based on four dichotomous preferences: Extraversion/Introversion, Sensing/Intuition, Thinking/Feeling, and Judging/Perceiving. In educational contexts, MBTI has been used to anticipate group dynamics. For example, ‘extraverted’ types are described as more comfortable in discussion-heavy settings, ‘thinking’ types as oriented toward logic-driven problem-solving, and ‘judging’ types as preferring structured, deadline-driven work.⁹

A smaller number of studies have directly tested whether MBTI-informed group composition improves outcomes in problem- or project-based settings. Related work, however, has approached this question observationally rather than through deliberate group assignment. For instance, a 2017 study by Ihm, An, and Seo examined 263 first-year dental students at Seoul National University who were randomly assigned into 11 small groups of up to eight students plus a facilitator, with MBTI types collected before PBL began and performance measured across four assessment components. The sample skewed toward extraverts (58.9%), sensors (66.5%), thinkers (74.5%), and judgers (63.9%), and females outperformed males on total PBL scores. Rather than manipulating group composition, the researchers used the Shannon diversity index to measure the MBTI heterogeneity that emerged naturally within each randomly formed group, and found that more diverse groups tended to perform better overall and specifically on facilitator evaluations (reflecting problem-solving ability), with the highest-performing groups clustered around ENTJ, ISTJ, and ESTJ profiles.¹⁰ This study offers useful groundwork by suggesting a link between personality diversity and PBL performance, but because groups were randomly assigned rather than deliberately composed by MBTI, it stops short of testing MBTI-informed grouping as an intervention. This gap is representative of the broader literature: most studies have evaluated MBTI-based diversity in isolation, whether through observation or intervention, rather than benchmarking it against an alternative composition framework, leaving open the question of whether MBTI's apparent benefits are specific to personality-based grouping or would appear with any structured, non-random composition strategy.

LSI- based grouping in collaborative and PBL settings

In 1984, several years after MBTI was created, David A. Kolb introduced his Experiential Learning Theory (ELT), inspired by the work of the gestalt psychologist Kurt Lewin, as well as John Dewey and Jean Piaget. ELT articulates a four-stage learning cycle (Concrete Experience, Reflective Observation, Abstract Conceptualization, Active Experimentation) and four corresponding learning styles. ELT emphasizes that individuals favor different modalities of learning and that teaching approaches should accommodate these variations to enhance engagement and learning outcomes. Within this model, the Active Experimentation–Reflective Observation (AE–RO) dimension speaks most directly to how a student behaves in a group: AE-oriented students tend to learn by doing and engaging immediately, while RO-oriented students tend to hold back to observe and process before contributing.¹¹

Prior work on learning-style-based grouping has generally examined *homogeneous* composition, which is grouping students by shared style, but without directly testing it against a mixed-style alternative. For instance, a 2012 study by Alghasham examined 75 first-year medical students at Qassim College of Medicine, identifying each student's learning style using Active-Reflective inventory (40% active, 60% reflective) and sorting them into nine PBL tutorial groups segregated by style (four active-only, five reflective-only) rather than mixed. Blinded tutors rated student behavior over five weekly PBL sessions across four domains: independent study, teamwork, reasoning/problem-solving, and active participation. Active learners were more collaborative, participative, and skilled at hypothesis generation, while reflective learners relied more on independent study, careful listening, and prior knowledge. However, these behavioral differences did not carry over to formative quiz scores, which showed no consistent advantage for either group. Notably, although the study design was homogeneous, the author concluded (without direct empirical comparison) that PBL groups should instead be intentionally mixed by learning style to balance these complementary strengths, a recommendation that itself remains untested against an actual mixed-group condition.¹²

Differentiating the Two Frameworks and Limitations of MBTI

Although MBTI and Kolb's ELT are often discussed together as personality/learning-style tools for group design, they are conceptually distinct in ways that matter for interpreting grouping outcomes. MBTI is a typological model: it sorts individuals into discrete categories along four independent preference dichotomies and is primarily descriptive of general behavioral and interpersonal tendencies. Kolb's model, by contrast, is dimensional and situates learners along two continuous axes (CE–AC and AE–RO) that describe how information is processed and acted upon, making it more directly tied to how a student engages with a specific task or activity rather than personality broadly.

This distinction matters because MBTI has been the subject of longstanding methodological criticism as a research and measurement instrument. Concerns raised in the psychometric literature include low test-retest reliability, with a substantial proportion of respondents receiving a different type classification on retesting weeks later; the forced dichotomization of what are more plausibly continuous traits into binary categories, which discards meaningful variance; and weak evidence for the

instrument's predictive validity relative to dimensional models such as the Five-Factor Model (Big Five), which is more consistently supported in personality research.^{13,14} Because MBTI's dichotomous types can obscure meaningful within-group variability, an MBTI-based classification such as the Keirsey temperament framework used in the present study necessarily treats individuals near a dichotomy's midpoint the same as individuals with a strong preference, a limitation worth bearing in mind when interpreting group-level outcomes tied to temperament category.¹⁵ Kolb's Learning Style Inventory (LSI) has also drawn validity criticism, though generally less severe, including questions about the stability of style classification across contexts and the extent to which self-reported style predicts actual behavior in group settings.¹⁶

METHODS AND PROCEDURES

Participants

Participants of this study were undergraduate students at the University of Wisconsin- Superior enrolled in Cell Biology (Fall 2022, Fall 2023) and Introduction to Biology Laboratory (Fall 2023, Section 001 and 002). Students were invited to participate in this study of the first day of each course. The invitation informed the students that (a) the course would involve substantial small group work regardless of study participation, (b) participation in the research study (completion of assessment and evaluation survey) was voluntary, and (c) participation, or the specific group/role a student was assigned to, would not affect course grades. Each course was assigned, in its entirety, to one grouping condition (MBTI- based or LSI- based); no course section contained a mixture of both conditions. Condition assignments by course section, semester, and enrollment size is reported in the Results Section (Demographics of Participants), see **Table 4**. It is also important to note that both the Fall 2022 and Fall 2023 Cell Biology course was instructed by the same instructor and followed the same learning curriculum and assignments to maintain consistency between these two sections.

Assessments

All participating students completed a Student Information Survey and either of the two validated self- report assessments prior to group formation. The Student Information Survey asked students to report their goals for the course, self- perceived strength and weaknesses relevant to group coursework, prior experience working in small groups, and a preferred group role (Leader, Communicator, or Organizer). Students then completed the assigned self- assessment for their said course, either the online MBTI assessment, or the LSI.

Group Formation and Role Determination: MBTI Based Groups

MBTI-based groups were formed using the Keirsey Temperament Sorter, a framework that organizes the 16 MBTI types into four broader temperaments, see **Table 1**.

Temperament	Defining Dichotomies	MBTI Types Included
Guardian	Sensing + Judging (SJ)	ISTJ, ISFJ, ESTJ, ESFJ
Artisan	Sensing + Perceiving (SP)	ISTP, ISFP, ESTP, ESFP
Idealist	Intuitive + Feeling (NF)	INFJ, INFP, ENFJ, ENFP
Rational	Intuitive + Thinking (NT)	INTJ, INTP, ENTJ, ENTP

Table 1: Full mapping of the 16 MBTI types to the four Keirsey temperaments used for group stratification.¹⁵

Keirsey's framework splits Sensing (S) types by their Judging/Perceiving preference (Guardian vs. Artisan) because, within Sensing types, this dichotomy most strongly differentiates preference for structure versus spontaneity. It splits Intuitive (N) types by their Feeling/Thinking preference (Idealist vs. Rational) because, within Intuitive types, this dichotomy most strongly differentiates value-driven versus logic-driven orientation. This is why the four temperaments are defined by different letter pairs (SJ/SP for Sensing types, NF/NT for Intuitive types) rather than a single consistent dichotomy across all four groups.

Each student was first classified into one of the four temperaments using **Table 1**. Groups were then formed using a stratified-composition strategy intended to maximize temperament diversity within each group. Groups were typically three members: for a three-member group, any three of the four temperaments (Guardian, Artisan, Idealist, Rational) could be represented, giving flexibility in which three temperaments were combined depending on section composition. A smaller number of groups had four members; in these cases, all four temperaments were represented once each, except when a section's temperament distribution made this impossible, in which case the most abundant temperament in that section was doubled up. No group contained more than one representative of the same temperament except under this doubling rule.

Within each temperament-stratified group, students were assigned one of three functional roles (Leader, Communicator, Organizer) based on their specific MBTI type, following the mapping in **Table 2** (below), such that each group had exactly one Leader, one Communicators, and one or two Organizers.

GROUP ROLE	MBTI TYPES	RATIONALE
Leaders	ENTJ, ESTJ, ENFJ, ESTP, ENTP	These types are natural at setting direction and structure, motivating others, and ensuring progress by keeping the group accountable to timelines and goals
Communicators	ENFP, ESFP, ESFJ, INFP, INFJ	These types excel at connecting with others, expressing group ideas clearly, and serving as bridges between the team and external stakeholders
Organizers	INTJ, INTP, ISTJ, ISFJ, ISTP, ISFP	These types thrive in analyzing details, refining outputs, and ensuring the final product is both accurate and high-quality, keeping the project grounded and complete.

Table 2. MBTI-to-role mapping used for functional role assignment within MBTI-based groups.

Because a temperament-stratified group could contain more than one student whose MBTI type mapped to the same functional role (most commonly among Organizer-eligible types, since six of the sixteen types map to that role), the role-preference item from the Student Information Survey was used as a tiebreaker: when two eligible students in the same group mapped to the same role, the student who had indicated that role as a preference was assigned to it, and the other was assigned the next-best-fitting available role. Following group formation and role determination, each student was emailed to notify them of the role they were assigned, a detailed explanation as to how their personality assessment contributed to the role assigned, and the expectation of their role in their group (**Table 3**).

GROUP ROLE	EXPECTATIONS
Leaders	Establish a clear timeline and plan for all the group activities, responsible for establishing deadline for the final project (human bio course only), Ensuring the work is evenly distributed and everyone in the group is participating in and contributing to the group activity, Ensures the group stays on task and the assignment is being completed in a timely manner.
Communicators	Serves as a group spokesperson checking in with the instructor when clarification is needed, submitting group assignments and participating on behalf of the group on class discussion boards.
Organizers	Quality control and finalization, overseeing the finalization of the infographic (human bio only), reviewing the content, design and overall quality of all the assignments the group is submitting. Contribute new ideas and perspectives to the group.

Table 3. Group roles and expectations in a PBL setting: Leaders (planning, deadlines, and accountability), Communicators (spokesperson and assignment submission), and Organizers (quality control, finalization, and idea contribution).

Group Formation and Role Determination: LSI Based Groups

For the purposes of this study, LSI group formation used only the Active Experimentation (AE)–Reflective Observation (RO) dimension of Kolb's Learning Style Inventory. Students scoring higher on Active Experimentation were classified as active learners, whereas those scoring higher on Reflective Observation were classified as reflective learners. Every participant received a score on this dimension and was therefore classified into one of these two categories. Although the Concrete Experience (CE)–Abstract Conceptualization (AC) dimension was also measured, it was not used for group formation. The AE–RO dimension was selected because it most directly reflects how students engage in collaborative learning tasks, including their preferred level of participation, discussion style, and approach to problem solving within a group. In contrast, the CE–AC dimension primarily describes how learners perceive and process information internally rather than how they interact with peers during collaborative activities. Because the primary outcomes of this study focused on group dynamics, communication, productivity, and role fulfillment, the AE–RO dimension was considered the most relevant dimension for forming groups.¹⁷

LSI based groups were formed homogeneously with respect to the AE/RO classification described above: students classified as active learners were grouped only with other active learners, and students classified as reflective learners were grouped only with other reflective learners. No group contained a mixture of active and reflective learners. Group size was matched to the MBTI condition (three to four students per group) wherever enrollment allowed.

Roles within LSI based groups were assigned directly from the role-preference item on the Student Information Survey: students were grouped with same-style peers whose stated role preferences (Leader, Communicator, Organizer) were non-overlapping, so that each group again contained one Leader, one Communicator, and one to two Organizers.

Rationale for the Composition Strategy and a Note on Design Symmetry

The two grouping conditions in this study were composed using different strategies: MBTI-based groups were formed heterogeneously (stratified across temperaments), while LSI-based groups were formed homogeneously (matched on learning style). This asymmetry was a deliberate feature of the original study design, not an oversight, and is described here explicitly so that it can be evaluated on its merits.

The heterogeneous, one-member-per-temperament structure used for MBTI groups follows a composition convention commonly recommended in Keirsey/MBTI-based team-building guidance, which favors temperament diversity within a team to ensure coverage of different behavioral and functional strengths. We want to be precise about what this citation does and does not support: it describes a widely used team-formation heuristic, not a controlled study demonstrating that heterogeneous Keirsey-based grouping produces superior PBL performance outcomes relative to homogeneous grouping.¹⁸ We are not aware of a published study that makes that specific comparison, and we have not represented the heterogeneous approach as empirically validated for that purpose.

The homogeneous structure used for LSI based groups was informed by prior, unpublished classroom observations by the research team, which suggested that groups mixing students with markedly different learning paces or engagement styles experienced more friction and lower performance than groups of students with similar learning approaches. Because this observation had not been formally tested, one aim of the present study was to evaluate it empirically by contrasting a heterogeneous, personality-based composition strategy against a homogeneous, learning-style-based one.

We note explicitly that this design choice confounds framework (MBTI vs. Kolb learning style) with composition strategy (heterogeneous vs. homogeneous): differences observed between the MBTI and LSI conditions in this study cannot be attributed solely to the underlying psychological framework, since they may instead (or additionally) reflect the composition strategy paired with each framework. This limitation, and the factorial design (Homogeneous MBTI, Heterogeneous MBTI, Homogeneous LSI, Heterogeneous LSI) that would be required to separate these two variables, is discussed further in the Discussion and Limitations sections.

Group Evaluation

Across the course, students engaged in collaborative activities including online discussions and PBL assignments. Students in Cell Biology completed exam wrappers at the end of each structured course unit; each wrapper included 10 Likert-scale items (1 = Strongly Disagree, 5 = Strongly Agree) assessing group functioning (e.g., “I believe the group worked well together to accomplish the project”). All students in all courses additionally completed a course wrapper at the end of the semester, which included the same 10 Likert-scale group-functioning items plus three additional Likert-scale items assessing performance in each students’ assigned role (Leader, Communicator, or Organizer). These wrapper responses were the source of all group performance, satisfaction, and role-performance data reported in the Results.

Data Analysis

SPSS and Microsoft Excel were used for all analyses. Independent-samples t-tests were used to compare mean scores between MBTI-based and LSI-based groups on each group-performance metric (listening, productivity, sense of safety, belonging, satisfaction, contribution) and on each role-performance rating (Leader, Communicator, Organizer). Pearson correlation coefficients were computed to assess relationships among group-level variables (e.g., satisfaction, productivity, psychological safety) separately within each grouping condition, using data from the two Cell Biology cohorts (fall 2022 LSI based, fall 2023 MBTI based). Statistical significance was set at $\alpha = 0.05$ for all tests.

IRB Permissions’ number

All study procedures involving human participants were reviewed and approved by the University of Wisconsin–Superior Institutional Review Board (IRB approval number E159).

RESULTS

Demographic of Participants.

Table 4 summarizes enrollment, grouping condition, and Keirsey temperament distribution by course section.

Course / Semester	N	Condition	Guardian	Artisan	Idealist	Rational
Cell Biology, Fall 2022	15	LSI (homogeneous)	—	—	—	—
Cell Biology, Fall 2023	21	MBTI (heterogeneous)	9	0	6	6
Biology Lab, Sec. 1, Fall 2023	18	MBTI (heterogeneous)	5	3	7	3
Biology Lab, Sec. 2, Fall 2023	16	LSI (homogeneous)	—	—	—	—

Table 4. Enrollment and Keirsey temperament distribution by course section and grouping condition. Dashes indicate sections assigned to the LSI based condition, for which temperament was not used for grouping.

Group Performance Metrics

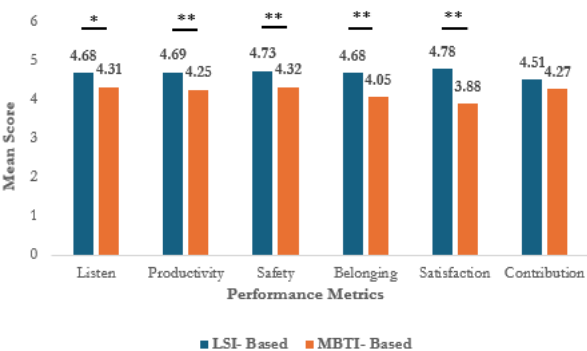


Figure 1. Comparison of Mean performance metrics between MBTI- based and LSI- based grouping strategies. The bar chart shows the mean scores for listening, productivity, sense of safety, belonging, satisfaction and contribution for students in Cell Biology 2023 (MBTI- based groups) and Cell Biology 2022 (LSI- based groups). Asterisk indicates statistically significant differences between group strategies (*p < 0.05). All metrics showed significant decreases in the MBTI-based cohort except for contribution.

Figure 1 compares mean scores for listening, productivity, sense of safety, belonging, satisfaction, and contribution between the MBTI-based cohort (Cell Biology, fall 2023) and the LSI-based cohort (Cell Biology, fall 2022). Mean scores were lower in the MBTI-based cohort on every metric, reaching statistical significance for all metrics except contribution. The largest differences were observed for belonging (MBTI: 4.68 vs. LSI: 4.05, t-test p = 0.0003) and satisfaction (MBTI: 4.78 vs. LSI: 3.88, p < 0.0001). Contribution did not differ significantly between cohorts (MBTI: 4.51 vs. LSI: 4.27, p = 0.13), despite a numerically lower mean in the MBTI-based group.

Role Fulfillment and Performance by Group Type

Role-performance ratings (self- and peer-assessed, 0–3 scale, where 0 = “never participated” and 3 = “exceeds expectations”) were compared between conditions for each functional role using independent-samples t-tests. Students in LSB groups scored significantly higher than students in MBTI groups in the Leader role (t = 4.21, p < 0.001) and the Communicator role (t = 3.87, p = 0.002). No significant difference between conditions was observed for the Organizer role (t = 0.45, p = 0.66).

Correlations Between Group Variables

Using data from the two Cell Biology cohorts (LSI, fall 2022, N = 15; MBTI, fall 2023, N = 21), Pearson correlations were computed separately within each condition among group satisfaction, productivity, and psychological safety (“safe-to-share”). Within MBTI-based groups, satisfaction was most strongly correlated with perceived productivity. Within LSI-based groups, satisfaction was most strongly correlated with psychological safety (safe-to-share) rather than productivity. Full correlation coefficients are reported in Table 5.

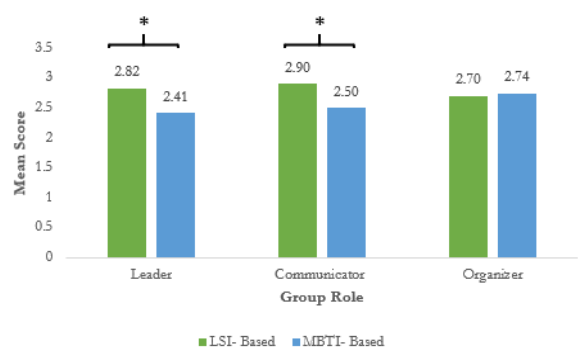


Figure 2. Role performance ratings by group type. Students in Biology Lab course, rated themselves and their group members on a 0–3 scale. Mean scores were compared between MBTI-based and LSB groups using independent, pairwise t-tests for each role. LSB groups scored significantly higher in the Leader ($t = 4.21$, $p < 0.001$) and Communicator ($t = 3.87$, $p = 0.002$) roles. No significant difference was observed for the Organizer role ($t = 0.45$, $p = 0.66$). Asterisks on the figure indicate statistically significant differences between group types.

Variable	Contribution	Listen	Productivity	Safe to Share	Belonging	Satisfaction
LSI- Based						
Satisfaction	0.576*	0.732**	0.648**	0.750**	0.756**	---
Productivity	0.606*	0.906**	---	0.933**	0.843**	0.648**
Safe to Share	0.512	0.911**	0.933**	---	0.954*	0.750**
MBTI- Based						
Satisfaction	0.387	0.644**	0.568**	0.523**	0.739**	---
Productivity	0.362	0.593**	---	0.560**	0.510**	0.568**
Safe to Share	0.511*	0.678**	0.560**	---	0.708**	0.523**

Table

5. Correlation among group variables for LSI- based and MBTI-based groups. Shown are Pearson correlation coefficients between group satisfaction, productivity, and perceived safety to share opinions (Safe-to-Share) and the variables contribution, listening, productivity, safety, belonging, and satisfaction for two group types: Learning Style–Based (LSB) groups ($N = 15$; Fall 2022) and MBTI-Based groups ($N = 21$; Fall 2023) from a Cell Biology course. Correlation analyses were conducted using SPSS. Diagonal entries (---) indicate self-correlations. Asterisks denote statistical significance of the correlations (* $p < 0.05$; ** $p < 0.01$)

DISCUSSION AND LIMITATIONS

The primary aim of this study was to compare MBTI-based and LSI-based grouping frameworks to determine which more effectively enhanced performance metrics and role fulfillment in PBL environments. Across two course contexts: Cell Biology and Introduction to Biology Laboratory; LSI -based grouping consistently outperformed MBTI-based grouping on key performance metrics. In particular, **Figure 1** demonstrates that students in MBTI-based groups (Cell Biology 2023) reported lower scores across nearly all performance metrics of group functioning compared to students in LSB groups (Cell Biology 2022), including listening, productivity, sense of safety, belonging, and overall satisfaction. Contribution was the only metric that did not differ significantly between grouping strategies, suggesting a selective rather than uniform impact of grouping approach on student experiences.

LSI-based groups demonstrated significantly higher productivity scores in both Cell Biology and Biology Lab courses, reinforcing the idea that grouping students according to shared learning processes (e.g., active vs. reflective) may reduce friction in task execution and pacing. The additional findings related to listening and sense of safety further support this interpretation. Groups formed based on learning style alignment may facilitate more predictable communication patterns and mutual responsiveness, enabling students to feel heard and comfortable sharing ideas. In contrast, MBTI-based grouping, which intentionally promotes personality heterogeneity, may introduce variability in communication preferences and decision-making styles that complicate coordination, particularly in time-limited or task-intensive PBL settings.

Group satisfaction and belonging exhibited the largest and most robust differences between grouping strategies, with MBTI-based groups reporting markedly lower scores in both domains. These findings suggest that beyond task efficiency, learning-style homogeneity may play a critical role in fostering social cohesion and inclusion within small-group learning environments. Importantly, the absence of a significant difference in contribution indicates that students in MBTI-based groups did not perceive themselves as contributing less, despite experiencing lower satisfaction and weaker group climate.

Role performance analyses further clarify how grouping strategies shape group processes. As seen in **Figure 2**, Students in LSI-based groups scored significantly higher in Leader and Communicator roles, while no significant differences were observed for the Organizer role. Leadership and communication are inherently interactive and depend on shared expectations, pacing, and responsiveness. Learning-style similarity may facilitate smoother leadership emergence and clearer communication norms, whereas heterogeneous personality groupings may require greater negotiation and adaptation. The stability of the Organizer role across grouping conditions suggests that detail-oriented or task-structuring responsibilities may be less sensitive to group composition and more dependent on individual traits or clearly defined task demands.

Correlation analyses provide additional insight into the mechanisms underlying these differences. As seen in **Table 5**, In MBTI-based groups, satisfaction was strongly correlated with perceived productivity, suggesting that these groups may be particularly sensitive to affective dynamics: when interpersonal functioning declines, productivity may be disproportionately affected. In contrast, LSI-based groups exhibited stronger associations between satisfaction and psychological safety, indicating that learning-style alignment may foster environments in which students feel comfortable expressing ideas, asking questions, and engaging in constructive disagreement. Sense of safety has been widely identified as a key predictor of effective teamwork and learning, particularly in collaborative educational contexts.

While MBTI-based grouping offers a structured framework for role differentiation and exposure to interpersonal diversity, the present findings suggest that learning style alignment may be a more robust predictor of effective group functioning in PBL settings. LSI-based grouping more directly supports productivity, satisfaction, and positive group climate. Importantly, these results do not imply that MBTI is pedagogically ineffective, but rather that its strengths may not align optimally with performance-driven PBL outcomes.

This study has several limitations. Sample sizes were modest and drawn from a single institution, limiting generalizability. The Cell Biology grouping conditions were implemented across different semesters rather than within the same cohort, introducing potential cohort effects. Additionally, outcome measures relied on self-reported Likert-scale instruments, which may be subject to response bias. Future studies should incorporate larger, multi-institutional samples, randomized within-cohort designs, and objective performance measures to further clarify how grouping strategies influence learning outcomes.

CONCLUSIONS

This study demonstrated that LSI-based grouping, grounded in Kolb's ELT, is more effective than MBTI-based grouping in promoting group productivity, satisfaction, and role fulfillment in undergraduate PBL settings. While MBTI-based groups showed meaningful internal correlations between satisfaction and productivity, they consistently underperformed relative to LSI-based groups on primary outcome measures. These findings suggest that how students learn may be more consequential for group effectiveness than how they interact personality-wise. For instructors designing collaborative learning environments, particularly in science courses that rely heavily on teamwork, grouping students by learning style may offer a practical and evidence-based strategy for enhancing both performance and student experience.

ACKNOWLEDGEMENTS

We thank all the students who participated in the surveys for their time and contributions to this study. We also acknowledge the Undergraduate Research Student-Centered Activities (URSCA) program at the University of Wisconsin–Superior for funding this research. Additionally, we appreciate the support of course instructors and teaching staff who facilitated participant access and assisted with logistical aspects of data collection.

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PRESS SUMMARY

Group work is a cornerstone of many college science courses, yet how students are assigned to teams is often overlooked. In this study, we found that forming groups based on students' learning styles led to higher productivity, stronger leadership and communication, and greater overall satisfaction compared to grouping students by personality type using the Myers-Briggs Type Indicator (MBTI). Students in learning style-based groups reported feeling more comfortable sharing ideas and worked more efficiently together, while personality-based groups showed lower satisfaction and performance overall. These findings suggest that aligning how students learn may be more important than mixing personality types when designing effective collaborative learning experiences in higher education.